UNIVERSITI TENAGA NASIONAL

College of Computer Science and Information Technology

BACHELOR OF COMPUTER SCIENCE (HONS)
BACHELOR OF INFORMATION TECHNOLOGY (HONS)

FINAL EXAMINATION
SEMESTER I 2016/2017

DISCRETE STRUCTURES
(CSNB143)

September 2016

Time allowed: 3 hours + 10 minutes for reading

INSTRUCTIONS TO CANDIDATES.

1. The total mark for this exam is **100 marks**.
2. Answer **ALL** questions

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE INSTRUCTED TO DO SO.

THIS QUESTION PAPER CONSISTS OF   6   PRINTED PAGES INCLUDING THIS PAGE.

Question 1

A private college has 285 students. From that number, 140 students registered for Pascal language class, 125 students registered for Fortran language, while 130 students registered in Cobol language. 50 students registered in both Pascal and Cobol, 35 in Fortran and Cobol, while 40 students registered in both Pascal and Fortran. All students is compulsory to take at least one language. Find:

(a)   Number of students who registered in all three (3) languages.

[3 marks]

(b)   Draw a Venn Diagram to show the related numbers.

[5 marks]

(c)   Number of students who registered in Fortran language only.

[1 mark]

Question 2

Let the universe set U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, A = {1, 4, 7, 10}, B = {1, 2, 3, 4, 5} and set C = {2, 4, 6, 8}. List out the elements of the final set.

(a)   A U B

(b)   B ∩ C

(c)   (C – B)

(d)   B ∩ (C – A)

[4 marks]

Question 3

(a)   Consider the following sequence v defined by :

$$v_n = n! + 2, \ n \geq 1$$

Find the first three (3) elements of the sequence. .

[6 marks]

(b)   List all strings over X = {0, 1} of length 3 or less.

[3 marks]

Question 4

Find out by using truth table if following statements $p \rightarrow q$ and $p \wedge q \rightarrow (r \wedge p)$ are

logically equivalent.

[7 marks]

Question 5

Given that R and S are relation on set A = {a, b, c, d} with matrix $M_R = \begin{bmatrix} 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$

and $M_S = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$.

(a)   Change the matrix M_R into set and diagraph.

[2 marks]

(b)   Determine if M_R is reflexive, symmetric, asymmetric, antisymmetric and/or

transitive. (provide a reason for each of your answer).

[10 marks]

(c)   Find the in-degree and out-degree for each vertex in M_R.

[2 marks]

(d)   Find $M_R \wedge M_S$ and $M_R \vee M_S$

[4 marks]

(e)   Find the transitive closure of M_S by using Warshall's algorithm.

[6 marks]

Question 6

(a) Let F is a function and it is defined as $F(x) = 6x - 8$ where x is the input to the function F and its value ranges between $2 \leq x \leq 6$. List all the ordered pairs of (x, F(x)) and gives its domain and range. Also determine either F is onto and/or one-to-one.

[6 marks]

(b) Given f (a) = a + 3, g (b) = $2b^2$ + 1 and h (c) = $3c + c^2$. Find the value of the following:

(i) f ° g(x)

[2 marks]

(ii) g ° f(x)

[2 marks]

Question 7

Using the Induction Principle of Mathematics, shows that

$1 + 5 + 9 + \ldots + (4n - 3) = n (2n - 1)$ for all integer n ≥ 1.

[7 marks]

Question 8

A basket contains six (6) red roses and four (4) white roses. Ainah wants to make a flower bouquet of five (5) roses, where

(a) She can choose any color

[1 mark]

(b) The bouquet must contain **THREE (3)** red roses

[2 marks]

(c) The bouquet must contain **AT LEAST TWO (2)** white roses

[3 marks]

Question 9

Let A = {1, 2, 3, 4, 5, 6, 7, 8}. Get the value of this permutation function, get the transposition and determine either it is an odd or even permutation.

$$(2, 4, 5, 6) \circ (1, 4, 6, 7)$$

[5 marks]

Question 10

A building has a floor plan as in **Figure 1**. Every week, the room inspector, Ali, will come and tidy up all rooms including outside area, F. While, every end of the month, Bahari, will come and check all doors of all rooms. You need to help Ali and Bahari in term of:

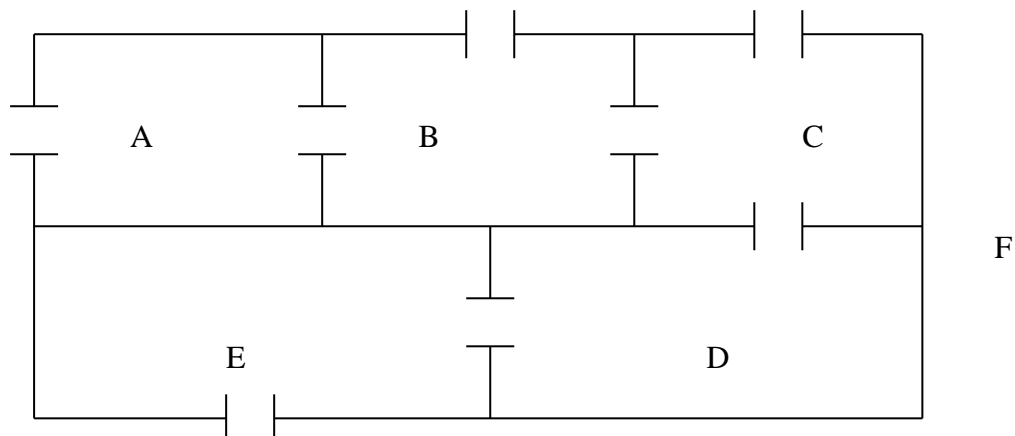(a) Modeled the floor plan into a graph and get the degree of each vertex.

[4 marks]

(b) Help Ali to move from one room to another only ONCE without have to get into any room MORE THAN ONCE. Get the path and cycle, if any.

[4 marks]

(c) Help Bahari to check all doors without going through any doors MORE THAN ONCE. Get the path and cycle, if any.
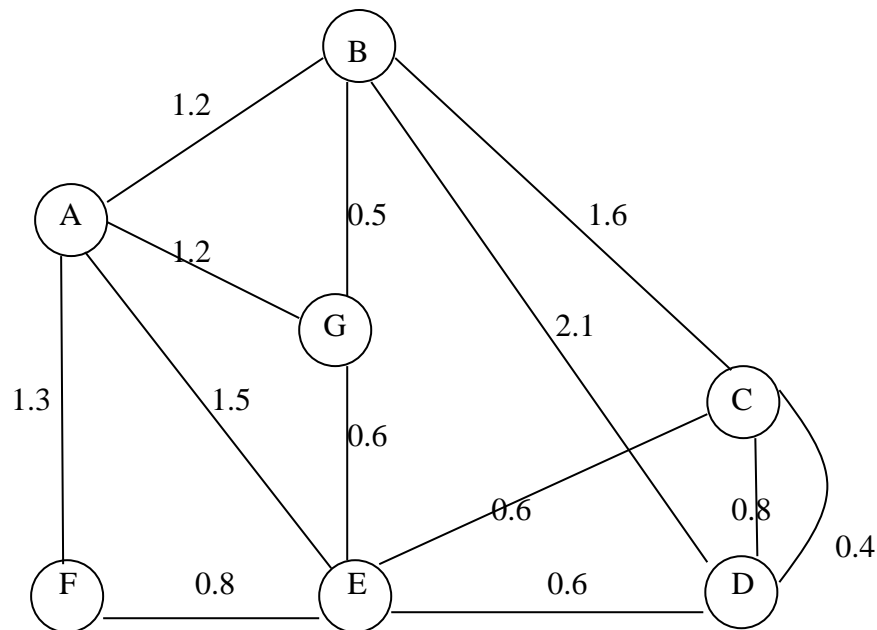
[4 marks]

Figure 1

Question 11

The graph was then be given a weight (in km) for each edge as in **Figure 2**. Find

(a)   The Minimal Spanning Tree for the weightage graph from E using Prim approach.

[6 marks]

(b)   The shortest distance.

[1 mark]

Figure 2

---End of Questions---