University of Swaziland

Department of Computer Science

Supplementary Examination
JULY 2012

Title of paper : *Software Engineering I*

Course number : CS451

Time Allowed : Three(3) hours

Instructions :

- *Each question is worth 25 marks*
- *Answer Question 1*
- *Answer any three(3) questions from questions 2 to 6*

This paper may not be opened until permission has been granted by the invigilator

Case study

(Questions 1 and 2 are based on the following descriptive case study)

<u>Entek Electronics (pty) ltd</u>

Entek electronics manufactures and deliveries consumable electronic items to its customers. It has three production facilities, each specializing in a range of items. Manufactured items are sent to anyone of about 20 depots where they are stored. Customer orders are received at the depots and each depot arranges deliveries of items ordered at the depot to customers.

The following set up is to determine how to satisfy verified orders as quickly as possible. If the items ordered are available at the depot that received the order, a local delivery advice and an invoice are generated for the order. If the items are not available at the depot, but are available at another depot, a transfer delivery advice is generated. This advice requests the second depot to transfer the needed items to the depot that received the order. If the items are not available at any of the depots, then the customer is informed that the order cannot be made quickly.

Delivery advices are used to prepare deliveries and delivery dockets by the store at the depot. At the same time transport requests are sent to vehicle schedulers to arrange vehicles to deliver the ordered items. The delivery dockets are then sent by the store to the scheduled truck for delivery.

<u>Question 1 - compulsory</u>

(a) Draw a context diagram for *Entek Electronics*   *5 marks*

(b) Draw a top-level (level 1) logical data flow diagram for *Entek Electronics*

20 marks

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Question 2

Based on the description of *Entek Electronics* and the DFD obtained in question 1 above,

(a) Identify two (2) entities and draw their entity life history diagrams. *10 marks*

(b) Draw an entity life history matrix *Entek Electronics*. *15 marks*

Question 3

Consider the following outline of a Pascal program that implements a graph using an adjacency list.

(a) Draw a **Structure Chart** for the given program. Show all procedure/function calls and data flows. 15 Marks

(b) Write a **data dictionary** to go with the structure chart obtained in question (a) above. 10 Marks

```
program Graphy (input, output);
{ A pascal implementation of a graph using adjacencey list. }

(*****************************Type Definitions************************)
CONST MaxSize    = 10;
Type DataType    = integer;
    AdjNodePtr   = ^AdjNode;
    AdjNode      = Record
                     Data    : DataType;
                     NextAdjNode : AdjNodePtr;
                   end;
    AdjNodeList  = AdjNodeptr;
    GraphNode    = Record
                     NodeVal : DataType;
                     AdjList : AdjNodePtr;
                   end;
    Graph        = Record
                     Nodes : Array [1..MaxSize] of GraphNode;
                     Size  : 0..MaxSize;
                   end;
{ ***************Operations on list of adjacent nodes ******************}
Procedure CreateAdjList ( L : AdjNodeList); {Create empty list L}

Function IsEmptyAdjList ( L : AdjNodeList):Boolean; { returns TRUE if L is empty}

Function IsElement ( x : DataType; L : AdjNodeList):Boolean; {returns TRUE if x is in L}
Begin
If not IsEmptyAdjList(L) then ...
end;
```

```
procedure AddAdjnode (x : DataType; var L : AdjNodeList); {adds new node x to list L}
 begin
  if not IsElement (x, L) then  ...
end;


Procedure ShowList ( L : AdjNodeList); {displays elements of L on standard output}


(***************************Operations on graph******************)
Procedure CreateGraph (var G : Graph); {Creates an empty Graph G (set size to 0)}


Function IsEmptyGraph ( G : Graph) : Boolean; { returns TRUE or FALSE}


Function IsFullGraph ( G : Graph) : Boolean; { returns TRUE or FALSE}


Function IsMember ( u : DataType; G : Graph):Boolean; { returns TRUE or FALSE}
begin
   If not IsEmptyGraph(G) then  ...
 end;


Procedure AddNode ( u : DataType; var G : Graph); { adds new node u to G}
begin
  If not IsMember (u, G) then ...
   If not IsFullGraph (G) then  ...
 end;


Procedure AddEdge ( u,v : DataType; var G : Graph); {adds a new edge (u,v) }
var Indexu, Indexv : 0..MaxSize;
begin
  if not IsEmptyGraph(G) then
    if ( IsMember (u,G)) and IsMember(v,G) then
        ...      AddAdjNode (v, G.Nodes[Indexu].AdjList);
end;


Procedure ShowGraph (G : Graph); {displays all node values in graph G}

var Index : 1..MaxSize;
 begin
     ...
    ShowList (G.Nodes[Index].AdjList);
 end;

(*************************Main Program *****************)
var G : Graph;
begin { main }
  CreateGraph (G);  AddNode (10,G);   AddNode (20,G);   AddEdge (10,20, G);
  ShowGraph (G);

end. {main}
```

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Question 4 - compulsory

(a) "*Software development is a partnership between the system developer and the client*". Discuss the significance and extent of this partnership, noting its particular challenges and how these challenges can be managed.   *15 marks*

(b) Patience Employment Bureau operates the following procedure for registering office typists:

> Every applicant for office typing work has to take our speed and competence test. Applicants getting 25% or less are not registered, no matter what they have said on their application form.
>
> Applicants who get between 25% and 50% are still not very welcome and we only place them on our branch provisional list if they have City and Guilds Certificate and nave had at least two years' relevant experience.
>
> Applicants who get 50% through 75% are a better prospect. If they have got two years' experience or if they have City and Guilds certificate they are put on a provisional list, but if they do not have either they are not registered at all.
>
> Applicants obtaining over 75% go straight onto our citywide circulation sheet unless they don't have relevant experience and they don't have the city and Guilds certificate, in which case they are only placed on the provisional list.

Draw a decision tree for the decision procedure as explained above.
10 Marks

Question 5

(a) What is a software method?.   *4 Marks*

(b) What is the main difference between problem-oriented and product-oriented design method

4 Marks

(c) Briefly explain the basic steps of the Jackson structured programming method.

8 Marks

(d) Briefly explain the basic steps of the Structured Analysis and Structured Design methods.   *9 Marks*

5

Question 6

Show the first two steps of the JSP method in developing a program for the problem defined below.

Information about height (*in Meters*) and weight (*in Kgs*) of several students are given in a text file DATA.TXT. The file contains the student name, identity number, height and the weight in the following format.

```
THWALA D.M.    : 121210 1.59  70.5
BENNET L.A.    : 101055 1.80  80.4
BEATRIC S.P.   : 132141 1.70  60.7
DVUBA M.       : 120740 1.92 100.2
SIBISI J.N.    : 120875 1.78  50.6
```

The program performs the following
1. Reads in all the data from DATA.TXT
2. Computes the BMR (Body Mass Ratio) for each student and displays the information on standard output in the following layout –

```
              UNIVERSITY OF SWAZILAND
        BODY MASS INDEX OF CS245 CLASS, JULY, 2003
========================================================
ID   NAME             HEIGHT    WEIGHT    BMR      STATUS
========================================================
---- ---------------  -.--     ---.--    ---.--   ------
---- ---------------  -.--     ---.--    ---.--   ------
---- ---------------  -.--     ---.--    ---.--   ------
========================================================

SUMMARY
=======
TOTAL NUMBER OF STUDENTS   = ---
AVERAGE WEIGHT             = ---.--
AVERAGE HEIGHT             = -.--
COUNT OF HEALTHY STUDENTS  = ---
COUNT OF OBESSE STUDENTS   = ---
COUNT OF OVER WEIGHT STUDENTS = ---
```

NOTES:
1. BMR is Weight divided by the square of height.
2. STATUS is HEALTHY if BMR lies between 20 to 25,
    STATUS is OBESSE if BMR is greater than 25 but less than 30.
    STATUS is OVERWEIGHT if BMR is greater than or equal to 30.
    STATUS is UNDER WEIGHT if BMR is less than 20.

The program works for any input data file (with similar format), containing any number of employees. Not just for the given data above.   *25 marks*