Tesis of different topics towards the graduation of Master of Information Technology.

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Master of Information Technology

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ITC 203 – Object Oriented Systems Analysis and Design. "Assignment 1"

Report on Statistics
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Introduction

The development of the technology has moved to the humanity to find different ways to get advantage of the resources with the aim of getting a profit for the companies. The managing of information is one of the priorities for the most of the business in order to get advantage of the technological development and a competitive advantage in the market. In order to obtain an adequate management of the information is necessary to create a well-designed information model by the use of the different techniques and models developed for this purpose. The aim of this document is to show detailed examples of the use of the object-oriented data modeling for the improvement in the administration and use of information.
Question 1. Domain model for the production run environment

The data from the book’s exercise has been analysed in order to obtain the following Domain model showed in Figure 1.1.

Figure 1.1: Domain Model

Use cases:

Identified Actors are: Supervisor, Operators, Production Planner, and Auditor.

Supervisor

Start the line run

Record employee running the line

Record employee leaving the line

Stop line

Record line problems
End line run
Production Planner
Produce Line Run
Auditor
Check Quantity
Check Costs

Question 2. Create a use case model for the production line environment

**Use case diagram:** Based on the information from Question 1 the following figure has been developed:

![Use case diagram](image)

**Figure 2.1: Use case Diagram**
## Intermediate level use case description

<table>
<thead>
<tr>
<th>Use Cases</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start the line run</td>
<td>Supervisor checks that there are enough ingredients to start the line running. Determines if there are the staff needed to start the operations.</td>
</tr>
<tr>
<td>Record employee running the line</td>
<td>Supervisor starts taking the employees names, copies the job numbers to the production record sheet and on the timesheets.</td>
</tr>
<tr>
<td>Record employee leaving the line</td>
<td>The supervisor make a note for the employees who leaves the line during a run.</td>
</tr>
<tr>
<td>Stop line</td>
<td>Supervisor manager halts the line if something is wrong with the run. Such as an ingredient runs out</td>
</tr>
<tr>
<td>Record line problems</td>
<td>The registration of the finish time as well as the downtime is performed by the supervisor, when a halt was executed.</td>
</tr>
<tr>
<td>End line run</td>
<td>The supervisor registers the production quantities, the hours worked by the employees and returns the ingredients remaining.</td>
</tr>
<tr>
<td>Produce Line Run</td>
<td>The schedule for every Friday is produced by the production planner, running for each line during the next week.</td>
</tr>
<tr>
<td>Check Quantity</td>
<td>Checking the products and its quantities.</td>
</tr>
<tr>
<td>Check Costs</td>
<td>Check the costs of the products for each line in order to determine the economic relevance for each line.</td>
</tr>
</tbody>
</table>

### Table 2.1: Use cases description

**Detailed use case description for use case: Recording an employee leaving the line.**

<table>
<thead>
<tr>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Supervisor login into the system</td>
<td>2. System shows the line operations</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>3. Supervisor select employee leaving</td>
<td>4. System request reason and duration</td>
</tr>
<tr>
<td>5. Supervisor register reason and duration of leaving</td>
<td>6. System show a message of confirmation</td>
</tr>
</tbody>
</table>

**Table 2.2: Detailed Use case description**

Question 3.

**Production line object, set of states and transitions. State Diagram.**

The production line object, including its sets of states and states are shown in figure 3.1.
Figure 3.1: State diagram

Question 4.

Communication Diagram
Figure 4.1: Communication diagram “Employee Leaving Registration”

Question 5.

Sequence diagram

Figure 5.1: Sequence diagram “Employee Leaving Registration”
Question 6.

a: Class Diagram: Employee Leaving the Line_run registration

Figure 6.1: Class diagram “Employee Leaving Registration”

b: Sequence Diagram: Stop line

Figure 6.2: Sequence diagram “Stop_Line”

c: Class Diagram: Stop line
**Figure 6.3: Class diagram “Stop_Line”**

**Figure 6.4: Class diagram “Stop_Line”**

**d: Class Diagram: Employee Leaving the Line_run and Stop Line**
References:

ITC 203 – Object Oriented Systems Analysis and Design "Assignment 2"

Report on Statistics

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Master of Information Technologies

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Introduction

The needs of information; and the interaction between humans and computers lead to the creation of new ways to manage the information. There are many strategies to gain advantages from the information obtained by the information systems. In order to gain effective information from the applications of a defined company is necessary to focus the design on the interaction of humans and systems. Based in a well designed interface and defining a strong database as a platform for the information produced by the business; a company can gain a competitive advantage in the market. The following document will shows the ways to design and manage the process development on an information system.
Case Description:

The use case considered in this document is: “The line supervisor halting the production line for a line stoppage”.

<table>
<thead>
<tr>
<th>Actor Action</th>
<th>System Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Supervisor login into the system</td>
<td>2. System shows the lines list</td>
</tr>
<tr>
<td>“Password provided”</td>
<td></td>
</tr>
<tr>
<td>3. Supervisor select line to be stopped</td>
<td>4. System shows line status</td>
</tr>
<tr>
<td>5. Supervisor selects “stop line” option</td>
<td>6. System show a message of confirmation</td>
</tr>
</tbody>
</table>

Question1.

List of requirements for the user interface when the supervisor halts the production line for a stoppage without considering the hardware or software platform on which it will be implemented.

- Identify which is the line? Presenting a problem; and needs to be stopped.
- What kind of fault was produced? Affecting the line.
- The time the line has been halted, until it is resumed.
- Next a detail of the time necessary for the line resuming.
- The reason causing the problem for which the line has been stopped.

The rules to perform the filling of the information on the interface are detailed:

- The first step is to identify where the problem happen; thus, the line showing the problem has to be selected first.
- If the line is not selected no more information can be inserted on the next fields.
• Once the line is selected the next fields are enabled; and allows to the insertion of information.
• Next the fault which causes the problem has to be inserted.
• If the fault is not inserted no other information can be registered as well.
• After selecting the type of fault the fields, for inserting the information related to the time of halting and the time of resuming, are enabled and ready to receive information in the respective order.
• The reason field it is the last data inserted in the interface, and contains the reasons why the line has been stopped.
• Finally the button “Save” has to be pressed to submit the information.

Question 2.
In order to create an effective interface to interact with the users, a prototype has been developed using Java Swing.

Before accessing to the interface that allows the supervisor “halting the production line for a line stoppage”, An access from the main menu has to be added to the main application indentifying the action to be taken by the interface such as “Halt for line stoppage”. Now accessing to the interface the data to be inserted uses the following tools:

The first two dropdown windows are required to be selected. The first one required the line to be halted; if a line is not selected, no other information is allowed to be filled.

Once the line has been choice the fault is required. The fault has to be choose from the second dropdown window. Once selected the time of the stoppage the textbox from the stoppage, time and resume time; are enabled to be filled with the information.

Stooping time is required before continuing; but, resume time can be leaved in blank.
Stopping time can be increased or decreased by the arrows beside the textbox; so that the date inserted is going to be automatically adjusted to the time format.

Finally the reasons have to be inserted in regard to the line stoppage. A comment box is available for be filled with the reasons of the line stoppage.

When all the information has been entered the save button is clicked to save the data. An alert is triggered asking for the confirmation of the information to be saved. If the user choose “ok” the data is saved; otherwise, the information is discarded and the Line stoppage interface is closed.

If the user chooses to click on the “Cancel” button at any time of the interaction the data is discarded after an alert has been accepted; closing the interface as well. Figure 2.1 shows the interface with all the characteristics described:
Figure 2.1. User’s interface “halting the production line for a line stoppage”

The elements forming the interface for the line stoppage use case and according the GUI elements are:

<table>
<thead>
<tr>
<th>&lt;&lt;Interface&gt;&gt;</th>
<th>Line Stoppage UI</th>
</tr>
</thead>
<tbody>
<tr>
<td>LinesLabel:</td>
<td>Label</td>
</tr>
<tr>
<td>FaultLabel:</td>
<td>Label</td>
</tr>
<tr>
<td>StoppingTimeLabel:</td>
<td>Label</td>
</tr>
<tr>
<td>ResumeTimeLabel:</td>
<td>Label</td>
</tr>
<tr>
<td>ReasonLabel:</td>
<td>Label</td>
</tr>
<tr>
<td>LinesDropdownwindow:</td>
<td>DropDownWindow</td>
</tr>
<tr>
<td>FaultDropdownwindow:</td>
<td>DropDownWindow</td>
</tr>
<tr>
<td>StoppingTimeTextbox:</td>
<td>Textbox</td>
</tr>
<tr>
<td>ResumeTimeTextbox:</td>
<td>Textbox</td>
</tr>
<tr>
<td>ReasonListBox:</td>
<td>Commentbox</td>
</tr>
<tr>
<td>CancelButton:</td>
<td>Button</td>
</tr>
<tr>
<td>SaveButton:</td>
<td>Button</td>
</tr>
<tr>
<td>ControlsMenuBar:</td>
<td>MenuBar</td>
</tr>
</tbody>
</table>

Figure 2.2. GUI elements “halting the production line for a line stoppage”

Question 3.

Draw state diagrams to model the behaviour of the high level user interface objects identified in Question 2.

Considering the “halting the production line for a line stoppage” interface developed in question 2, the following state diagram has been developed:
Figure 3.1. State diagram “halting the production line for a line stoppage”

Question 4.

Draw a sequence diagram to show the interaction between the high level (window/dialog) objects of your user interface, and any control and/or entity/domain objects during the use case.
Figure 4.1. Sequence diagram “halting the production line for a line stoppage”
Question 5.
Map the information held for the production run environment onto a set of tables in third normal form that can be stored in a database. Submit the specifications for the set of tables.

According to Figure 5.1, defining the domain model for the production run environment, the tables included in the database are defined by the 6 use cases obtained.

![Figure 5.1. Domain model](image)

From the six use cases obtained:

- Start the line run: Classes (Supervisor, Line, Line_run)
- Record employee running the line: Classes (Employee, Line, LineRun)
- Record employee leaving the line: Classes (Supervisor, Employee, Line, LineRun)
Stop line: Clases (Supervisor, Line, LineRun)

Record line problems: Clases (Supervisor, Line, Faults)

End line run: (Supervisor, Line, Line_Run)

Analysing the use cases and all the process on a production run environment the following ERD has been developed:
Figure 5.2. ERD production run environment

The use cases considered for the normalization process are: Recording the line problems and the recording an employee leaving an active production run.
### Halting the line for a line stoppage:

#### 1st. Normal Form:

<table>
<thead>
<tr>
<th>COD_SUPERV</th>
<th>SUPERVISOR_NAME</th>
<th>COD_LINE</th>
<th>LINE_NAME</th>
<th>COD_FAULT</th>
<th>FAULT_NAME</th>
<th>TIME_STOPPED</th>
<th>TIME_RESUME</th>
<th>REASONS</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>S001</td>
<td>David Young</td>
<td>L001</td>
<td>Rolls</td>
<td>F001</td>
<td>Ran out raw materials</td>
<td>5:30 PM</td>
<td>7:10 PM</td>
<td>Floor not delivered on time</td>
<td>3-Jan-10</td>
</tr>
<tr>
<td>S002</td>
<td>Jack Lewis</td>
<td>L003</td>
<td>Tomato Sauce</td>
<td>F002</td>
<td>Equipment faulty</td>
<td>6:31 AM</td>
<td>7:15 AM</td>
<td>Service not provided efficiently</td>
<td>4-Jan-10</td>
</tr>
<tr>
<td>S001</td>
<td>David Young</td>
<td>C002</td>
<td>Plastics</td>
<td>F001</td>
<td>Ran out raw materials</td>
<td>3:00 PM</td>
<td>3:50 PM</td>
<td>Ran out of boxes for packing</td>
<td>6-Jan-10</td>
</tr>
<tr>
<td>S003</td>
<td>Peter Adams</td>
<td>L001</td>
<td>Rolls</td>
<td>F003</td>
<td>Power supply lost</td>
<td>6:14 PM</td>
<td>8:31 PM</td>
<td>Power supply faulty</td>
<td>6-Jan-10</td>
</tr>
<tr>
<td>S002</td>
<td>Jack Lewis</td>
<td>C002</td>
<td>Plastics</td>
<td>F002</td>
<td>Equipment faulty</td>
<td>5:31 AM</td>
<td>7:30 AM</td>
<td>Conveyor belt broken</td>
<td>7-Jan-10</td>
</tr>
</tbody>
</table>

#### 2nd. Normal Form:

**Problem_Record**

<table>
<thead>
<tr>
<th>COD_PROBLEM</th>
<th>COD_SUPERV</th>
<th>SUPERVISOR_NAME</th>
<th>COD_LINE</th>
<th>COD_FAULT</th>
<th>TIME_STOPPED</th>
<th>TIME_RESUME</th>
<th>REASONS</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P001</td>
<td>S001</td>
<td>David Young</td>
<td>L001</td>
<td>F001</td>
<td>5:30 PM</td>
<td>7:10 PM</td>
<td>Floor not delivered on time</td>
<td>3-Jan-10</td>
</tr>
<tr>
<td>P002</td>
<td>S002</td>
<td>Jack Lewis</td>
<td>L003</td>
<td>F002</td>
<td>6:31 AM</td>
<td>7:15 AM</td>
<td>Service not provided efficiently</td>
<td>4-Jan-10</td>
</tr>
<tr>
<td>P003</td>
<td>S001</td>
<td>David Young</td>
<td>C002</td>
<td>F001</td>
<td>3:00 PM</td>
<td>3:50 PM</td>
<td>Ran out of boxes for packing</td>
<td>6-Jan-10</td>
</tr>
<tr>
<td>P004</td>
<td>S003</td>
<td>Peter Adams</td>
<td>L001</td>
<td>F003</td>
<td>6:14 PM</td>
<td>8:31 PM</td>
<td>Power supply faulty</td>
<td>6-Jan-10</td>
</tr>
<tr>
<td>P005</td>
<td>S002</td>
<td>Jack Lewis</td>
<td>C002</td>
<td>F002</td>
<td>5:31 AM</td>
<td>7:30 AM</td>
<td>Conveyor belt broken</td>
<td>7-Jan-10</td>
</tr>
</tbody>
</table>

**Lines**

<table>
<thead>
<tr>
<th>COD_LINE</th>
<th>LINE_NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>L001</td>
<td>Rolls</td>
</tr>
<tr>
<td>L003</td>
<td>Tomato Sauce</td>
</tr>
<tr>
<td>C002</td>
<td>Plastics</td>
</tr>
<tr>
<td>L004</td>
<td>BBQ Sauce</td>
</tr>
<tr>
<td>C003</td>
<td>Pizza Boxes</td>
</tr>
</tbody>
</table>

**Faults**

<table>
<thead>
<tr>
<th>COD_FAULT</th>
<th>FAULT_NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>F001</td>
<td>Ran out raw materials</td>
</tr>
<tr>
<td>F002</td>
<td>Equipment faulty</td>
</tr>
<tr>
<td>F003</td>
<td>Power supply lost</td>
</tr>
<tr>
<td>F004</td>
<td>Employees unavailable</td>
</tr>
<tr>
<td>F005</td>
<td>No defined</td>
</tr>
</tbody>
</table>

**Problem_record(Cod_problem, Cod_superv, Supervisor_name, Cod_line, Cod_fault, Time stopped, Time resume, Reasons, Date)**

**Lines(Cod_line, Line_name)**
Faults( Cod_line, Line_name)

3rd. Normal Form:

Problem_Record

<table>
<thead>
<tr>
<th>Cod_Problem</th>
<th>Cod_superv</th>
<th>Cod_line</th>
<th>Cod_fault</th>
<th>time_stopped</th>
<th>time_resume</th>
<th>Reasons</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>P001</td>
<td>S001</td>
<td>L001</td>
<td>F001</td>
<td>5:30 PM</td>
<td>7:10 PM</td>
<td>Floor not delivered on time</td>
<td>3-Jan-10</td>
</tr>
<tr>
<td>P002</td>
<td>S002</td>
<td>L003</td>
<td>F002</td>
<td>6:31 AM</td>
<td>7:15 AM</td>
<td>Service not provided efficiently</td>
<td>4-Jan-10</td>
</tr>
<tr>
<td>P003</td>
<td>S001</td>
<td>C002</td>
<td>F001</td>
<td>3:00 PM</td>
<td>3:50 PM</td>
<td>Ran out of boxes for packing</td>
<td>6-Jan-10</td>
</tr>
<tr>
<td>P004</td>
<td>S003</td>
<td>L001</td>
<td>F003</td>
<td>6:14 PM</td>
<td>8:31 PM</td>
<td>Power supply faulty</td>
<td>6-Jan-10</td>
</tr>
<tr>
<td>P005</td>
<td>S002</td>
<td>C002</td>
<td>F001</td>
<td>5:31 AM</td>
<td>7:30 AM</td>
<td>Conveyor belt broken</td>
<td>7-Jan-10</td>
</tr>
</tbody>
</table>

Lines

<table>
<thead>
<tr>
<th>Cod_line</th>
<th>Line_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>L001</td>
<td>Rolls</td>
</tr>
<tr>
<td>L003</td>
<td>Tomato Sauce</td>
</tr>
<tr>
<td>C002</td>
<td>Plastics</td>
</tr>
<tr>
<td>L004</td>
<td>BBQ Sauce</td>
</tr>
<tr>
<td>C003</td>
<td>Pizza Boxes</td>
</tr>
</tbody>
</table>

Faults

<table>
<thead>
<tr>
<th>Cod_fault</th>
<th>Fault_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>F001</td>
<td>Ran out raw materials</td>
</tr>
<tr>
<td>F002</td>
<td>Equipment faulty</td>
</tr>
<tr>
<td>F003</td>
<td>Power supply lost</td>
</tr>
<tr>
<td>F004</td>
<td>Employees unavailable</td>
</tr>
<tr>
<td>F005</td>
<td>No defined</td>
</tr>
</tbody>
</table>

Supervisors

<table>
<thead>
<tr>
<th>Cod_superv</th>
<th>Supervisor_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>S001</td>
<td>David Young</td>
</tr>
<tr>
<td>S002</td>
<td>Jack Lewis</td>
</tr>
<tr>
<td>S003</td>
<td>Peter Adams</td>
</tr>
<tr>
<td>S004</td>
<td>Jose Clarks</td>
</tr>
<tr>
<td>S005</td>
<td>Mishell Heins</td>
</tr>
</tbody>
</table>

Problem_record(Cod_problem, Cod_superv, Cod_line, Cod_fault, Time stopped, Time resume, Reasons, Date)

Lines(Cod_line, Line_name)

Faults( Cod_line, Line_name)

Supervisor( Cod_superv, Supervisor_name)
Record employee leaving the line

1st Normal Form:

<table>
<thead>
<tr>
<th>Cod_employee</th>
<th>Name_Employee</th>
<th>Date</th>
<th>Time</th>
<th>Duration</th>
<th>Cod_supervisor</th>
<th>Supervisor_name</th>
<th>Cod_line</th>
<th>Line_name</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>E01</td>
<td>John P.</td>
<td>10-Jan-10</td>
<td>10:00 AM</td>
<td>30 min</td>
<td>S001</td>
<td>David Young</td>
<td>L001</td>
<td>Rolls</td>
<td>Manager meeting</td>
</tr>
<tr>
<td>E02</td>
<td>Paul R.</td>
<td>11-Jan-10</td>
<td>5:00 PM</td>
<td>40 min</td>
<td>S002</td>
<td>Jack Lewis</td>
<td>L003</td>
<td>Tomato Sauce</td>
<td>Late start</td>
</tr>
<tr>
<td>E03</td>
<td>Randy M.</td>
<td>12-Feb-10</td>
<td>6:00 PM</td>
<td>2 hours</td>
<td>S001</td>
<td>David Young</td>
<td>C002</td>
<td>Plastics</td>
<td>Sick</td>
</tr>
<tr>
<td>E01</td>
<td>John P.</td>
<td>15-Feb-10</td>
<td>3:00 AM</td>
<td>15 min</td>
<td>S003</td>
<td>Peter Adams</td>
<td>L001</td>
<td>Rolls</td>
<td>Delivering raw materials</td>
</tr>
<tr>
<td>E03</td>
<td>Randy M.</td>
<td>10-Mar-10</td>
<td>6:00 AM</td>
<td>20 min</td>
<td>S002</td>
<td>Jack Lewis</td>
<td>C002</td>
<td>Plastics</td>
<td>Manager meeting</td>
</tr>
</tbody>
</table>
2nd. Normal Form:

**Employee_leaving_Record**

<table>
<thead>
<tr>
<th>Cod_Leaving</th>
<th>Cod_employee</th>
<th>Name_Employee</th>
<th>Date</th>
<th>Time</th>
<th>Duration</th>
<th>Cod_supervisor</th>
<th>Cod_line</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL01</td>
<td>E01</td>
<td>John P.</td>
<td>10-Jan-10</td>
<td>10:00 AM</td>
<td>30 min</td>
<td>S001</td>
<td>L001</td>
<td>Manager meeting</td>
</tr>
<tr>
<td>CL02</td>
<td>E02</td>
<td>Paul R.</td>
<td>11-Jan-10</td>
<td>5:00 PM</td>
<td>40 min</td>
<td>S002</td>
<td>L003</td>
<td>Late start</td>
</tr>
<tr>
<td>CL03</td>
<td>E03</td>
<td>Randy M.</td>
<td>12-Feb-10</td>
<td>6:00 PM</td>
<td>2 hours</td>
<td>S001</td>
<td>C002</td>
<td>Sick</td>
</tr>
<tr>
<td>CL04</td>
<td>E01</td>
<td>John P.</td>
<td>15-Feb-10</td>
<td>3:00 AM</td>
<td>15 min</td>
<td>S003</td>
<td>L001</td>
<td>Delivering raw materials</td>
</tr>
<tr>
<td>CL05</td>
<td>E03</td>
<td>Randy M.</td>
<td>10-Mar-10</td>
<td>6:00 AM</td>
<td>20 min</td>
<td>S002</td>
<td>C002</td>
<td>Manager meeting</td>
</tr>
</tbody>
</table>

**Supervisors**

<table>
<thead>
<tr>
<th>Cod_superv</th>
<th>Supervisor_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>S001</td>
<td>David Young</td>
</tr>
<tr>
<td>S002</td>
<td>Jack Lewis</td>
</tr>
<tr>
<td>S003</td>
<td>Peter Adams</td>
</tr>
<tr>
<td>S004</td>
<td>Jose Clarks</td>
</tr>
<tr>
<td>S005</td>
<td>Mishell Heins</td>
</tr>
</tbody>
</table>

**Lines**

<table>
<thead>
<tr>
<th>Cod_line</th>
<th>Line_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>L001</td>
<td>Rolls</td>
</tr>
<tr>
<td>L003</td>
<td>Tomato Sauce</td>
</tr>
<tr>
<td>C002</td>
<td>Plastics</td>
</tr>
<tr>
<td>L004</td>
<td>BBQ Sauce</td>
</tr>
<tr>
<td>C003</td>
<td>Pizza Boxes</td>
</tr>
</tbody>
</table>

Employee_leaving_record(Cod_leaving, Cod_employee, Name_employee, Date, Time, Duration, Cod_supervisor, Cod_line, Reason)

Supervisors(Cod_superv, Supervisor_name)

Lines(Cod_line, Line_Name)
### 3rd. Normal Form:

**Employee_leaving_Record**

<table>
<thead>
<tr>
<th>Cod_Leaving</th>
<th>Cod_employee</th>
<th>Date</th>
<th>Time</th>
<th>Duration</th>
<th>Cod_supervisor</th>
<th>Cod_line</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL01</td>
<td>E01</td>
<td>10-Jan-10</td>
<td>10:00 AM</td>
<td>30 min</td>
<td>S001</td>
<td>L001</td>
<td>Manager meeting</td>
</tr>
<tr>
<td>CL02</td>
<td>E02</td>
<td>11-Jan-10</td>
<td>5:00 PM</td>
<td>40 min</td>
<td>S002</td>
<td>L003</td>
<td>Late start</td>
</tr>
<tr>
<td>CL03</td>
<td>E03</td>
<td>12-Feb-10</td>
<td>6:00 PM</td>
<td>2 hours</td>
<td>S001</td>
<td>C002</td>
<td>Sick</td>
</tr>
<tr>
<td>CL04</td>
<td>E01</td>
<td>15-Feb-10</td>
<td>3:00 AM</td>
<td>15 min</td>
<td>S003</td>
<td>L001</td>
<td>Delivering raw materials</td>
</tr>
<tr>
<td>CL05</td>
<td>E03</td>
<td>10-Mar-10</td>
<td>6:00 AM</td>
<td>20 min</td>
<td>S002</td>
<td>C002</td>
<td>Manager meeting</td>
</tr>
</tbody>
</table>

#### Supervisors

<table>
<thead>
<tr>
<th>Cod_superv</th>
<th>Supervisor_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>S001</td>
<td>David Young</td>
</tr>
<tr>
<td>S002</td>
<td>Jack Lewis</td>
</tr>
<tr>
<td>S003</td>
<td>Peter Adams</td>
</tr>
<tr>
<td>S004</td>
<td>Jose Clarks</td>
</tr>
<tr>
<td>S005</td>
<td>Mishell Heins</td>
</tr>
</tbody>
</table>

#### Lines

<table>
<thead>
<tr>
<th>Cod_line</th>
<th>Line_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>L001</td>
<td>Rolls</td>
</tr>
<tr>
<td>L003</td>
<td>Tomato Sauce</td>
</tr>
<tr>
<td>C002</td>
<td>Plastics</td>
</tr>
<tr>
<td>L004</td>
<td>BBQ Sauce</td>
</tr>
<tr>
<td>C003</td>
<td>Pizza Boxes</td>
</tr>
</tbody>
</table>

#### Employees

<table>
<thead>
<tr>
<th>Cod_employee</th>
<th>Employee_name</th>
</tr>
</thead>
<tbody>
<tr>
<td>E01</td>
<td>John P.</td>
</tr>
<tr>
<td>E02</td>
<td>Paul R.</td>
</tr>
<tr>
<td>E03</td>
<td>Randy M.</td>
</tr>
<tr>
<td>E04</td>
<td>James P.</td>
</tr>
<tr>
<td>E05</td>
<td>Glory D.</td>
</tr>
</tbody>
</table>

---

Employee_leaving_record(Cod_Leaving, Cod_employee, Date, Time, Duration, Cod_supervisor, Cod_line, Reason)

Supervisors(Cod_superv, Supervisor_name)

Lines(Cod_line, Line_Name)

Employees(Cod_employee, Name_employee)
Question 6.

Design a database broker framework, which can be used to implement a persistence mechanism for the production run environment using the objects and tables you have designed. Construct class and sequence diagrams to show the interactions between entity objects and the database during the execution of the use case you selected for Part 1.

a: Database broker framework

![Database broker framework diagram]

Figure 6.1. Database broker framework

b: Sequence Diagram:

Line Stoppage
Employee leaving the line

Figure 6.3. Sequence Diagram: Employee Leaving the line

c: Class Diagram:

Line Stoppage
Figure 6.4: Class diagram “Line Stoppage”
Figure 6.5: Class diagram “Employee Leaving the Line”
References:

ITC 411 – Introduction to Information Technology
"Assignment 1"

A report of the different components of a computer system

Student: Cesar Garcia
Student number: 11432783
Master of Information Technologies
Lecturer: Chandana Penatiyana Withanage
Due Date: 1-April-2010

Table of contents

1. Introduction
   1. A practical task specified in the Study Guide in Topic 2. Computer architecture, was to record Your computer’s specifications.
   2. A practical task specified in the Study Guide in Topic 3, Number systems, was Trivially using openSUSE Linux
3. Describe three different ways to start a command line interpreter when using the Gnome desktop of openSUSE Linux.

4. Calculate the binary representation using an 8-bit, two’s complement system of each of the following decimal integers: -64, -1, 15 and 77

5. Describe what occurs in the fetch-execute cycle of a von Neumann machine.

6. Convert the characters in the following string into ASCII code represented in hexadecimal.

II. Conclusion

III. References

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Figure 2.1 Installation Linux

Figure 2.2 Installation Linux in process

Figure 2.3 Executing Linux through Virtual Machine Application

Figure 2.4 Executing help command
I. Introduction

In the last decades the world has experienced the most technological advance in terms of information management. This is one of the reasons which move the new generations to learn more about technology especially in the use of computers and communications. It is important to gain knowledge about the principal characteristics of the new computers; their functional processes, and the different applications used to manage them, and their information. This report aims to describe the components
of a computer system, its functions, and the use of the command line interfaces. Additionally it will be covered some of the basic binary and hexadecimal mathematics, showing resolutions of exercises and the process to move from a decimal to a binary number.

1. A practical task specified in the Study Guide in Topic 2, Computer architecture, was to record Your computer’s specifications. Submit the data you recorded, which will contain the following data items:

   o Operating system name and version:

       Name: Windows Vista Ultimate 2007

       Version: 6.0.6001 Service Pack 1 Build 6001

   o BIOS brand and version:

       Hewlett-Packard F.03,25/11/2008

   o Processor(s) type and identifier:

       Processor AMD Turion (tm) X2 Dual Core Mobile RM-72 2.10 Ghz, 2 Core(s), 2 Logical Processor(s)

   o Total physical memory and total virtual memory:

       Physical memory: 3.75 GB

       Virtual memory: 7.72 GB

   o Capacity of Hard Disk Drive(s) (HDD):

       285 GB

   o Amount of free HDD space:
146 GB

- **Graphics card and amount of memory:**
  
  Card: ATI Radeon HD 3200 Graphics “ATI Technologies Inc.”.
  
  Graphic memory: 1982 MB

- **Display resolution and maximum display resolution:**
  
  Resolution: 1280 by 800 pixels
  
  Maximum display resolution: 32 bit

2. A practical task specified in the Study Guide in Topic 3, Number systems, was *Trivially using openSUSE Linux*. For this you took a screen shot of your host operating system desktop showing the openSUSE desktop in the running virtual machine. Submit that screen shot as the answer to this question.

Installation of Linux through virtual machine application:
1.1 What the ways can we start a command prompt window in SLED?
There are two ways to start the command prompt window in SLED, and one is pressing Ctrl + Shift + N, and the other way is going to the ‘Computer Button’, and choosing ‘More Applications/ System’ and ‘Gnome Terminal’.

1.2 After watching the tutorial on Vi, practice using it within SLED.
1.2.1 Open a Terminal.
1.2.2 Type vi at the prompt to begin a Vi session.
1.2.3 Type: Help to read the online help.

![Figure 2.4 Executing help command](image)

2.3 Type `man man` to read about the man command.
2.3.1 Read the man pages for the following pages. For each task write down the basic functions the command carries out.

a) `ls`

`ls` is a Linux command which provides a list of the files in a specific directory. The principal parameters used by this command are:

- `-a`: List of all files and directories.
- `-B`: Exclude entries which end in ~
- `-C`: Entries by columns.
- `-d`: Directory entries
- `-l`: List in a long format
- `-o`: The same as `-l` but don’t show all the group of information
-r : Reverse the order of the entries.

-s : Show the size of the files.

b) cp

Used to copy files and directories. The principal parameters of this command are:

-- backup : Create a copy of the destination files instead of replace them.

-l : link files


-t : Copy of the arguments

-u : The parameter update make a copy only if the source file is newer than the destination file.

-v : Explanation of the action done.

c) Pwd

Pwdd is the command used to print the current directory. The principal parameters of this command are

-- help : Show the help of the command Pwdd.

-- version : Show the version information.

d) Chmod
The command Chmod in relation with mode changes the permission to the files. The principal parameters of this command are

- `-c`: Reports the changes made.
- `-f`: The error messages are avoided.
- `-R`: Changes files and directories recursively.
- `--help`: Show the help of the command Chmod.
- `--version`: Show the version information.

3. In UNIX and Linux the command line interpreter is referred to as the shell, whereas in Windows and DOS the terminology command prompt window has been used. Furthermore in Linux the command that produces a window that runs a shell is called terminal. For open SUSE Linux that command depends on the desktop, being gnome-terminal for the Gnome desktop.

Describe three different ways to start a command line interpreter when using the Gnome desktop of open SUSE Linux.

The three ways to access to the command line interpreter are:

1. Pressing Ctrl + Alt + F6, that’s allows to enter into the command line interpreter, and to change to the graphic interface it is needed to press Ctrl + Alt + F7. Shown in Figure 3.1.
2. Other way to access to the command line is pressing over the Computer button in the inferior left part of the Linux interface, and then pressing over the ‘More Applications’ button, ‘System’ and subsequently ‘Gnome Terminal’, shown in the figure 3.2.
3. The third way to access to the command interpreter line is executing pressing ‘Shift+Ctrl+N’, shown in figure 3.3.
4. Calculate the binary representation using an 8-bit, two's complement system of each of the following decimal integers: -64, -1, 15 and 77. You can check your answers using the Windows calculator, but you should show the steps you have used to obtain your answers.

Firstly, is needed to change the number to a binary number. There are two ways to do this. One is dividing the number by 2 and taking the remainders form the binary number. The other form is selecting the number by logical method shown in the next example at the right side.

-64

\[
\begin{array}{cccccccc}
-64 / 2 & = & -32 & 0 & \text{remainder} & 64 & 32 & 16 & 8 & 4 & 2 & 1 \\
-32 / 2 & = & -16 & 0 & \text{remainder} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
-16 / 2 & = & -8 & 0 & \text{remainder} & & & & & & & \\
-8 / 2 & = & -4 & 0 & \text{remainder} & 64 & + & 0 & + & 0 & + & 0 & + & 0 & + & 0 = 64 \\
-4 / 2 & = & -2 & 0 & \text{remainder} & & & & & & & \\
-2 / 2 & = & -1 & 0 & \text{remainder} & & & & & & & \\
\end{array}
\]

The number is: -1000000
-1 1 remainder

The number in binary is -1000000.

To change into a 8-bit we have to represent the sign of the number 1 for negative and 0 for positive and complete the number to 8 bits.

The number in 8-bits will be:

8 bits

\[
\begin{array}{cccccc}
1 & 1 & 0 & 0 & 0 & 0 \\
\end{array}
\]

The first number represents the sign.

To change to a 1s complement is necessary to change the 0 per 1 and vice versa:

1s

\[
\begin{array}{cccccc}
1 & 1 & 1 & 1 & 1 & 1 \\
\end{array}
\]

To change to a 2s complement is necessary to add 1.

2s

\[
\begin{array}{cccccc}
1 & 1 & 0 & 0 & 0 & 0 \\
\end{array}
\]

Adding 1 the result is shown in the last table. The next numbers calculating with the same process are:

-1

<table>
<thead>
<tr>
<th>64</th>
<th>32</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

\[0 + 0 + 0 + 0 + 0 + 0 + 1 = 1\]

The number is: -0000001

8 bits
1s complement

\[ \begin{array}{cccccccc}
0 & 0 & 0 & 0 & 0 & 0 & 1 \\
\end{array} \]

2s complement

\[ \begin{array}{cccccccc}
1 & 1 & 1 & 1 & 1 & 1 & 0 \\
\end{array} \]

15

\[ \begin{array}{cccccccc}
64 & 32 & 16 & 8 & 4 & 2 & 1 \\
0 & 0 & 0 & 1 & 1 & 1 & 1 \\
\end{array} \]

\[0 + 0 + 0 + 8 + 4 + 2 + 1 = 15\]

The number is: 0001111

8 bits

\[ \begin{array}{cccccccc}
0 & 0 & 0 & 0 & 1 & 1 & 1 \\
\end{array} \]

1s

\[ \begin{array}{cccccccc}
0 & 1 & 1 & 1 & 0 & 0 & 0 \\
\end{array} \]

2s

\[ \begin{array}{cccccccc}
0 & 1 & 1 & 1 & 0 & 0 & 0 \\
\end{array} \]

77

\[ \begin{array}{cccccccc}
64 & 32 & 16 & 8 & 4 & 2 & 1 \\
1 & 0 & 0 & 1 & 1 & 0 & 1 \\
\end{array} \]

\[64 + 0 + 0 + 8 + 4 + 0 + 1 = 77\]

The number is: 1001101
8 bits

```
01001101
```

1s

```
00110010
```

2s

```
00110011
```

4.1 **Consider a BMP file that holds a screen image at 1280 x 1024 pixels resolution. How large would the file need to be if**

A bmp image represents bit for bit an image showed in the computer monitor. The number of bits per pixel determine the different variety of colors or grays could be perform to mold an image (knowledgerush, 2009). For example a BMP image of 24 bits can have a mayor number of combinations and a better quality than a 16 bits image, and the space in disk will be mayor as well.

To obtain the space needed to save a bmp image at 1280 x 1024 pixels resolution the way to calculate will be:

\[ 1280 \times 1024 = 1310720 \text{ pixels} \]

The number of bits must be multiplied per the number of pixels, for example if the image is a 24 bit image the follow step will be:

\[ 1310720 \times 24 \text{ bits} = 31457280 \text{ bits} \]

So if I want to storage a BMP 24 bits image, the space needed is 31457280 bits, or 31457280 / 8 = 3932160 bytes and subsequently 3932160 / 1024 = 3840 KB (Kilo Bytes).
1. It represents a black and white image;

A BMP black and white image contains just one bit per pixel (knowledge rush, 2009), so that the space needed would be:

\[ 1280 \times 1024 = 1310720 \text{ pixels} \]

\[ 1310720 \times 1 \text{ bit} = 1310720 \text{ bits} \]

\[ 1310720 \div 8 \text{ bits} = 163840 \text{ bytes} \]

And Finally \( 163840 \text{ bytes} \div 1024 = 160 \text{ KB} \)

In conclusion to represents a BMP black and white image the space needed is **160 KB**.

2. It represents a color image using RGB encoding?

A BMP RGB image contains 3 bits per pixel, every bit represents a color, Red, Green and Blue (knowledge rush, 2009), so that the space needed would be:

\[ 1280 \times 1024 = 1310720 \text{ pixels} \]

\[ 1310720 \times 3 \text{ bit} = 3932160 \text{ bits} \]

\[ 3932160 \div 8 \text{ bits} = 491520 \text{ bytes} \]

And Finally \( 491520 \text{ bytes} \div 1024 = 480 \text{ KB} \)

In conclusion to represents a RGB BMP image the space needed is **480 KB**.

5. Describe what occurs in the fetch-execute cycle of a von Neummann machine. Explain what part the system clock plays in this and how this
has limited improvements in the performance of processors. (Half a page plus references expected)

In a development of a computer application, every sentence is translated into instructions to be executed, those instructions are located into the RAM memory, and the execution is carried out by three steps: Fetch, Decode and Execute (Indiana University, 2004). The Fetch process starts locating over the instruction to be executed into the Instruction Register (IR), and according Indiana University (2004) the follow steps are executed:

- The program counter (PC) contains the address which is moved to the memory address registry (MAR).
- The memory position assigned is sent to the memory data register (MDR) after a fetch was started, in order to be decoded.
- PC will be incremented by 1 to execute the next instruction.

The Decoded step defines the operation to be executed, and the Execute step occurs moving the contents in the IR to the MDR by the address saved into the MAR (Indiana University, 2004).

Computer Hardware & Organization (n.d.), express that ‘The clock defines one machine cycle’, and the clock should be stopped in order to detain the cycle. Clock speed plays an important role in the execution of instructions, being the regulator of the instructions execution and also the synchronizer of some computer parts (Webopedia, 2010). A CPU require ticks or clock cycles for the instructions running, so that, with as faster is the clock as
faster the performing of instructions could be carried out by the processor (Webopedia, 2010).

6. Convert the characters in the following string into ASCII code represented in hexadecimal.

Question: 2B or not 2B?

The conversion from string characters into ASCII code is done using the ASCII table shown in figure 6.1.

![Figure 6.1 Ascii table from Ascititable (n.d.).](image)

The conversion of ‘2B or not 2B?’ would be:

2 32

B 42
space 20
o 6f
r 72
space 20
n 6e
o 6f
t 74
space 20
2 32
B 42
? 3f

Question: 2B or not 2B?

Result: 32,42,20,6f,72,20,6e,6f,74,20,32,42,3f

Check your conversion using the od command in openSUSE Linux. For this you will need first to create a file containing the above sequence of characters. Then apply the od command to that file using appropriate options, as specified in the system manual. As the od command has suffered some changes in moving from UNIX to Linux, with some resulting obscurities in the manual, it may help to tell you that appropriate options are

-t x1

This stands for (t)raditional, he(x)adecimal, and with units of (1) byte.

To make the conversion of the question to ascii characters, a text file called hexadecimal was created and executed by the Od command shown in figure 6.2.
Other way to do the conversion is writing the command `Od –t x1` and pressing enter. After that write the question 2B or not 2B? and press enter until the command is executed. The result is shown in figure 6.3
II. Conclusion

The revolution of the computers is influencing the development of the new knowledge, which is taking an important site in the education system. It is a necessity to be able to identify the principal features of the new computes and its internal structure. The applications also are playing an important role in the increment of the functions that a computer system can perform. And the comprehension of the basic mathematics, associated to the computer internal functionality, is a requisite to gain the experience to continue studying a career in the technology field.
III. References:


ITC 411 – Introduction to Information Technology
"Assignment 2"

A report of the different topics, Xhtml, Stack Structure and Assembler.

Student: Cesar Garcia
Student number:  11432783
Master of Information Technologies
Lecturer: Chandana Penatiyana Withanage
Due Date: 25-May-2010

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IV. Introduction


8. Task2. Stack data structures.

V. Conclusion

VI. References
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Figure 2.1  Installation Linux
IV. **Introduction**

In the last decades the world has experienced the most technological advance in terms of information management. This is one of the reasons which move the new generations to learn more about technology especially in the use of computers and communications. It is important to gain knowledge about the principal characteristics of the new computers; their functional processes, and the different applications used to manage them, and their information. This report aims to describe the some of the techniques to design html pages to perform a web page. Additionally it will be covered some of the basic data structure commands and a example about programming using assembler the most basic programming language.
Task 1

Overview

For this task you are required to produce a web site using XHTML. It is expected that you will create the pages for your site using only a simple editor like Notepad. Your web site is to be about you, (for example your interests or hobbies, the area you live in etc.). You will submit the files of your web site as a zipped archive, in their immediate directory structure, electronically via EASTS. You will also describe some aspects of your web site in your word-processed submission.

Web site content and construction

Your site should identify you to others although you may select a topic that is about an interest you have. Your word-processed submission must identify your intent.

To allay privacy concerns, your web site will not be published. However you should still avoid using information like addresses and telephone numbers.

- You need to consider design, layout, navigation and appropriateness of material for your site.
- You must create the pages for your site using a simple editing tool such as Notepad (not a Web page generator like FrontPage, Dreamweaver, etc.). If you use a web page generator you will receive no marks for your XHTML.
- Your site should be at least three (3) and no more than four (4) pages.
- It should contain links to other sites related to its intent. These links should be used within a context in which they are relevant. Do not just have a page of 'my favourite links'.
- The internal links between the pages and resources that you provide must be relative links so that your web site will work properly if it is relocated. You must not use any relative links that use access above your web site’s top directory. Any absolute links used must be to public sites.
- It should load quickly - do not go overboard with graphics (read the relevant sections of the study resources for appropriate use of graphics). Ideally the total size for all the files for each page should be less than 100Kb.

Required XHTML features

Your XHTML must use the strict DTD with all the basic features described in the online XHTML tutorial of Topic 6.
It is expected that you will include examples of the following:

- cascading style sheet (CSS)
- different fonts
- tables
- lists
- a variety of hypertext links
- should also include graphics
- meta tags
- comment tags

Referencing

You must acknowledge your use of resources (images, background wallpapers or patterns etc.) by listing the URLs, either at the bottom of your home page, or on a separate page linked from your home page. You must also reference any books or online resources used in learning XHTML and creating your page as a separate page linked from your home page.

Material to submit

The following material must be submitted for this task:

15. In the word-processed document of your assignment submission, describe the intent of your web site and its structure, including a list of the names of the directories and files provided.
16. A zip file will contain the top directory of your web site containing all the files and subdirectories that are below it.

Solution:

The following material must be submitted for this task:

- In the word-processed document of your assignment submission, describe the intent of your web site and its structure, including a list of the names of the directories and files provided.

The web page designed aims to show my studies and my job experience during the last years and a brief explanation about my natal country and the country where I am living currently. My design is form by 3 pages (principal.htm, ecuador.html and australia.html). The main page is called “principal.htm” and includes my picture, a brief description of the
page, a table showing my studies done in Ecuador and the list of my lasts jobs. The files
including in the principal.htm page are:

- principal.htm “Main web page”
- fotol.jpeg      “Cesar’s Picture”
- australia.jpeg “Australian flag”
- ecuador.jpeg “Ecuadorian flag”

The australia.html page shows some pictures about Australia and Sydney, and one picture
of the page designer in Sydney. The files included in this page are:

- australia.htm “Information of Australia”
- australia1.jpeg “Australia map”
- sydney.jpeg “Picture of Sydney”
- cesar.jpeg “Cesar’s pictures”

The ecuador.html page shows some pictures about Ecuador and Azogues the city where I
live in, and one picture of my family. The files included in this page are:

- ecuador.htm “Information of Australia”
- ecuador1.gif “Australia map”
- azogues.jpeg “Picture of Sydney”
- myfamily.jpeg “Cesar’s pictures”

- A zip file will contain the top directory of your web site containing all the files
and subdirectories that are below it.

The zip file is attached in this submission and it is called 11432783CesarGarcia.zip.

Principal Web page Code:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head>
<meta name="description" content="Information about Cesar Garcia" />
<meta name="keywords" content="XHTML,CSS" />
<meta name="author" content="Cesar Garcia" />
<meta name="subject" content="ITC411- Introduction to Information Technology" />
<meta http-equiv="refresh" content="30" />
</head>
```

In this webpage you can find a brief description about my education and my job experience. Firstly I am going to detail my education background, secondly my experience working in Ecuador, and finally two interesting links one to shows general pictures of Australia and the second showing pictures of Ecuador my natal country.

### Education

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Place</th>
<th>Institution</th>
<th>Certificate</th>
<th># of Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>Ecuador</td>
<td>Azogues</td>
<td>Jose Belizario Pacheco Primary School</td>
<td>Primary School Certificate</td>
<td>5 years</td>
</tr>
</tbody>
</table>

![photo1.jpg](foto1.jpg)
<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
<th>School/Institution</th>
<th>Degree</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>Azogues, Ecuador</td>
<td>Technic Institute &quot;Luis Rogerio Gonzalez&quot; High School</td>
<td>High School Certificate</td>
<td>5 years</td>
</tr>
<tr>
<td>1995</td>
<td>Cuenca, Ecuador</td>
<td>Catholic University of Cuenca</td>
<td>Systems Engineer</td>
<td>5 years</td>
</tr>
<tr>
<td>2005</td>
<td>Cuenca, Ecuador</td>
<td>Catholic University of Cuenca and ESPOL</td>
<td>Magister of Systems Information Management</td>
<td>2 years</td>
</tr>
</tbody>
</table>

<h2>Laboral Experience</h2>
<ul>
  <li>Catholic University of Cuenca – Azogues</li>
  <ul>
    <li>Professor of the Academic Systems Unit 2002-2009</li>
    <li>Professor of the Teaching Sciences and Communication Unit 2006-2009</li>
  </ul>
  <li>Vazcorp Sociedad Financiera “Finance Corporation Vazcorp”</li>
  <ul>
    <li>Head of the Systemas Department 2002-2006</li>
  </ul>
</ul>

<h2>My Experiences in Australia and Ecuador</h2>
<a href="australia.html"><img src="Australia.jpg" width="104" height="80"/></a>
<a href="ecuador.html"> <img src = "Ecuador.JPG" width="104" height="80"/></a> </center> 
Australia Web page Code:

<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang ="en" lang="en">
<head>
<meta name="description" content="Information about Australia" />
<meta name="keywords" content="XHTML,CSS" />
<meta name="author" content="Cesar Garcia" />
<meta name="subject" content="ITC411- Introduction to Information Technology"/>
<meta http-equiv="refresh" content="30" />

<style type="text/css">
  H2,H3 { color: darkblue }
  H1 {color:darkred}
  H4 {font-size: 12pt;
   font-family: Arial;}
  !establishing the styles, use of cascading style sheet (css)>
  body{background:lightyellow}
</style>
<title>Australia</title>
</head>
<body>
<h1 color:red> AUSTRALIA </h1>
<br>
<br>
<center><img src = "australia1.gif" /></center>
<p> I arrived in Australia in September 2009. This is one of the most popular destinations for students and tourists. The reason for me to coming to Australia is to Study a master degree in one of the most prestigious University "<a href="http://www.csu.edu.au">Charles Sturt</a>".</p>
<h2>Sydney</h2>
<center><img src = "Sydney.jpg" /></center>
<p> Sydney is one of the most beautifull cities that I have known. As you can see above the picture shows the Opera House and the Harbour bridge behind. Two land marks in Sydney, and the most popular attractions in Australia</p>
<h2>Cesar in Sydney</h2>
<center><img src = "cesar.jpg" /></center>
<p>This is my picture from other location, in front of the Opera House.</p>
</center>
</body>
</html>
Ecuador Web page Code:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head>
<meta name="description" content="Information about Ecuador" />
<meta name="keywords" content="XHTML,CSS" />
<meta name="author" content="Cesar Garcia" />
<meta name="subject" content="ITC411- Introduction to Information Technology" />
<meta http-equiv="refresh" content="30" /> <!--Refresh the page every 30 seconds-->
<br />
<STYLE type="text/css">
H2,H3 { color: darkblue }
H1 { color: darkred }
H4 { font-size: 12pt;
font-family: Arial; }
<!--establishing the styles, use of cascading style sheet (css)>
body{background:lightyellow}

</STYLE>
<title>Assignment2 Webpage2</title>
</head>
<body>
<br />
<!--Azogues my city-->
<h2>Azogues: the city where I born</h2>
<br />
<p> I born in Azogues in 1978, and the picture above is the principal church in the city called "San Francisco".</p>

<!--My family-->
<h1>My family</h1>
<br />
<p> My family are shown in the picture Above, my wife "Gabriela" and my two children "Santiago" and "Valentina".</p>
```

Ecuador is a Latin American country. The name of Ecuador comes from the ecuadorian line which goes through the capital city called Quito. The city where I born is called Azogues. Azogues is a small city over the south area of Ecuador.
Task 2

Write a short essay on the stack data structure and its applications. Your essay should be of about 500 words plus references. Your essay should cover the following points:

- Describe what a stack data structure is and explain how it works. As part of this explanation you should specify clearly the operations that can be performed on a stack.
- Describe at least two typical applications of the stack data structure. To do this you will need to investigate beyond the textbook and study guide. Your discussion should make it clear how the stack operations are used to perform a task required by the application.

Stack data structure:

A stack is part of a abstract data structures useful to save and allow the access to information in different type of applications (Bell College, n.d.). A stack is similar to an array but is referred as LIFO (Last in First out) because its elements are added in an order but the last element is the first element that can be accessed or retrieved; so that the order of retrieve the elements is inverted (Bell College, n.d.). The stack has two primitive operations: “Push” to add new elements and “Pop” to remove a node (Bell College, n.d.).

According Bell College (n.d.) additionally primitives are part of the stack, which are:

IsEmpty : To get the information if the stack is empty.

IsFull: To get the information if the stack is full.

Initialise: Used to prepare the stack to save information.

Destroy: Used to empty the stack.

A clear example of the use of a stack would be:

1. Initialise(St);
2. St.Push(‘1’);
3. St.Push('2');
4. St.Push('3');
5. St.Pop();

In this example when the command Initialise is executed the stack “St” is created and ready to be used:

```
  1
  St
```

In the line number two the first element is added to the stack:

```
  1
  St
```

In lines number three and four the subsequently elements are added showing the follow structure:

```
  3
  2
  1
  St
```

When the command “Pop” is executed the stack returns this element “3” which is in the last position of the stack, and the structure would be like this:

```
  2
  1
  St
```

Thus the example shows how a stack works and its principal primitives commands for its operation.
Applications of a Stack:

A comparison of the way a Stack works could be showed by the most common example of Stack. In a restaurant a stack of dishes is preformed usually as part of their activities, when the employees need to take a dish they cannot take the first which can be located in the Stack because this could cause the collapse of all the dishes. Thus the correct order to take the elements of the Stack would be taking the last one on the Stack until reach the first one. In terms of informatics, Stacks are using usually in the management of the computer’s memory (Wikipedia, 2010).

For example if an application needs to register elements in memory, usually the application would make a Stack of the memory positions, for example 1000 positions. If an element is saved in this reserved group of positions the application would use the memory starting from the button of the Stack of memory locating the register in the last part of the memory reserved, and then the second element would be stored in the next position, this process will continue until reach the first position. Consequently the reservation of memory is made from, for example 100, until 1100; and the use of memory is made from 1100 until 100 it means the use of memory is LIFO last to be reserved is the first to be used.
Task 3

The Little Man Computer (LMC) described in the Study Guide has instructions for adding and subtracting integers but not for multiplying and dividing integers. The following pseudocode algorithm displays the quotient for a given dividend and a given divisor, which are related by

\[ \text{dividend} = \text{quotient} \times \text{divisor} + \text{remainder} \]

It is assumed that none of these are negative and that the divisor is not zero. The algorithm is:

- Prompt user for input
- Set DIVIDEND = input value
- Prompt user for input
- Set DIVISOR = input value
- Set QUOTIENT = 0
- While DIVIDEND is greater than DIVISOR
  - DIVIDEND = DIVIDEND – DIVISOR
  - QUOTIENT = QUOTIENT + 1
- Display QUOTIENT

Write assembly language code that implements this algorithm for the LMC. Use the simulator at the LMC Home page to assemble and run your code for testing and correction. If that is not available there is a copy of the simulator at the Interact site for this subject, under Resources/LMC. Include your tested code in your assignment submission (i.e. in the word-processed document) in such a way that it can be copied into the LMC simulator for assembly and running. Describe how your testing went.

The follow code reflects the solution of the exercise in the Task3. This code has been copied from the LMC, and has been executed obtaining the results desired. The algorithm represented in assembly language is:

```
in Div   //reading dividend
sto 60   //storing dividend
in Divs  //reading divisor
sto 61   //storing divisor
lda 60   //loading dividend
sub 61   //subtracting divisor from dividend
brp 08   //goes to position 8 if acc +
br 13    //goes line 13 if acc -
sto 60   //save acc in storage 60
lda 17   //load counter
```
add 16 // add 1 to counter
sto 17 // save counter pos 17
br 04 //goes to line 4 to repeat
lda 17 //comes from line 7
out //shows result
hlt //finish
dat 001
dat 000

The code in VVM software is attached to this assignment as a “task3.txt” which is located in the same folder of the web page preformed according task1.
V. Conclusion

The revolution of the computers is influencing the development of the new knowledge, which is taking an important site in the education system. It is a necessity to be able to identify the principal features of the new computes and sequence to perform operations. The applications also are playing an important role in the increment of the functions that a computer system can perform. And the comprehension of the basic commands, associated to the computer internal functionality, is a requisite to gain the experience to continue studying a career in the technology field.

III. References:

Bell College (n.d.). The stack data structure. Retrieved 09 of May 2010 from:

http://hamilton.bell.ac.uk/swdev2/notes/notes_12.pdf


Report on Information technologies in APC College

Student: Cesar Garcia
Student number: 11432783
Master of Information Technologies
Lecturer: Phillip Kazanis
Due Date: 21-December-2010

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Introduction

APC “Australian Pacific College” is a training organization registered by the Australian Government with the aim to provide quality in the teaching of English language and business. APC has a significant number of international students reaching students from more than 70 countries around the world from different cultures and backgrounds. Maximizing the potential of the students APC is looking for the achievement of the student’s goals. Its different campuses around Sydney are providing an excellence in terms of education making the experience of studying a lifetime benefit. The analysis of the information systems used to manage, and produce the services in the education field, is made in this document to give a clear image of the organization of this institution and the different strategies to cover the demands of the rapid growth of APC in the market.
Major business processes, i.e. operations, the organisation carries out?

The principal business processes APC carries out is the “Enrolments” application. Due to the nature of the business, is the main application to manage the student’s information and their behaviour in terms of academic progression in the institution.

Enrolments is the main processes that APC needs to manage the information needed to provide the services to their students; but, other internal processes are preformed to manage the information from the institute operations such as: accounting system, and payroll application. Those activities are carried out by a system called TEAMS by outsourcing; so that, the institution can get benefits from the application without the economic cost as well as the time and staff needed to develop the applications internally.

Another important operation that is covered by the use of TEAMS is the marketing task as well as the feedback processes to determine the customer satisfaction and the best practices of advertising (Softwaredreams.com.au, 2009).

Information systems that are used to automate the processes.

AIMS – In-house software.

The AIMS application allows the students to perform the timetable online, by the registration and enrolment of the subjects for the term in course. To have access to this application the first term, the fees has to be paid in advance; otherwise, the system won’t allow the users to choose the subjects and consequently to perform the enrolment.

TEAMS- Third party software application.

TEAMS is an application developed by the use of cutting edge technology in order to make the management tasks in the administration fields more stress
less reducing the risks of a new software implementation. This applications has been developed integrating marketing, administration and academic fields to make the access more centralized which a intuitive interface and the integrated management of the system (Softwaredreams.com.au, 2009). The extensive experience of the TEAMS application provider; and the vast experience in the past implementations, can contribute with the organization and administration of the educational institutions; so that, the decision of APC to outsource this application reducing the developing costs and the process of implementation. APC got benefits of managing different internal departments in a short period of time by the use of TEAMS instead of waiting for the internal developing of the application to perform these tasks.

One information systems used to automate the enrolment process.

The enrolment system works giving the students a complete access to perform the enrolment by their selves. The application works online by the APC’s website and the student has to be registered previously to use the application. During enrolment periods, students choose their subject performing the enrolment of their subjects online. The web portal allows the students to access to the system remotely from everywhere when an Internet connection is available. Whenever the enrolment has been preformed the student can make the payments of all the subjects selected by the website using a credit card allowed by the system, otherwise the payment would be hold until the student approach to the student services office to make the payment personally. It is an automated process so the students enrol and pay by themselves without any interaction with the company’s staff. That gives the student the facility to perform the hole enrolment process by it self and reducing the amount of time spent in this particular institution’s operation.
Description of one situation of the use of an information system by the user

When the student has been registered at the time to start attending class in the Institution, a new User name and password is provided to access to the APC’s web portal. When the student has the login information available the access to the system would be made the first time with the request to change the password immediately after the login. After login into the web portal a message of the confirmation of the session started will be shown; and the student becomes logged into the application. If the student has not been enrolled in the subjects for the term in consideration, he or she will be asked to choose the desired subjects considering their compulsory subjects and the subjects the student has to approve to complete the course; so that, the system will give some advises about the options to be considered by the user. Once the student has chosen its subjects, they proceed to check and agree with the timetable they just chose. The system could control any discrepancy between the subjects selected by the student and the current timetable established in the application. An email is sent to the student to confirm the transaction detailing the subjects choose and details of the enrolment. Once the session is ended the APC’s staff can have access to the students details and its scores. Regularly the staff of APC can have different type of reports related to the students enrolment and the lecturers will use this information to register the attendance and the scores during the term in progress.

Who heads the development information systems in the organisation?

The IT administrator is in charge of the management of the information systems and all the internal projects. There are some process and small organization’s tasks that have to be analysed in order to establish the adequate strategy to be executed. The staff on the systems department is qualified to continue developing applications, the team has enough knowledge about how to design an application and the different stages involved. Designing, planning, analysing, implementation and maintaining some applications has been developed; and
the politic of APC is developing the applications internally if they are small or medium applications. Otherwise, if the applications involve a big amount of resources and the benefits are not visible in a short period of time, the organization could consider the purchased of a package or the outsourcing of applications in the market. According to Alfonso Unda the tasks of the systems department are divided by helpdesk staff which are in charge of implementation and maintenance, and the developers which perform the analysis, planning and designing of applications.

**System development methodology used in the organization?**

APC use two methodologies to developing software into the organization. Those methodologies have been used by the APC information technologies team in order to improve the developing process and to create a high quality software avoiding the errors and defects in the control stage. The methodologies used are RTU and Scrum.

**RPU: Rational Unified Process**

From the Software Engineering Process developed by an object oriented and developed methodology. RUP was created by the Rational Software Corporation under the direction of IBM in 2003. RUP has been designed as a framework to reduce the time in control and developing and to create a scheme to follow in the developing of new applications (IBM, 1998). According to IBM (1998) The Rational Unified Process gives to the different integrant of the developing team the follow effective practices:

“1. Develop software iteratively
2. Manage requirements
3. Use component-based architectures
4. Visually model software
5. Verify software quality
6. Control changes to software

Scrum:

Scrum aims to improve the developing of software applications by the practice of an agile methodology. According to Scrummethodology.com (n.d), *Scrum is unique because introduced the idea of “empirical process control”*. The main characteristics of Scrum are the designation of responsibilities and the different roles into the developing team. Scrum also has the advantage of been adaptable to any environment when is needed, and the structure can be changed according to the business scope. Scope creates the perfect environment in developing by the designation of three roles: Product Owner, Scrum Master and Team Member. Product Owner is the bridge between he customer and the team transmitting the customer requirements and needs to the team, the Scrum Master makes the relationship between the product owner and the team members, and the team member are the group of engineers, designers, programmers, etc. to work directly in the developing of the applications Scrummethodology.com (n.d).

Data collection techniques used to answer the above topics.

The data techniques used to collect the information from APC College to create this document are questionnaires, interviews and observation.

Questionnaires.- Can allow to the collecting of a significant amount of information with no intimidating people (Mcnamara, n.d.), the application is simple and don’t need to be supervised.

Interviews.- It is more personal and can get accurate information from the person interviewed, and can allow to ask new questions despite the structure of the questions predefined (Mcnamara, n.d.). In this method the improvisation is important to cover different gaps into the process to get information.
Observation .- In cases where the questionnaires and interviews cannot allow to collect accurate information or the process it is too complex to described, it is necessary to perform a observation. Observation allows to the collecting of information by the direct analysis in the place where the process or even is occurring (Mcnamara, n.d.).

The three methods have been applied during the recollection of information in APC College. Firstly a questionnaire was applied to both persons which are working in the IT department in APC. After collection the information a interview was held with Alfonso Unda, one of the integrants of the IT department, who give the complete information to make clear some points of the information collected by the questionnaires. Finally an observation was held by the use of the application in the website of the institution; even though, the process hasn’t been completed totally due to the sensitive information in the database, the most of the functions where shown to collect the information about one process or activity from APC.

People interviewed in the organization.

Alfonso Unda (IT support Officer / Helpdesk) APC: Alfonso Unda is one of the persons working in the helpdesk field. He is in charge of giving support to the application’s users and giving them the adequate training in new applications or application’s changes. He is in charge also of the developing of new small applications and the support; even tough, the implementation and control after the launch of small internal applications of software maintenance.

With him an interview was held in order to get the most of the information to get enough information to complete this document. Among others, some questions have been done to collect the information from the organization in the analysis. The questions performed where:
Which are the operational processes in APC?

Which of the processes has been automated?

What are the applications used by APC?

What are the tasks performed by these applications?

Who are the users?

With the application of these questionnaire the information has been collected and registered in each question above; thus, the knowledge about the organization of APC college can give a clear image about the optimization of resources and efficiency in the use of external providers to perform a more reliable system.

References:


Report on systems analysis

Student: Cesar Garcia
Student number: 11432783
Master of Information Technologies
Lecturer: Phillip Kazanis
Due Date: 18-January-2011

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Figure 7.1 Answer question 7
Figure 8.1 Answer question 8
Introduction

The Systems analysis process is one of the most important activities into the business operations. The strategies established by an organization in the most of the cases, is related to the developing of systems applications; thus, the importance to perform an adequate analysis of the business and its processes. It is fundamental the accurate analysis in terms of economic, technological and operational feasibilities in order to ensure the project successes. In this report the most of the commons diagrams are developed to give a general panorama of the effective analysis; and the design of projects to manage the information adequately.
Question 1.

Wagga Base Hospital has a special facility that does X-rays by appointment. When a GP asks a patient to undergo an X-ray and gives him/her a request for an X-ray, the patient visits the Wagga Base Hospital X-ray facility to make an appointment and receives an appointment slip. When the patient goes to the X-ray facility, he/she presents the appointment slip and gets X-rayed; a report is prepared (one copy of which is sent to the patient GP).

Identify a use case from this short case study and write a Fully Developed Use Case description.

Answer: The question refers to the process of getting an x-rays after visiting the GP. In this scenario the use case “Making an appointment” has been considered to develop a Fully Developed Use Case Description.

<table>
<thead>
<tr>
<th>Use Case Name:</th>
<th>Making an appointment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario:</td>
<td>X-rays appointments</td>
</tr>
<tr>
<td>Triggering Event:</td>
<td>Patient request an appointment</td>
</tr>
<tr>
<td>Brief Description:</td>
<td>After the GP asks the patient to undergo an X-ray, the patient visits the Wagga Base Hospital facilities to make an appointment.</td>
</tr>
<tr>
<td>Actors:</td>
<td>Clerk</td>
</tr>
<tr>
<td>Related Use Cases:</td>
<td>Includes: checking availability</td>
</tr>
<tr>
<td>Stakeholders:</td>
<td>GP</td>
</tr>
<tr>
<td></td>
<td>Patient</td>
</tr>
<tr>
<td>Preconditions:</td>
<td>The GP must exist.</td>
</tr>
<tr>
<td></td>
<td>The Patient must exist.</td>
</tr>
</tbody>
</table>
### Postconditions:
The appointment slip has to be registered in the database and printed.

### Flow of Events:

<table>
<thead>
<tr>
<th>Actor Events</th>
<th>System Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clerk check the availability (checking availability)</td>
<td>1.1 System makes a query to get the available dates.</td>
</tr>
<tr>
<td>2. Clerk enters the patient and GP information</td>
<td>1.2 System displays available dates for the x-rays.</td>
</tr>
<tr>
<td>3. Clerk prints the appointment slip.</td>
<td>2.1 System saves the patient and GP information.</td>
</tr>
<tr>
<td></td>
<td>2.2 System displays the slip.</td>
</tr>
<tr>
<td></td>
<td>3.1 System prints the slip.</td>
</tr>
</tbody>
</table>

### Exception Conditions:

1.1 Patient is not found.
2.1 GP is not found.

---

**Question 2.**

[Diagram image]

*Figure 2.1 Question 2*
For the above diagram:
What is aaa in relation to fff?
What is kkk in relation to fff?
What are the operations of aaa?
What are the attributes of kkk

Answer: Firstly, this is a Class diagram which represents a hierarchy and a relationship by aggregation; and, any characteristics “Attributes” and “Methods” of any of the classes defined in the diagram.

What is aaa in relation to fff?
In the case of “aaa” there is a hierarchy where the class “aaa” is the father and the class “fff” represents the child in the diagram; Hence, the attributes of “aaa” are inherited by “fff”. “aaa” represents a superclass, whereas “fff” represents a subclass which can shared the characteristics of the superclass “aaa”.

What is kkk in relation to fff?
“kkk” and “fff” represents a a relationship by aggregation where the parts can exist separately. In this case “fff” is part of “kkk” like tire is part of car; but, both can exist independently.

What are the operations of aaa?
In the class diagram a class use to be formed by 3 rows; the first row represents the name of the class, the second the attributes of the class and finally the third one represents the methods. Considering the class “aaa” the methods are “ddd” and “eee”.

What are the attributes of kkk?
The second row of the class represents the attributes; so that, the attributes of “kkk” are “lll” and “mmm”.

Question 3.

![Class diagram](image)

**Figure 3.1 Question 3**

**For the above diagram:**
What is Name in relation to Video?
What is Get Name() in relation to Video?
What kind of diagram is this?

**Answer:** This diagram represents a Class diagram where video and customer are the classes and are related to each other.

**What is Name in relation to Video?**

The “Name” component in the class video is an attribute of this class, this diagram represents the class Video its attributes and functions.

**What is Get Name() in relation to Video?**

The “Get Name()” in the diagram inside the class video, is a method of Video and could be executed in time of the system execution. In this case the method “Get
Name()” should be a function to perform a query in order to obtain a specific name from the items in the class “Video”.

**What kind of diagram is this?**

This is a RM class diagram where the classes, relationships, attributes and methods are shown in the Figure 3.1.

**Question 4.**

A football coach can train only one team at a time and each team can be trained by only one football coach at a time. Each team consists of 24 players who could be either foreigners or Australians. Draw a class diagram to represent the above information.

**Answer:**

The first diagram where the classes are identified is shown in the follow figure:

![Class Diagram 1](image1)

**Figure 4.1 Class Diagram 1**

Considering the types of nationalities for the players the final diagram it is shown in figure 4.2:
Question 5.
The management of a train station has requested an automatic ticket machine to work as follows. The user of the machine asks for a destination and ticket type (e.g. single, return or 1 day ticket) and the machine displays the price. When the appropriate amount has been inserted, the machine issues a date-stamped ticket containing the destination, ticket type and price. The machine records the number of tickets issued for each destination and the number of tickets of each type for each day. Once a week these statistics are sent back to the central database.
Complete what is missing in this diagram 0 DFD for this system.

Figure 5.1 Question 5

Answer: The missing part is:

Figure 5.2 Missing diagram
In Figure 5.2 the missing part is shown. First the external agent “User” and the process to get a ticket called “Get Ticket” are shown; whereas, the information about prices, destination and type of ticket would be reported by the database D1 “Tickets”. The next part is the graphic in figure 5.1; thus, the total diagram is:

![Figure 5.3 Total diagram](image)

**Question 6.**

A lecturer teaches at least one subject. Each subject is taught by one lecturer, and may be studied by zero or more students. A student must study at least one subject, and may study several. A subject consists of lectures, possibly tutorials, and at least one assessment. Both coursework and exams are types of assessment.
Figure 6.1 Question 6

**Answer:** The missing part is:

In the figure 6.2 the missing part is Student as a Class, Lectures for subject, and the last part is “coursework” as a type of assessment.
Question 7.

This question concerns the Wagga base hospital case study listed in Task 1 above. Draw a system sequence diagram on the Use Case description you developed. Hint: a system sequence diagram shows the interaction between an actor and a system for one use case only.

**Answer:** The use case considered to develop the system sequence diagram is shown in figure 7.1. The use case has been taken from the question number 1, where a Fully Developed Use Case Description has been done considering the Wagga base hospital case of study. The use case developed is the “Making an appointment”.

![Figure 6.2 Answer question 6](image-url)
Figure 7.1 Answer question 7

Question 8.

Draw E-R diagrams for the following statements:

In a library system

• A member can make many reservations, but a reservation is only for one member.
• A member can make several loans, but a loan is only for one member.
• A loan is for one copy of a book, but a copy may be on many loans (over time).
• A book may be reserved many times, but a reservation is only for one book.
• A book can have several copies, but a copy is only associated with one book.
• A book can have several authors, but an occurrence of an author/ISBN combination is only associated with one book.

**Answer:** The ERD diagram represents all the entities and its relationships. In figure 8.1 the statements above has been represented.
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I. Introduction

The data design is part of the current business world, becoming a vital part to create a structure to manage information. The goal of the data design is the creation of a design which can support the daily operations of a business and their future growing. Not only the support of the operations has to be considered during the design, also the better way to get appropriate, and accurate information from the database is important to this delicate process. In this report the aim is the showing of some examples of the process used to develop an effective database design, starting from the Entity Relational Model until achieve the design of a Relational Data Model. In this regard the examples show the process to the design and the considerations taken to create an effective database model for specific cases of study.

1. Part A: Convert ERD to Relational Data Model

Part A has three questions. Answer each question independently.

Prepare the Relational Tables to represent the following situations, which are described by means of text and an Entity Relationship Diagram. The relational table descriptions are to be in the form:

**Table Name_1** (attribute_1, attribute_2, attribute_3, … ,attribute_x)

- Primary Key (attribute_1, attribute_2)
- Foreign Key attribute_4 References Table_Name_2 (repeat for each foreign key)
- Alternate Key (attribute_5, attribute_6) (repeat for each alternate key)

1.1 Question A.1

Charles Sturt University has many campuses, including Wagga Wagga, Bathurst and Albury. Each campus is known by its campus code, eg WW, B, and A respectively. Additionally a unique campus id is assigned to each campus. Staff members are located on one campus.

Attributes to be included in the relational tables are campus_code, campus_id, campus_name, staff_member_id, first_name, last_name.
Entity Relationship Diagram:

One “campus” has various “Staff members” and one “Staff member” is located in one campus, consequently the relationship is one to many. The relationship between campus and staff member is based on a strong relationship when the campus’s primary key is part of the Staff’s primary key table. Thus the table “Staff” has a compose primary key including the Staff_Mamber_Id and the Campus_Id, that is showed in the figure 1.1.

Relational Data Model:
Once the design of the Relational Data Model is complete, the Relational Table Descriptions are:

**Campus** (Campus_id, Campus_Code, Campus_Name)
   Primary Key (Campus_id)
   Alternate Key (Campus_Code)

Campus_code is an Alternate Key in the table “Campus” because it could represent as a super key the records in the campus table.

**Staff** (Staff_Member_Id, Campus_id, First_Name, Last_Name)
   Primary Key (Staff_Member_Id, Campus_id)
   Foreign Key Campus_Id References Campus (Campus_Id)
   Alternate Key (Staff_Member_Id)

The table Staff has a compose Primary Key including Staff_Member_Id (Super Key) and Campus_Id (Foreign Key from Campus Table).

**1.2 Question A.2**

Contractors are employed with specific skills. Skills are described with a skill_id – a uniquely assigned number, and a skill description. The skill description must also be uniquely stored in the database. The system needs to be able to list the skills for each contractor as shown below.

John Smith Database design, SQL, UML.

Jane Doe C#, Java, Database design, SQL.

Attributes to be included in the relational tables are: contractor_id, first_name, last_name, skill_id, skill_description, skill_acquired_date.

**Entity Relationship Diagram:**
One “contractor” employed various “Skills” and one “Skill” is employed by various “contractors”, consequently the relationship is many to many. The relationship between contractor and skill is based on a strong relationship, but the relationship has to be made using a bridge between both tables. In figure 1.2 the use of a third table and the relationship among the tables are shown.

Relational Data Model:
Once the design of the Relational Data Model is complete, the Relational Table Descriptions are:

**Contractor** (Contractor_id, First_name, Last_name)

Primary Key (Contractor_id )

Contractor_id is an Primary Key in the table “Contractor” because could represent as a super key the records in the campus table.

**Skill** (Skill_id, Skill_description, Skill_acquired_date)

Primary Key (Skill_id)

Skill_id is an Primary Key in the table “Skill” because could represent as a super key the records in the Skill table.
**Contractor_Skill**  
(Contractor_id, Skill_id)  
Foreign Key Contractor_Id References Contractor (Contractor_Id)  
Foreign Key Skill_Id References Skill (Skill_Id)

The table “Contractor_Skill” has a compose Primary Key including  
Skill_Id(Foreign Key from Skill Table) and Contractor_Id (Foreign Key from  
Contractor Table), becoming a bridge table.

### 1.3 Question A.3

Staff Members work on many projects at any one time. One staff member supervises each project.

Staff members can stop and restart work on a project and the system must record the history of starting and stopping work on the project.

Attributes to be include are staff_member_id, first_name, last_name, project_id, project_name, staff_member_work_start_date, staff_member_work_end_date

**Entity Relationship Diagram:**

![Entity Relationship Diagram](image-url)
One “Staff member” works in various “Projects” and one “Project” is carry out by various “Staff members”, consequently the relationship is many to many. The relationship between Project and Staff member is based on a strong relationship, but the relationship has to be made using a bridge between both tables. In figure 1.3 the use of a third table and the relationship among the tables are shown.

The relationship between Staff member and Projects has another occurrence, when one Staff member can supervise one Project. In the data relational model the relationship one to one is not represented, but also exist in the diagram when the table project has been assigned a new attribute called “Supervisor_id” which will contain the code of the staff member in charge of supervise the project. Another way to include the staff member as a supervisor in the project table, could be including the name of the staff member, but the best way is the use of the staff_id to avoid redundancy or the problem of some similar staff names.

Relational Data Model:
Once the design of the Relational Data Model is complete, the Relational Table Descriptions are:

**Staff_member** (Staff_member_id, First_name, Last_name, Staff_member_work_start_date, Staff_member_work_end_date)

Primary Key (Staff_member_id)

Staff_member_id is an Primary Key in the table “Staff_member” because could represent as a super key the records in the staff_member table. The attributes Staff_member_work_start_date and Staff_member_work_end_date has been included in the Staff_member table because are attributes which determine the date
when the Staff started working and the date when the Staff finished working respectively.

**Project** (Project_id, Project_name, Supervisor_id)

Primary Key (Project_id)

Project_id is an Primary Key in the table “Project” because could represent as a super key the records in the Project table, also the attribute Supervisor_id was added to register the staff who is in charge to supervise the project, representing also the relationship one to one between the tables Staff_member and Project.

**Staff_member_Project** (Staff_member_id, Project_id)

Foreign Key Staff_member_id References Staff_member (Staff_member_id)
Foreign Key Project_id References Project (Project_id)

The table “Staff_member_Project” has a compose Primary Key including Project_id (Foreign Key from project Table) and Staff_member_id (Foreign Key from Staff_member Table), becoming a bridge table.

### 2. Part B ERD and RDM

Represent this problem by means of:

i. an Entity Relationship model;
ii. Relational Data Model.

### 2.1 Hare and Tortoise Case Study

The Hare and Tortoise is a chain of noodle and dumpling restaurants in London serving Asian influenced meals. The following information has been gathered about the restaurant.

There are several restaurants, for each you need to record the restaurant location (Bloomsbury, Putney, Ealing, Kensington and Blackfriars) and the address and telephone number.
The chain has a standard range of dishes that are produced at each restaurant. Each dish is described by the dish code, dish name, and description (e.g., R2, 'Malaysian Chicken Curry and Rice', 'chicken on the bone stewed ...'). This information is displayed on the menu available at each restaurant.

Each restaurant is free to construct its own menu choosing from the standard dishes and to set the price of the dish at the restaurant. A sample menu with the menu dishes available at the Bloomsbury locations is shown below.

### Hare and Tortoise: Bloomsbury

**Noodle and Dumpling Bar**

**Menu**

R2  
**Malaysian Chicken Curry and Rice**  
chicken on the bone stewed with traditional spices, curry leaves, lemon grass.  
£4.50

T3X  
**Char Sui Pork**  
marinated fillet of pork, oven roasted, and braised with cane syrup.  
£4.30

S2C  
**Kani Salad**  
snow crab leg and green leaves with home made Japanese dressing.  
£5.50

M3  
**Futomaki**  
big seaweed roll filled with omelette, avocado, crab stick, cucumber, pickle and sakura denbu - 8pcs  
£5.00

C1  
**Yaki Udon**  
wok fried thick white noodles with prawns, squid, pork, crab sticks, Chinese mushrooms, onions and beansprouts.  
£6.00

---

*Figure 2.1 Extract from the Menu Offered at the Bloomsbury Restaurant*
Orders are taken by a waiter recording the dish(es) and the table number. The order information for each table is entered into the system, recording the table number, the dishes ordered and the waiter that serves the table. The system will record the date and the shift automatically, for example 10/09/2010, lunch shift. The order is sent to the kitchen for preparation.

A sample order (figure 2) for five people is shown below. A dish ordered twice is repeated on the order.

**Hare and Tortoise: Bloomsbury**
Noodle and Dumpling Bar
15 / 17 Brunswick Shopping Centre
London WC1 Tel 020 7278 4945

Date: 11-09-2010  Shift: Lunch,
Table: 12  Waiter: ES

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2</td>
<td>Malaysian Chicken Curry and Rice</td>
<td>£4.50</td>
</tr>
<tr>
<td>R2</td>
<td>Malaysian Chicken Curry and Rice</td>
<td>£4.50</td>
</tr>
<tr>
<td>T3X</td>
<td>Char Siu Pork</td>
<td>£4.30</td>
</tr>
<tr>
<td>SC2</td>
<td>Kani Sashimi</td>
<td>£5.50</td>
</tr>
<tr>
<td>C1</td>
<td>Yaki Udon</td>
<td>£6.00</td>
</tr>
</tbody>
</table>

Total: £24.80

**Figure 2.2 A simple order**

Staff are employed on a casual basis and may work at one or more restaurants in the chain. Each staff member has an id, a unique set of initials (ES in the above figure), name and contact phone number. The system needs to record the first date that a staff member worked in each Restaurant.

There are two shifts per day: lunch at 11:30 – 3:00 and evening at 5:00 – 10:00. The system will record the shift codes (L, E), shift name (Lunch and Evening) and shift times.

**Part B solution:**
Entity Relationship model:

The relational data model is shown in Figure 2.3. According to the “Hare and Tortoise Case Study” it is necessary to record the data of each restaurant, so that “Restaurant” is considered as an entity. Other entities are designed in this case of study such as:

**Menu.** Which relationship with “Restaurant” is one to one, and the relationship with dish is many to many due to a menu is formed by many dishes and also one dish is included in many menus.

**Staff_member.** Which relationship with “Restaurant” is many to many, due to a Restaurant employ many Staff_members and also one Staff_member works on many Restaurants.

**Dish.** This entity has many to many relationships with Order and also with menu, because both includes many dishes, many dishes are included in an Order or a Menu.

**Shift.** This entity contains information about the different shifts used by the restaurants for their activities.

**Tables.** This entity contains information about the different tables used by the restaurants for taking the orders.

**Order.** This is the most important table to register the operations of each restaurant. Thus the relationships with the majority of the tables is needed to register the orders by Table, Shift, Staff_member and Restaurant. As a result of this the relationship with the tables mention before is on to many, for example one Table many order and so on. There is just one many to many relationship with order which is established with the table Dish. The relationship is many dishes can be part of many orders and many orders can include many dishes.
In conclusion the tables considered to the design of the Entity Relationship Model are shown in the Figure 2.3 according their characteristics and relations.

![Entity Relationship Model](image)

**Figure 2.3 Entity Relationship Model**

Having the design of the Entity Relationship Model, the next step is the design of the Relational Data Model.

**Relational Data Model**

According the Entity Relationship Model shown in Figure 2.3, the design of the Relational Data Model is developed a continuation:

First the many to many relationships are eliminated by the use of a Bridge Table. The figure 2.4 shows this process:
Additionally the relationship between Restaurant and Menu in Figure 2.3 is one to one, but this relationship is not possible when is developed a Relation Data Model; Hence, the relationship was change to “one to many” in order to establish the ownership of one menu by the entity Restaurant. In this case the possibility to have more than one menu is open, which could be possible in case of one restaurant want to create a new menu in the future. In addition this change ensures that a restaurant can have a menu, which belongs just to the restaurant in this regard.

Based in the Figure 2.4 the Relation Data Model was designed showing the different data characteristics showed in Figure 2.5.
Figure 2.5 Relation Data Model
The relational table descriptions:

According to the design shows in the figure 2.5 the table descriptions are:

**Menu** (Menu_Id, Restaurant_id)
- Primary Key (Menu_id, Restaurant_id)
- Foreign Key Restaurant_id References Restaurant (Restaurant_id)

The attribute Menu_id was included in the table menu in order to permit the creation more than one menu for each restaurant. Because is possible the creation of a menu for regular days and a new one for special occasions such as holydays. In this case that is possible and is a real fact in this kind of business.

**Restaurant** (Restaurant_id, Restaurant_location, Restaurant_address, Restaurant_phone)
- Primary Key (Restaurant__Id)
- Alternate Key (Restaurant_location)

Restaurant location attribute is a superkey, which is consider as a Alternate Key in the restaurant table.

**Dish** (Dish_id, Dish_name, Dish_description)
- Primary Key (Dish_id)
- Alternate Key (Dish_name)

Dish name attribute is a superkey, which is consider as a Alternate Key in the Dish table.

**Menu_Dish** (Menu_id, Restaurant_id, Dish_id, Dish_price)
- Primary Key (Menu_id, Restaurant_id, Dish_id)
- Foreign Key Menu_id, Restaurant_id References Restaurant (Menu_id, Restaurant_id)
- Foreign Key Dish_id References Dish (Dish_id)

In the table Menu_Dish the primary key is a composite identifier which contains the foreign key from the table Restaurant plus the foreign key Dish_id from the table Dish.
Staff_member (Staff_id, Staff_name, Staff_contact_number)
   Primary Key (Staff_id)

Staff_id is the attribute considered the primary key of this table according the case
of study.

Restaurant_Staff_member (Staff_id, Restaurant_id)
   Primary Key ((Staff_id, Restaurant_id))
   Foreign Key Staff_Id References Staff_member (Staff_id)
   Foreign Key Restaurant_id References Restaurant (Restaurant_id)

Shift (Shift_id, Shift_description, Shift_Time)
   Primary Key (Shift_id)
   Alternate Key (Shift_description)

Shift_description attribute is a superkey, which is consider as a Alternate Key in the
Shift table.

Order (Order_number, Restaurant_id, Shift_id, Staff_id, Table_number, Order_date)
   Primary Key (Order_number, Restaurant_id)
   Foreign Key Restaurant_id References Restaurant (Restaurant_Id)
   Foreign Key Shift_id References Shift (Shift_Id)
   Foreign Key Staff_id References Staff_member (Staff_Id)
   Foreign Key Table_number References Tables (Table_number)

In the table Menu_Dish the primary key is a composite identifier which contains the
foreign key from the table Restaurant plus the Order_number attribute.

Order_Dish (Order_number, Restaurant_id, Dish_id, Dish_price)
   Primary Key (Order_number, Restaurant_id, Dish_id)
   Foreign Key Order_number, Restaurant_id References Order (Order_number, Restaurant_id)
   Foreign Key Dish_id References Dish (Dish_id)

In the table Order_Dish the primary key is a composite identifier which contains the
foreign key from the table Order plus the Dish_id attribute.

Tables (Table_number, Table_location)
   Primary Key (Table_number)
II. Conclusion

The design of data bases is a critic process because the successful of a project or applications relay on a good data base design. Some considerations have to be taken when a data design is developed. It is important to consider the user needs, the business needs and the future growth that the project designed will have in the future. Thus at the time to design a project the designers should take this considerations and also invest enough time to ensure the application will have the adequate data base to solve the business needs and to allow their future growing. This report shows the process to design a data base including all the considerations taken and the steps followed during this process.
IV. Introduction

1.- SQL Queries

a) List the first name, surname, address (street, town and postcode) and staff_type of all female nurses and female surgeons.
b) For each surgeon that has performed more than 2 operations list the surgeon first_name, surname, and the number of operations performed.

c) List the patients of the hospital (persons that have been admitted) that have a next of kin listed as a staff member of the hospital. List the patient's first name and surname and the staff members first name and surname.

Answer this question using joins. Sub-queries are not required or permitted in the solution.

d) List the admissions that have been discharged and did not have an observation. List the patient surname, first_name, admission_date, and discharge_date. Order the list by surname and first_name in ascending order.

e) For each admission list admission_id, admission_date, surname, first_name, the number of Temp observations and the average Temp value taken during the admission. For patients without observations list the number as 0, and the average as '-'.
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III. Introduction

The data design is part of the current business world, becoming a vital part to create a structure to manage information. The goal of the data design is the creation of a design which can support the daily operations of a business and their future growing. Not only the support of the operations has to be considered during the design, also the better way to get appropriate, and accurate information from the database is important to this delicate process. In this report the aim is the showing of some examples of the process used to extract information from a data base using the SQL structure and facilities. In this regard the examples show practical cases in which we need accurate information and well organized.

1. SQL Queries

Requirements

Use the Hospital database (hosp2010.mdb) available from the subject sites interact site. Answer the following queries.

You are required to submit:

i. The appropriate SQL statement, and

ii. The resultant table.

Note: Your SQL should be correct for any data, not just the sample data.

Write SQL SELECT statements to retrieve the following information from the database.

a) List the first name, surname, address (street, town and postcode) and staff_type of all female nurses and female surgeons.

The SELECT for this question is:

```sql
SELECT person.First_name, person.Surname, person.Street, person.Town, person.Postcode, staff.Staff_type
FROM person INNER JOIN staff ON person.person_id = staff.person_id
WHERE person.sex = 'F' and (staff.staff_type = 'Nurse' or staff.staff_type = 'Surgeon');
```
The results of the query are:

Figure 1: Results of SQL query question “a”.

In this case there are not female persons who are “Surgeon”.

b) For each surgeon that has performed more than 2 operations list the surgeon first_name, surname, and the number of operations performed.

The SELECT for this question is:

```
SELECT person.First_name, person.Surname, count(operation.surgeon) AS Operation_Number
FROM person INNER JOIN operation ON person.person_Id = Operation.surgeon
GROUP BY person.First_name, person.Surname
HAVING count(operation.surgeon) > 2;
```

The results of the query are:

Figure 2: Results of SQL query question “b”.

```
There is just one Surgeon who perform more than 2 operations.

c) List the patients of the hospital (persons that have been admitted) that have a next of kin listed as a staff member of the hospital. List the patient's first name and surname and the staff members first name and surname.

Answer this question using joins. Sub-queries are not required or permitted in the solution.

*The SELECT for this question is:*

```sql
SELECT person.First_name, person.Surname, pstaff.First_name, pstaff.Surname
FROM ((person INNER JOIN admission ON person.Person_id = admission.patient_id) INNER JOIN person AS pstaff ON person.Next_of_kin = pstaff.Person_id) INNER JOIN staff ON person.Next_of_kin = staff.person_id;
```

*In this select the result shows the same item twice, because the patient has two records in the table “Admission”; so that, to avoid this problem is a necessity to add the command distinct shows next.*

```sql
SELECT DISTINCT person.First_name, person.Surname, pstaff.First_name, pstaff.Surname
FROM ((person INNER JOIN admission ON person.Person_id = admission.patient_id) INNER JOIN person AS pstaff ON person.Next_of_kin = pstaff.Person_id) INNER JOIN staff ON person.Next_of_kin = staff.person_id;
```

*The results of the first select are:*

![Figure 3: Results of Sql query number 1 question “c”](image)

9
The results of the second select are:

![Figure 4: Results of SQL query number 2 question “c”.

In this question the correct answer is the second SQL query showing its results in the Figure number 4.

d) List the admissions that have been discharged and did not have an observation. List the patient surname, first_name, admission_date, and discharge_date. Order the list by surname and first_name in ascending order.

The SELECT for this question is:

```sql
SELECT person.person_id, person.First_name, person.Surname, admission.Admission_date, admission.Discharge_date
FROM person INNER JOIN admission ON person.Person_id = admission.patient_id
WHERE admission.Admission_id NOT IN(SELECT observation.Admission_id FROM observation)
AND admission.Discharge_date IS NOT NULL
ORDER BY person.Surname, person.First_name ASC;
```

The results of the query are:
Figure 5: Results of SQL query question “d”.

In this case the command “ASC” was included in the Select; although is not necessary because the “Order By” clause order the items in Ascendant order by default.

e) For each admission list admission_id, admission_date, surname, first_name, the number of Temp observations and the average Temp value taken during the admission. For patients without observations list the number as 0, and the average as ‘-’.

The SELECT for this question is:

```sql
SELECT admission.Admission_id, admission.Admission_date, person.Surname, person.First_name,
Switch(Count(observation.observ_value)<>0,Count(observation.observ_value),Count(observation.observ_value)=0,0) AS Obs_Number,
Switch(Avg(observation.observ_value) Is Null,'-', AVG(observation.observ_value)<>NULL, AVG(observation.observ_value)) AS Temp_Average
FROM person INNER JOIN (admission LEFT JOIN observation ON
admission.admission_id = observation.admission_id) ON person.Person_id = admission.patient_id
WHERE (((observation.observ_type)='Temp' Or (observation.observ_type) Is Null))
GROUP BY admission.Admission_id, admission.Admission_date, person.person_id, person.Surname, person.First_name;
```

The results of the query are:
Figure 6: Results of SQL query question “e”.

The number of records is ten because the number of admissions.

IV. Conclusion

The design of databases is a critical process because the successful of a project or applications rely on a good database design. Some considerations have to be taken when a data design is developed. It is important to consider the user needs, the business needs when the information has to be reported from a database. With the application of SQL queries, an important group of values can be extracted and reported in a specific order and containing valuable information. This report shows the process to design SQL queries including all the considerations taken and the steps followed during this process.
ITC 431 – Data Communications "Assignment 1"

A Report on different methods and general knowledge about communications

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Master of Information Technologies
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Due Date: 19-April-2010

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Figure 5.1: Longitudinal Parity adapted from (Wang, 2006)
Introduction

Data communications has experienced the most significant growth over the last decades due to the Internet developing. Internet provides millions of gigabytes of information, creating a network to keep people interconnected from all over the world. To make possible the inevitable growing of the Internet is necessary a variety of devices, software, standards and protocols in order to provide the essential tools for an efficient interconnection. It is estimated that there are around one hundred thousand of hosts connected to Internet, and the number of users or devices connected to Internet is increasing by almost the double every year. With the new developments and the new technologies, the connections became faster and more accessible. This document aims to analyze some of the different methods used to provide a better way to use the actual resources and exploit them at the max of their capacity, and to create a security Internet connection to protect the integrity of the information transported over this Global Network.
1. What happens when you introduce noise into digital data and digital signals?

It is possible to find noise over a digital data or digital signals transmission. Signal to noise ratio (SNR) express how much noise is interfering into a digital signal transmission, and the form to calculate is equal to power signal by power noise $PS/PN$, which can shows the level of incidence of noise into a signal (Park, n.d.). The fact to introduce noise into digital signals could not cause any problems if the noise is slight, and the receiver could ignore these inaccuracies; However, if the level of noise is significant, the data transmitted in this condition could be lost partially or totally due to the interference caused by the noise (Cysco Systems,2010). Digital data such as images, data, voice, and video could be affected by noise as well. The presence of noise into digital data affects its quality, for example in the case of the “figure 1.1”, when it is introduced noise is clearly affected, and the results are showed in figure 1.2 when the deterioration is caused by the lost of some pixels (The MathWorks,2010).

![Image source](The MathWorks,2010)
Finally according to Wang (2006), the presence of noise into a signal can cause the follow errors:

- **White noise.**- Caused by the movement of electrons which can interrupt completely the transmission.
- **Impulse noise.**- Spikes of power can cause the elimination of some bits transmitted.
- **Crosstalk.**- It is the mix of two signals from different origin.
- **Echo.**- Reflective data transmitted before.
- **Jitter.**- It is the constant repeating of the information.
- **Delay distortion.**- The variation of the transmission time.
- **Attenuation.**- Losing signal during the transmission.

2. **What are the standards that conform the EIA-232F interface standard?**

In 1962, the standard 232 was developed, becoming the Industry Standard for Data Transmission. It was developed by the Electronic Industries Alliance EIA due to the necessity of a standard interface between the Data Terminal Equipment (DTE) and the Data Communication Equipment (DCA).
The first goal of this standard was focused on the connection of modems and DTEs, but its popularity was gained by the increment in the use of PCs, which moved to the use of 232 standard to other equipments such as mouses, keyboards, plotters, scanners etc. The standard 232 was improved in 1969 which took place to the development of the EIA RS-232-C standard. In 1986 the RS-232-C was replaced by the TI/EIA-232-D, which was again replaced by the TI/EIA-232-E few years later. The TI/EIA-232-F interface standard is the last reviewed by Electronic Industries Alliance. Although the limitation of transmission length, low data rates, and the noise vulnerability, the TI/EIA-232-F is one of the most popular standard used in the communications field (Texas Instruments, 2002). According to Interface bus (2010), the standards included into the TI/EIA-232 are:

**EIA/TIA 574**: (DE9M or DE9F) used for serial communications through DB9 connectors.

**RS-232C**: (DB25M or DB25F) It refers to connectors which has 25 pin serial ports used for serial data communications as well.

**EIA/TIA – 561** (RJ-45) It is a 8 ping connector used for telephone connections.

**EIA-562 .-** It is the low voltage version of RS232

3. How does T-1 multiplexing work?
T1 is a Synchronous Time Division Multiplexing, used basically for transmitting voice and data in the same circuit. T1 is a part of the T-carrier System. With T1 the transmission between two points could be done in high velocity rates. T1 works splitting the digital transmission media in 24 channels for conveying voice and data from up to 24 users in a continue generation of frames. The transmission bandwidth is 1.544 Mbps having 64kbps for each channel (Shop for Bandwidth, 2000-2007). T1 is the classic Synchronous Time Division Multiplexing technique, and is one of the most popular methods as well as ISDN and SONET. The Figure 3.1 shows the frames generating using T1 and the 24 channels split, allowing to the transmission of data and voice in an efficient way, that means one user can have a voice conversation at the same time using Internet (Giles, 2003).

![Figure 3.1: T1 multiplexed data stream, adapted from (Giles, 2003)](image)

The most common use for T1 is the telephonic communications for its high capacity to transmit voice and data. T1 circuits are also used to interconnect LAN’s over wide areas, and are equivalent to 10 times of the ISDN power.
(Shop for Bandwidth, 2000-2007). The installation of T1 could be done over the follow transport media: ‘Twisted-pair copper wire, fiber optics, coaxial cable, digital microwave, infrared lighting’ (Shop for Bandwidth, 2000-2007).

4. How does Wavelength division multiplexing work?

The significant necessity of data transmission in big scale, and the expansion in the use of telecommunications pushed the companies to find efficient methods using fiber optic to the maximum of its capacity (The Fiber Optic Association, 2003). Wavelength division multiplexing (DWDM) it is the result of those efforts. DWDM is used in fiber optic transmission wires to transmit multiples signals in an efficient manner, it works using different wavelength laser in different colors combining many signals on one fiber (The Fiber Optic Association, 2003). The signals produced by different length of wave lasers, go through a fiber optic wire at the same time in a variety of colors such as green, red, yellow etc. During the transmission the colors could be mixed. To separate each color is necessary to use a dispositive similar to a prism; so that, the data is divided according the color and delivered to the final destination (The Fiber Optic Association, 2003).

WDM works generating the different light colors by a Coupler, which in its various versions can allow to the creation of 2 to 64 data inputs. Once the inputs are introduced into the fiber optic, the transmission starts where the different colors can combine one with another. The difficulty of this method is the reception, when a demultiplexer receives the different lights. Through
the use of a mirror called grating, which works as a prism, has the capacity to separate the different lights into different wavelengths using a technique changing angles (The Fiber Optic Association, 2003).

5. How does longitudinal parity work?

Longitudinal parity also called horizontal parity, is an error detection method which has the objective to determine whether the data transmitted has been corrupted or not (Webster’s Online Dictionary, n.d.). Longitudinal parity works adding a Block Check Character (BCC) into the Characters to be transmitted (Wang, 2006). The Figure 5.1 illustrates the BCC added to the block of characters. Each column contains a parity bit in the BCC row according to the number of cells containing 1 or 0. If the number of the characters is pair in the BCC row the data contained is 1, if not is 0. The parity bit column works in the same way according to the number of one’s or ceros in the different rows. When the data arrived in the destination, this operation is preformed again and verified with the data received. This is not the best method to detect errors, because needs to add so many characters into the block of data, and in some cases the method does not detect errors correctly (Wang, 2006).
The process to calculate the parity is for example: in the first column there are four number 1s into the cells, in this case the BCC is 1, the same result was obtained from the second column because there are not any cell containing 1. In the case of the 3erd column the result is 0 due to the number of 1s in the cells is impair. The same operation is done in the parity bit column (Wang, 2006). When the calculation finish these results are added to the package. Finally when the package arrived at the destination the receiver realizes the same operation in order to verify that the data is correct. If the results doesn’t coincide with the original packet means that the data was corrupted and the information received is invalid (Wang, 2006).

6. How does the cyclic redundancy checksum work?

Cyclical redundancy check (CRC) is a method, which aim is the detection of data damaged, and also the correction of its errors by using an arithmetic algorithm; this algorithm uses a polynomial based process. After the operation was done the remained data is attached to the original packet, to
be confirmed by the receiver once the message has been delivered (National institute of standards and technology, 2009). The steps to calculate the remainder are: Firstly the CRC manage the block of data as a polynomial, which is divided by another polynomial. After the operation the quotient is ridded, and the remainder it is added to the end of the data block. Finally the device which received the block of data, divides, the data minus the remainder, by the polynomial used in the source to perform the first operation (Wang, 2006). The remainder resulting must be cero whether there are not presence of errors during the transmission. If the remainder has another different value, the block of data was corrupted or has been damaged during the transmission (Wang, 2006).

The receiver cannot take actions on the errors recognized after de transmission; thus, if some errors are detected by this method, the unique action that can be realized by the receptor, is the notification of the error to the transmitter by a negative acknowledge called “NAK”, which will send again the original data (Wang, 2006). If the data was received without the presence of errors, the receiver send a positive notification called ACK and the transmission will continue sending the next package (Wang, 2006).

7. How does NAT work?

The growth of internet and the necessity to provide the Internet service to millions of users moved to the creation of IPV6, replacing IPV4 which cannot provide enough number of IP address to the future number of Internet users
(Tyson, 2010). Every node in a network must be provided by an IP address to be able to connect to Internet. With the unavailability of IP address using IPV4 and the time needed to have IPV6 implemented for every node, NAT is the solution (Tyson, 2010). A router can be allowed to work as an intermediary representing a LAN over Internet by using Network Address Translation and needing just one address to do it. Tyson (2010) define NAT as “The receptionist in a large office” which can manage the access to the private network according the external and internal address. How NAT works according Cisco Systems (2006) involves the following steps:

- A local network is configured over a company assigning IP address by the use of an ISP “Internet Service Provider”. All the IP’s assigned are unique within the local network and are called inside global addresses.

- There are two groups of IP’s addresses, the outside local addresses used by NAT routers, and the inside local addresses used by the stub domain “Private Network”.

- The function of NAT is matching by a routing table the petitions of internal addresses to global addresses. If the traffic is internal the NAT router doesn’t need to translate the addresses.

- When a internal address want to send a packet to a global address, the packet is sent to the NAT router which reviews in the routing table, if the destination is a valid address, and follows the specific features to be sent, the address is translated
using an inside global address; otherwise, the packed will be dropped.

- The same case occurs when a package arrives from an external address, the NAT router check in the routing table whether the package belong to an internal address. Whether the packed contains a valid address, NAT transmits the package to the destination.

8. Briefly explain some of the more common HTTP methods.

The HTTP (Hyper Text Transfer Protocol) methods are designed to offer to perform different actions on a web server, and to make easier the web applications development (OWASP, 2009). The standard RFC2616 define the following HTTP methods: HEAD, GET, POST, PUT, DELETE, TRACE, OPTIONS, and CONNECT. Those methods represent a risk for web applications, thus the common action to be taken is the knocking off of some of them (OWASP, 2009). According to OWASP (2009) the methods defined by the RFC2616 are:

HEAD: HEAD in some languages is used as GET method, and this method “allowed unauthorized blind submission of any privileged GET request” (OWASP, 2009). The use of the method HEAD is the extraction of information from documents (Web Developer’s Virtual Library, 2010).
GET: This method is added to the end of the URL action when has been requested, and the objective is the request of a particular file (Web Developer’s Virtual Library, 2010).

POST: This method as well is added to the end of the URL action requested, and a difference of the GET method which cannot execute input of information into a database, the method POST could be used when a change is needed (Web Developer’s Virtual Library, 2010).

PUT: The upload of documents is made by using PUT on the web server.

DELETE: The delete of documents is made by using DELETE on the web server. Both PUT and DELETE could be a risk for a website because the allowing to the manipulation of files is a precious resource for a possible attacker. Thus this methods are usually deactivated (OWASP, 2009).

TRACE: This method has the aim to return and echo of whatever string was sent to the web server.

CONNECT: The use of a web server as a proxy server is permitted by this method (OWASP, 2009).
OPTIONS: According to OWASP (2009) “represents a request for information about the communication options available on the request/response chain”.

9. What does a business or home user need to establish a DSL connection?

A DSL (Digital Subscriber line) is a type of internet connection which aims to provide a high speed internet service using a telephonic network (Franklin, 2010). To establish a DSL connection is necessary to have a phone line and a DSL modem which is provided usually by the ISP Internet Service Provider. DSL use the same type of wires used in a standard telephone line; hence, if the business or home user have already a telephone line, could establish a DSL connection through a company who provide this service (Franklin, 2010). Usually the provider of the Internet service, using a DSL connection, supplies the DSL modem as a part of the service, and the type of connection is superior in comparison with the traditional cable modem (Franklin, 2010). The most notorious advantage of using a DSL connection is the utility to use the telephone line to internet connection and holding voice calls simultaneously; However, this service is not available everywhere and the connection speed depends on the distance from the provider’s main office (Franklin, 2010).
10. What are the advantages and disadvantages of ATM?

The ATM Asynchronous Transfer Mode protocol is a standard for high speed communication of data and voice; thus its use is specially for Internet services, and working over two pair wires or fiber (Mitchell, 2010). The 53 bytes which conform an ATM cell are form by 48 data bytes and 5 information head bytes, operating in the data link layer (Mitchell, 2010). According to Gouravaran (2004) the advantages and disadvantages of ATM protocol are:

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>The support of multiple type of information such as video, voice, images etc.</td>
<td>High cost</td>
</tr>
<tr>
<td>Low delay rate, similar as dedicated services.</td>
<td>The requirement of hardware and software to perform the installation</td>
</tr>
<tr>
<td>Works over twisted pair cable, coaxial cable and Fiber optic.</td>
<td>The benefits in other type of applications are reduced.</td>
</tr>
<tr>
<td>Allows to connect LAN to WAN</td>
<td>There are available another optimized technology for the applications.</td>
</tr>
<tr>
<td>Using Statistical Multiplexing can offer an efficient use of the bandwidth</td>
<td>The Competition with other technologies such as 100mbps Ethernet.</td>
</tr>
<tr>
<td>High speed service</td>
<td></td>
</tr>
<tr>
<td>Potential evolution among the technology.</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
The stunning world of communications is creating a new movement of specialists to create new technology and methods to improve the level of data compression and the velocity of transmission. In the future, communications will become an integral part of our lives. Currently communications are involving all the human activities, providing a variety of gears which can help everyone to work efficiently, getting benefits of the technology advances. One of the most successful apparatus in current times is the cell phone, which technology involves the majority of the services available through communications. Now a days it is possible to have in a small cell phone everything in terms of information, for example it is possible to connect it to Internet having e-mail, social networks, documents, and all the services provided by the Global Network “Internet”. Additionally business and home users are depending on their network connections, if these connections fail, business could be experienced huge negative economic effects; also the common user depends on those connections to work, and to manage their finances through mobile bank. The future is based on the advance of telecommunications, thus the importance of cover in this document some of the most popular methods and technologies to support this transcendent trend of the future world.
References:


ITC 431 – Data Communications "Assignment 1"

A Report on terminology about communications

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Due Date: 25-May-2010
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Introduction

Data communications has experienced the most significant growth over the last decades due to the Internet developing. Internet provides millions of gigabytes of information, creating a network to keep people interconnected from all over the world. To make possible the inevitable growing of the Internet is necessary a variety of devices, software, standards and protocols in order to provide the essential tools for an efficient interconnection. It is estimated that there are around one hundred thousand of hosts connected to Internet, and the number of users or devices connected to Internet is increasing by almost the double every year. With the new developments and the new technologies, the connections became faster and more accessible. This document aims to analyze some of the different methods used to provide a better way to use the actual resources and exploit them at the max of their capacity, and to create a security Internet connection to protect the integrity of the information transported over this Global Network.
Question 1.- What are the main characteristics of the multiplexed Earth station satellite topology?

It is important to know what is an Satellite Earth Station before talk about its topology. The Satellite Earth Station is a media of communication using a Satellite technology which aims to provide a communication's a local or international service (Isa A., Kusin Z & Mahdzur S., 2003). The earth station works usually as an receptor of signal from a satellite, but also having the capacity to send information to a satellite (Isa A., Kusin Z & Mahdzur S., 2003). The principal feature of a Satellite Earth Station is the transmission of information despite the distance, location, and the area where some equipment or receptor could be such as the air or the sea (Isa A., Kusin Z & Mahdzur S., 2003).

The parts which are part of a Earth Station Satellite are “a multiplexor, a modem, up and downconverters, a high power amplifier (HPA) and a low noise amplifier (LNA)” according to Answers.com(2010). The topologies used in a Satellite communication are Star and Mesh commonly (Gillat Satellite Networks, 2010);

Mentioning the principal characteristics of a Satellite Earth Station, it is possible to determine the principal characteristic of the multiplexed Earth station satellite topology.

- In a VSAT(Very Small Aperture Terminal), used as a satellite small Earth Station, for example the transmission can be done between various locations dispersed geographically (Saman, 2005).
- The capacity to interconnect remote areas.
- The connection of many users sharing the same canal.
- Using TDMA a single carrier can be used for many stations allowing the simultaneous access (Saman, 2005).
- In a mesh topology is possible to connect to another earth station directly (Saman, 2005).
• The transmission is flexible in the use of data, voice, video (Saman, 2005).
• Using TDMA-DAMA systems the service could be used for multiple services such as telephony.

Question 2.- A local area network (LAN) is a communications network that interconnects a variety of data communications devices within a small geographic area and broadcasts data at high data transfer rates. Expand on this definition by explaining the various terminology used.

A LAN (Local Area Network) is a group of workstations and different types of devices such as printers, servers, laptops, cameras, communications devices etc., interconnected by devices such as switches, hubs, and access points (Teare, D., 1999). A LAN is used to provide communication between a group of users over a small area, and principally aiming to provide a sharing of information, applications, software, hardware such as printers, or a server (Searchnetworking, 2009). A LAN could be consider even a small network in a house where there are two or more devices, or an office network where are interconnected thousands of users (Searchnetworking, 2009). The methodology used to transmit into a LAN could be categorized by three types: Unicast, Multicast and Broadcast (Searchnetworking, 2009).

In Unicast a packet is sent to a device or node in the network accessing by the node’s address, in this case there are just one destination (Searchnetworking, 2009). In Multicast a packet is sent but not just for one node, but also a group of nodes, when the network makes copies of the packet to each destination node (Searchnetworking, 2009). And in a Broadcast the process is the same as the multicast but the difference is that the package is sent to every node connected to the network (Searchnetworking, 2009).
The configuration of a LAN is determined by the method used to interconnect the nodes. There are various methods to distribute the nodes over a network, those methods are called topologies; and the principal topologies used to design a LAN network are: Star, Ring, Tree (Searchnetworking, 2009).

Question 3.- Briefly explain the evolution of the wireless LAN protocols?

In 1999, the first wireless standard being part of the 802.11b, was accepted by the IEEE as a wireless network standard (Strom, D. 2006). At this time the standard was covering a spread spectrum communication technology method, but no longer the 802.11a was readopted due to its enhanced to transmits higher rates of data using a OFDM(Orthogonal Frequency Division Multiplexing) (Strom, D. 2006). Even the enhances made by the new 802.11a, the new needs of transmitting voice, audio and video pushed the engineers to find the way to improve the rates of transmission; Subsequently, the 802.11g was developed and ratified in 2003 (Strom, D. 2006). These protocol was designed using the same OFDM multiplexing method but with the frequency division used by the 802.11b initially, and the 802.11g dispositives can be affected by interferences for other devices working in 2.4 Ghz Strom, D. 2006).

The proposal to the development of a 802.11n to improve the transmission of audio and video, and the important of these type of information now a days, impulse to the establishment of the first 802.11n draft in 2007, which was called 802.11-2007 (Wikipedia, 2010).

In September 2009 the IEEE approved after years of expectation the 802.11n protocol, which can transmit up to 300 mega bits per second a difference of the 54 mbps transmitted by the 802.11g devices Ngo, D. (2009). The special new technology that the 802.11n has is the MIMO (multiple input, multiple output) which allows the transmission of multiple strengths of data improving the wireless technology (Haskin, 2007).
In terms of security there are various protocols used to control the security of the information over a wireless connection. As part of these protocols used by the IEEE 802.11i protocol, some of them are mentioning next:

**TKIP:** “Temporal Key Integrity Protocol” is part of the IEEE 802.11i used to pack the information using a key and avoiding the problems caused by WEP “Wired Equivalent Privacy” a protocol used by previous wireless connections (Wikipedia, 2010).

**EAP:** “Extensible Authentication Protocol” an attempt to improve authentication over wireless connections. EAP-versions include LEAP, PEAP and other EAP’s (Wikipedia, 2010).

**PEAP:** “Protective Extensible Authentication Protocol” allows to protect passwords, information and different keys without the necessity of a certification server (Wikipedia, 2010).

**WAPI:** “WLAN Authentication and Privacy Infrastructure” defined as a standard by the Chinese Government (Wikipedia, 2010).

**RADIOUS:** “Remote Authentication Dial In User Service” used for remote access providing a efficient protection against hackers (Wikipedia, 2010).

**Question 4.- Explain a bridge filtering function.**

The device in charge to establish the union of two networks in order to allow the transmission of information from one to another network is called Bridge (Openbsd.org, 2010). The information goes through the bridge in two directions In and Out, and the bridge contains tow Nic fxp0 and ep0 (Openbsd.org, 2010). According the OSI model the Bridge functions are part of the data link layer Kioskea.net (2008). With the objective to
transmit data, is logic the use of a packet filter to take advantage of this device; thus, the importance of using the bridge filtering function (Openbsd.org, 2010). Packet filter could control the kind of packages which are going through the bridge avoiding dangerous packets, and creating a barrier against threatens (Openbsd.org, 2010).

Rules can be established in the filtering function by users to restrict the access to the network controlling the MAC address of both nodes in connection, and also controlling the type of frame transmitted Asim (n.d.). According the rules each the frames of the packets are analyzed and the authorization is granted to enter in the network Asim (n.d.).

Example from: Openbsd.org (2010)

```bash
# Pass all traffic through ep0
pass in quick on ep0 all
pass out quick on ep0 all

# Block fxp0 traffic
block in on fxp0 all
block out on fxp0 all

pass in quick on fxp0 proto tcp from any to any port {22, 80}
  flags S/SA keep state
```

The example above shows the way that the rules are setting into a bridge, to control the flow of data in this case through the fxp0 network interface card NIC. In this example the traffic in the bridge is blocked for any package except the HTTP and SSH data which uses the ports 22 and 80 (Openbsd.org, 2010).

**Question 5**.- Briefly explain the most important aspects of a Metro Ethernet.
The covering of a metropolitan area applying a carrier Ethernet technology is called a Metro Ethernet (Searchtelecom, 2009). The aim of a metro internet is the connection of companies or small personal networks to a WAN (Wide Area Network) or to Internet (Searchtelecom, 2009). The use of Metro Ethernet is usually for interconnect agencies, branches, or specific locations for different type of business including medium and large size institutions (Searchtelecom, 2009). The topology applied in a Metro Ethernet is usually Star or Mesh, establishing a connection among different devices such as routers, switches and servers, using fiber optic (Searchtelecom, 2009). According Wikipedia (2009), the principal characteristics of a Metro Ethernet are:

- Less expensive interface.
- High bandwidths supporting.
- The simple connection to a user network.
- The availability to connect even domestic and business networks.
- The option to migrate to a new form to offer from 10 to 100 Gb of speed.

The trend is to use Carrier Ethernet in order to cover the high demand of bandwidth, and allow the service providers to offer better services and low prices (Telecom Insights, 2009). This could help to migrate from the expensive and complex SONET/SDH infrastructure (Telecom Insights, 2009).

**Question 6.** How is routing through a wide area network accomplished?

The action to locate data from a particular origin to a destination is called routing (Cisco, 2010). Routing and bridging usually are been compared in the aim they have to perform; but, there are significant differences between them such as the Osi’s model layer where they work, while routing works in the third layer “Network layer” bridging works in the layer 2 “Link layer” (Cisco, 2010). The activities of a router are two: The establishment of a effective rout to transfer the data or packets through an Internetwork; and, the transport of the packets which is called packet switching (Cisco, 2010).
To establish the more suitable route to send a packet, routing uses metrics such as path bandwidth, used by algorithms to find the adequate path (Cisco, 2010). Those algorithms create and maintain actualized routing tables with information about the paths; and the information would be different according to the algorithm used (Cisco, 2010). Routers are connected among them, and when a router wants to send a packet, it sends a message to the router called “next hop” which is the router determined as the best route to send the information (Cisco, 2010). The next router receives the packet; and after verifying the destination address, finds the next hop in order to achieve the destination (Cisco, 2010).

Routers established connections among them through a variety of messages that contain information of the routing tables, thus the routing tables remain actualized (Cisco, 2010). With this information, a router can have a detailed image of the topology used in a particular network; and, can determine the optimal routes to reach the destination address (Cisco, 2010).

**Question 7.** How does phishing work?

Phishing is an action with a fraudulent aim. Usually, the theft and virus spreading actions, are recognized as phishing as well as the process to get financial or critical information from companies or users in common (Wilson, 2005). The most common way that phishing works is through the use of fake e-mails; which aim to the reader to register or submit personal or financial information (Wilson, 2005). Phishing works by the use of e-mails, which are sent to millions of e-mail users, telling for example, that your credit card was blocked or checking account have been overdrawn (Posey, 2005). Those e-mails ask for information about the account, such as the number, the owners address and the pin number; and the objective is to cause panic in the account owner in order to make him send this information immediately (Posey, 2005). Those e-mails look almost exactly as the institution of bank which is their source (Posey, 2005). The URL shown in the message is normally a domain which looks very similar to the original, and the characteristics of the e-mail makes the destination users to think that the...
message is dependable (Posey, 2005). According to Wilson (2005) there are 5 steps to perform a scam by phishing:

- Planning: Determine the victims of the scam.
- Setup: The creation of a method to send the fraudulent messages.
- Attack: The sending of the e-mails to the users.
- Collection: The information send or entered by the users is collected by the phisher.
- Identity theft and fraud. Fraudulent purchases.

Once the personal information is submitted in a apparently safety web site the phisher uses this information in order to make purchases or fraudulent actions (Wilson, 2005).

Question 8.- Describe some examples of systems that use biometric techniques to authenticate users.

In order to enhance the security methods used currently, biometric techniques have become very popular (Dunstone, 2009). The systems using biometric techniques are based, in a reduced group considered “mainstream, biometrics, such as fingerprint, iris, face, hand, voice and signature recognition systems” according Dunstone (2009). There are a significant number of biometric techniques in process of developing such as skin, facial and pulse recognition (Dunstone, 2009). As far as the biometric techniques are developed, hackers also develop ways to avoid this kind of security tools, that’s the reason way preventing the braking of the biometric, the esoteric biometric techniques are designed (Dunstone, 2009). Esoteric biometric techniques are special technique which can offer security in systems by recognition of special characteristics of the human body (Dunstone, 2009). There are a few examples of these techniques developed currently:

- Skin pore recognition: Every kind of skin has a distinctive characteristic with make it particular and can help to improve the fingerprint recognition system to achieve a more precise security method to protect sensitive information (Dunstone, 2009).
• Skin composition: Every person have a different skin pattern which is analyzed by this technique, which works analyzing the skin over the cheeks; and, having the precision to detect the differences even between twins (Dunstone, 2009).

• Heart beat recognition: In fingerprint systems is possible to include a dispositive to detect the pulse from the finger at the moment of the reading. This reading using a Heart Beat Recognition system can identify the patterns of the heart beating which has different characteristics which make it unique (Dunstone, 2009).

• Brain imaging: In this technique a response of the brain for some stimulus are read and processed showing different reactions in all the people. Although, it has to be performed by the use of a special hat, this technique is very precise and offer a high level of security (Dunstone, 2009).

All of those biometrical techniques are used for authentication and identification, for example in criminal situations when the authority needs to have the accurate information of a specific person (Dunstone, 2009).

Question 9 .- How does public key cryptography work?
In order to establish a secure connection between two nodes or users using a symmetric key encryption, a paper published in 1976 by IEEE titled “New Directions in Cryptography” offers the solution through the use of a public-key encryption (Tyson, 2010). Public-key encryption, Known as asymmetric-key encryption, uses both a private and a public key, combined them. A primary key remains in the local computer, while the public key is obtained from the computer which asks to the establishment of a connection (Tyson, 2010).

The public key is based in primary number such as “1, 3, 11, 17, and so on” which can make the method considerable secure, in regarding that there are an infinite number of primary numbers (Tyson, 2010). To perform a decryption of the message the local computer asks for the public key from the origin node. Once the public key is published, anyone can have access to it; but, no one can execute the decryption if doesn’t know the private key. One of the most popular public-key encryption applications is PGP “Pretty Good Privacy” (Tyson, 2010).

If the desire is to protect a web server by the use of public encryption, the process is different requiring the use of digital certificate (Tyson, 2010). This certificate aims to show that the web site is trusted and is form by a large number or a kind of code; which, is unique, and from a trusted source as a certificate authority (Tyson, 2010).

**Question 10 - What information does a certificate contain?**

The certificates generated by different institutions have to be designed according the X.509 v3 certificate specification, established by the ITU “International Telecommunications Union” (Docs.sun.com, 1998). The X.509, according Docs.sun.com (1998), is form by two sections:

**Data Section:**

- X.509 standard Version.
- A unique certificate’s serial number generated by Certificate Authorities “CA”.
• User's public key information, including the algorithm used.
• The Certificate Authorities' Distinguished Name “DN”.
• The period of validity (3:00 a.m. on October 10, 2002 to 3:00 a.m. December 10, 2003)
• The certificates' DN, called usually the subject name.
• Certificate extensions, which could be optional and provides additional information used by the client or server. For example, a certificate for signing emails.

Signature section:

• The CA's cryptographic algorithm, to create its digital signature
• The CA's digital signature, obtained by hashing all of the data in the certificate together and encrypting it with the CA's private key.

An example of a certificate is shown next, which was obtained from: (Docs.sun.com, 1998)

Certificate:

Data:

Version: v3 (0x2)
Serial Number: 3 (0x3)
Signature Algorithm: PKCS #1 MD5 With RSA Encryption
Issuer: OU=Ace Certificate Authority, O=Ace Industry, C=US
Validity:
  Not After: Sun Oct 17 18:36:25 1999
Subject: CN=Jane Doe, OU=Finance, O=Ace Industry, C=US
Subject Public Key Info:
  Algorithm: PKCS #1 RSA Encryption
  Public Key:
    Modulus:
    Public Exponent: 65537 (0x10001)
Extensions:
  Identifier: Certificate Type
    Critical: no
  Certified Usage:
    SSL Client
  Identifier: Authority Key Identifier
    Critical: no
Key Identifier:
26:ce9

Signature:
Algorithm: PKCS #1 MD5 With RSA Encryption
Signature:
dd:e4

A group of trusted CA certificates is registered by a client or server software that can support certificates Docs.sun.com (1998).
Conclusion

The stunning world of communications is creating a new movement of specialists to create new technology and methods to improve the level of data compression and the velocity of transmission. In the future, communications will become an integral part of our lives. Currently communications are involving all the human activities, providing a variety of gears which can help everyone to work efficiently, getting benefits of the technology advances. One of the most successful apparatus in current times is the cell phone, which technology involves the majority of the services available through communications. Now a days it is possible to have in a small cell phone everything in terms of information, for example it is possible to connect it to Internet having e-mail, social networks, documents, and all the services provided by the Global Network “Internet”. Additionally business and home users are depending on their network connections, if these connections fail, business could be experienced huge negative economic effects; also the common user depends on those connections to work, and to manage their finances through mobile bank. The future is based on the advance of telecommunications, thus the importance of cover in this document some of the most popular methods and technologies to support this transcendent trend of the future world.
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ITC 431 – Data Communications "Assignment 2"

A Report on terminology about communications

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XII. References
Introduction

Data communications has experienced the most significant growth over the last decades due to the Internet developing. Internet provides millions of gigabytes of information, creating a network to keep people interconnected from all over the world. To make possible the inevitable growing of the Internet is necessary a variety of devices, software, standards and protocols in order to provide the essential tools for an efficient interconnection. It is estimated that there are around one hundred thousand of hosts connected to Internet, and the number of users or devices connected to Internet is increasing by almost the double every year. With the new developments and the new technologies, the connections became faster and more accessible. This document aims to analyze some of the different methods used to provide a better way to use the actual resources and exploit them at the max of their capacity, and to create a security Internet connection to protect the integrity of the information transported over this Global Network.
Question 1.- What are the main characteristics of the multiplexed Earth station satellite topology?

It is important to know what is an Satellite Earth Station before talk about its topology. The Satellite Earth Station is a media of communication using a Satellite technology which aims to provide a communication’s a local or international service (Isa A., Kusin Z & Mahdzur S., 2003). The earth station works usually as a receptor of signal from a satellite, but also having the capacity to send information to a satellite (Isa A., Kusin Z & Mahdzur S., 2003). The principal feature of a Satellite Earth Station is the transmission of information despite the distance, location, and the area where some equipment or receptor could be such as the air or the sea (Isa A., Kusin Z & Mahdzur S., 2003).

The parts which are part of a Earth Station Satellite are “a multiplexor, a modem, up and downconverters, a high power amplifier (HPA) and a low noise amplifier (LNA)” according to Answers.com(2010). The topologies used in a Satellite communication are Star and Mesh commonly (Gillat Satellite Networks, 2010);

Mentioning the principal characteristics of a Satellite Earth Station, it is possible to determine the principal characteristic of the multiplexed Earth station satellite topology.

- In a VSAT(Very Small Aperture Terminal), used as a satellite small Earth Station, for example the transmission can be done between various locations dispersed geographically (Saman, 2005).
- The capacity to interconnect remote areas.
- The connection of many users sharing the same canal.
- Using TDMA a single carrier can be used for many stations allowing the simultaneous access (Saman, 2005).
- In a mesh topology is possible to connect to another earth station directly (Saman, 2005).
• The transmission is flexible in the use of data, voice, video (Saman, 2005).
• Using TDMA-DAMA systems the service could be used for multiple services such as telephony.

Question 2.- A local area network (LAN) is a communications network that interconnects a variety of data communications devices within a small geographic area and broadcasts data at high data transfer rates. Expand on this definition by explaining the various terminology used.

A LAN (Local Area Network) is a group of workstations and different types of devices such as printers, servers, laptops, cameras, communications devices etc., interconnected by devices such as switches, hubs, and access points (Teare, D.,1999). A LAN is used to provide communication between a group of users over a small area, and principally aiming to provide a sharing of information, applications, software, hardware such as printers, or a server (Searchnetworking, 2009). A LAN could be consider even a small network in a house where there are two or more devices, or an office network where are interconnected thousands of users (Searchnetworking, 2009). The methodology used to transmit into a LAN could be categorized by three types: Unicast, Multicast and Broadcast (Searchnetworking, 2009).

In Unicast a packet is sent to a device or node in the network accessing by the node’s address, in this case there are just one destination (Searchnetworking, 2009). In Multicast a packet is sent but not just for one node, but also a group of nodes, when the network makes copies of the packet to each destination node(Searchnetworking, 2009). And in a Broadcast the process is the same as the multicast but the difference is that the package is sent to every node connected to the network (Searchnetworking, 2009).
The configuration of a LAN is determined by the method used to interconnect the nodes. There are various methods to distribute the nodes over a network, those methods are called topologies; and the principal topologies used to design a LAN network are: Star, Ring, Tree (Searchnetworking, 2009).

**Question 3.- Briefly explain the evolution of the wireless LAN protocols?**

In 1999, the first wireless standard being part of the 802.11b, was accepted by the IEEE as a wireless network standard (Strom, D. 2006). At this time the standard was covering a spread spectrum communication technology method, but no longer the 802.11a was readopted due to its enhanced to transmits higher rates of data using a OFDM(Orthogonal Frequency Division Multiplexing) (Strom, D. 2006). Even the enhances made by the new 802.11a, the new needs of transmitting voice, audio and video pushed the engineers to find the way to improve the rates of transmission; Subsequently, the 802.11g was developed and ratified in 2003 (Strom, D. 2006). These protocol was designed using the same OFDM multiplexing method but with the frequency division used by the 802.11b initially, and the 802.11g dispositives can be affected by interferences for other devices working in 2.4 Ghz Strom, D. 2006).

The proposal to the development of a 802.11n to improve the transmission of audio and video, and the important of these type of information now a days, impulse to the establishment of the first 802.11n draft in 2007, which was called 802.11-2007 (Wikipedia, 2010).

In September 2009 the IEEE approved after years of expectation the 802.11n protocol, which can transmit up to 300 mega bits per second a difference of the 54 mbps transmitted by the 802.11g devices Ngo, D. (2009). The special new technology that the 802.11n has is the MIMO (multiple input, multiple output) which allows the transmission of multiple strengths of data improving the wireless technology (Haskin, 2007).
In terms of security there are various protocols used to control the security of the information over a wireless connection. As part of these protocols used by the IEEE 802.11i protocol, some of them are mentioning next:

**TKIP**: “Temporal Key Integrity Protocol” is part of the IEEE 802.11i used to pack the information using a key and avoiding the problems caused by WEP “Wired Equivalent Privacy” a protocol used by previous wireless connections (Wikipedia, 2010).

**EAP**: “Extensible Authentication Protocol” an attempt to improve authentication over wireless connections. EAP-versions include LEAP, PEAP and other EAP’s (Wikipedia, 2010).

**PEAP**: “Protective Extensible Authentication Protocol” allows to protect passwords, information and different keys without the necessity of a certification server (Wikipedia, 2010).

**WAPI**: “WLAN Authentication and Privacy Infrastructure” defined as a standard by the Chinese Government (Wikipedia, 2010).

**RADIOUS**: “Remote Authentication Dial In User Service” used for remote access providing a efficient protection against hackers (Wikipedia, 2010).

**Question 4**: Explain a bridge filtering function.

The device in charge to establish the union of two networks in order to allow the transmission of information from one to another network is called Bridge (Openbsd.org, 2010). The information goes through the bridge in two directions In and Out, and the bridge contains tow Nic fxp0 and ep0 (Openbsd.org, 2010). According the OSI model the Bridge functions are part of the data link layer Kioskea.net (2008). With the objective to
transmit data, is logic the use of a packet filter to take advantage of this device; thus, the importance of using the bridge filtering function (Openbsd.org, 2010). Packet filter could control the kind of packages which are going through the bridge avoiding dangerous packets, and creating a barrier against threatens (Openbsd.org, 2010).

Rules can be established in the filtering function by users to restrict the access to the network controlling the MAC address of both nodes in connection, and also controlling the type of frame transmitted Asim (n.d.). According the rules each the frames of the packets are analyzed and the authorization is granted to enter in the network Asim (n.d.).

Example from: Openbsd.org (2010)

```
# Pass all traffic through ep0
pass in quick on ep0 all
pass out quick on ep0 all

# Block fxp0 traffic
block in on fxp0 all
block out on fxp0 all

pass in quick on fxp0 proto tcp from any to any port {22, 80}
  flags S/SA keep state
```

The example above shows the way that the rules are setting into a bridge, to control the flow of data in this case through the fxp0 network interface card NIC. In this example the traffic in the bridge is blocked for any package except the HTTP and SSH data which uses the ports 22 and 80 (Openbsd.org, 2010).

**Question 5** - Briefly explain the most important aspects of a Metro Ethernet.
The covering of a metropolitan area applying a carrier Ethernet technology is called a Metro Ethernet (Searchtelecom, 2009). The aim of a metro internet is the connection of companies or small personal networks to a WAN (Wide Area Network) or to Internet (Searchtelecom, 2009). The use of Metro Ethernet is usually for interconnect agencies, branches, or specific locations for different type of business including medium and large size institutions (Searchtelecom, 2009). The topology applied in a Metro Ethernet is usually Star or Mesh, establishing a connection among different devices such as routers, switches and servers, using fiber optic (Searchtelecom, 2009). According Wikipedia (2009), the principal characteristics of a Metro Ethernet are:

- Less expensive interface.
- High bandwidths supporting.
- The simple connection to a user network.
- The availability to connect even domestic and business networks.
- The option to migrate to a new form to offer from 10 to 100 Gb of speed.

The trend is to use Carrier Ethernet in order to cover the high demand of bandwidth, and allow the service providers to offer better services and low prices (Telecom Insights, 2009). This could help to migrate from the expensive and complex SONET/SDH infrastructure (Telecom Insights, 2009).

**Question 6.** How is routing through a wide area network accomplished?

The action to locate data from a particular origin to a destination is called routing (Cisco, 2010). Routing and bridging usually are been compared in the aim they have to perform; but, there are significant differences between them such as the Osi’s model layer where they work, while routing works in the third layer “Network layer” bridging works in the layer 2 “Link layer” (Cisco, 2010). The activities of a router are two: The establishment of a effective rout to transfer the data or packets through an Internetwork; and, the transport of the packets which is called packet switching (Cisco, 2010).
To establish the more suitable route to send a packet, routing uses metrics such as path bandwidth, used by algorithms to find the adequate path (Cisco, 2010). Those algorithms create and maintain actualized routing tables with information about the paths; and the information would be different according to the algorithm used (Cisco, 2010). Routers are connected among them, and when a router wants to send a packet, it sends a message to the router called "next hop" which is the router determined as the best route to send the information (Cisco, 2010). The next router receives the packet; and after verifying the destination address, finds the next hop in order to achieve the destination (Cisco, 2010).

Routers established a connection among them through a variety of messages which contain information of the routing tables, thus the routing tables remain actualized (Cisco, 2010). With this information a router can have a detailed image of the topology used in a particular network; and, can determine the optimal routes to reach the destination address (Cisco, 2010).

Question 7. - How does phishing work?

Phishing is an action with a fraudulent aim. Usually the theft and virus spreading actions, are recognized as phishing as well as the process to get financial or critical information from companies or users in common (Wilson, 2005). The most common way that phishing works is through the use of fake e-mails; which aim to the reader to register or submit personal or financial information (Wilson, 2005). Phishing works by the use of e-mails, which are sent to millions of e-mail users, telling for example, that your credit card was blocked or checking account have been overdrawn (Posey, 2005). Those e-mails ask for information about the account, such as the number, the owner's address and the pin number; and the objective is to cause panic in the account owner in order to make him send this information immediately (Posey, 2005). Those e-mails looks almost exactly as the institution of bank which is their source (Posey, 2005). The URL shown in the message is normally a domain which looks very similar to the original, and the characteristics of the e-mail makes the destination users to think that the
message is dependable (Posey, 2005). According to Wilson (2005) there are 5 steps to perform a scam by phishing:

- Planning: Determine the victims of the scam.
- Setup: The creation of a method to send the fraudulent messages.
- Attack: The sending of the e-mails to the users.
- Collection: The information send or entered by the users is collected by the phisher.
- Identity theft and fraud. Fraudulent purchases.

Once the personal information is submitted in a apparently safety web site the phisher uses this information in order to make purchases or fraudulent actions (Wilson, 2005).

Question 8.- Describe some examples of systems that use biometric techniques to authenticate users.

In order to enhance the security methods used currently, biometric techniques have become very popular (Dunstone, 2009). The systems using biometric techniques are based, in a reduced group considered “mainstream, biometrics, such as fingerprint, iris, face, hand, voice and signature recognition systems” according Dunstone (2009). There are a significant number of biometric techniques in process of developing such as skin, facial and pulse recognition (Dunstone, 2009). As far as the biometric techniques are developed, hackers also develop ways to avoid this kind of security tools, that’s the reason way preventing the braking of the biometric, the esoteric biometric techniques are designed (Dunstone, 2009). Esoteric biometric techniques are special technique which can offer security in systems by recognition of special characteristics of the human body (Dunstone, 2009). There are a few examples of these techniques developed currently:

- Skin pore recognition: Every kind of skin has a distinctive characteristic with make it particular and can help to improve the figer print recognition system to achieve a more precise security method to protect sensitive information (Dunstone, 2009).
• Skin composition: Every person have a different skin pattern which is analyzed by this technique, which works analyzing the skin over the cheeks; and, having the precision to detect the differences even between twins (Dunstone, 2009).

• Heart beat recognition: In fingerprint systems is possible to include a dispositive to detect the pulse from the finger at the moment of the reading. This reading using a Heart Beat Recognition system can identify the patterns of the heart beating which has different characteristics which make it unique (Dunstone, 2009).

• Brain imaging: In this technique a response of the brain for some stimulus are read and processed showing different reactions in all the people. Although, it has to be performed by the use of a special hat, this technique is very precise and offer a high level of security (Dunstone, 2009).

All of those biometrical techniques are used for authentication and identification, for example in criminal situations when the authority needs to have the accurate information of a specific person (Dunstone, 2009).

Question 9.- How does public key cryptography work?
In order to establish a secure connection between two nodes or users using a symmetric key encryption, a paper published in 1976 by IEEE titled “New Directions in Cryptography” offers the solution through the use of a public-key encryption (Tyson, 2010). Public-key encryption, known as asymmetric-key encryption, uses both a private and a public key, combined them. A primary key remains in the local computer, while the public key is obtained from the computer which asks for the establishment of a connection (Tyson, 2010).

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Signature section:

• The CA’s cryptographic algorithm, to create its digital signature
• The CA’s digital signature, obtained by hashing all of the data in the certificate together and encrypting it with the CA's private key.

An example of a certificate is shown next, which was obtained from: (Docs.sun.com, 1998)
Key Identifier:
- 26:e9

Signature:

Algorithm: PKCS #1 MD5 With RSA Encryption

Signature:
- dd:e4

A group of trusted CA certificates is registered by a client or server software that can support certificates Docs.sun.com (1998).
Conclusion

The stunning world of communications is creating a new movement of specialists to create new technology and methods to improve the level of data compression and the velocity of transmission. In the future, communications will become an integral part of our lives. Currently communications are involving all the human activities, providing a variety of gears which can help everyone to work efficiently, getting benefits of the technology advances. One of the most successful apparatus in current times is the cell phone, which technology involves the majority of the services available through communications. Now a days it is possible to have in a small cell phone everything in terms of information, for example it is possible to connect it to Internet having e-mail, social networks, documents, and all the services provided by the Global Network “Internet”. Additionally business and home users are depending on their network connections, if these connections fail, business could be experienced huge negative economic effects; also the common user depends on those connections to work, and to manage their finances through mobile bank. The future is based on the advance of telecommunications, thus the importance of cover in this document some of the most popular methods and technologies to support this transcendent trend of the future world.
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