UNIVERSITY OF MAURITIUS

Faculty of Engineering

SPECIAL RETAKE EXAMINATIONS

AUGUST 2016

PROGRAMME	**BSc (Hons) Software Engineering**		
MODULE NAME	**Discrete Mathematics for Software Engineering**		
DATE	**Saturday 27 August 2016**	**MODULE CODE**	**CSE 1014Y(1)**
TIME	**09:30-12:30 Hrs**	**DURATION**	**3 Hrs**
NO. OF QUESTIONS SET	**6**	**NO. OF QUESTIONS TO BE ATTEMPTED**	**5**

INSTRUCTIONS TO CANDIDATES

Answer ANY 5 questions.

All questions carry equal marks.

Question 1 (20 marks)

(a) A is a symmetric matrix. Find the values of a, b and c.

$$A = \begin{pmatrix} 0 & -1 & 2 \\ c & 4 & b \\ a & -3 & 0 \end{pmatrix}$$

[3 marks]

(b) Using the properties of determinant show that

$$\begin{vmatrix} x+a & a & a \\ a & x+a & a \\ a & a & x+a \end{vmatrix} = x^2(x+3a)$$

[6 marks]

(c) Decompose the matrix below into product of lower (L) and upper triangular (U) matrix.

$$\begin{pmatrix} 1 & 2 & 4 \\ 1 & 3 & 6 \\ -1 & 0 & 1 \end{pmatrix}$$

[6 marks]

(d) Using the formula AX = B and the results obtained in (c) find the values of x_1, x_2 and x_3.

$$\begin{pmatrix} 1 & 2 & 4 \\ 1 & 3 & 6 \\ -1 & 0 & 1 \end{pmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -1 \\ -6 \\ 2 \end{bmatrix}$$

[5 marks]

Question 2 (20 marks)

(a) State one (1) advantage each of Gauss-Seidel and Jacobi methods over each other.

[2*2 marks]

(c) State two advantages of using Iterative methods over direct methods to find the solution of systems of linear equation.

[2*2 marks]

(d) Consider the following linear system

$$9x + y + z = 10$$

$$3x + 4y + 11z = 0$$

$$2x + 10y + 3z - 19 = 0$$

Starting with an initial guess of (0,0,0) perform two (2) iterations of both Jacobi and Gauss-Seidel. Show all the intermediate steps and use 4 d.p. for calculations.

[7 marks]

(e) Consider the following systems of equation:

$$3x-2y+z=5$$

$$x+2y+3z=4$$

$$5x+6y+7z=8$$

(i) Show that (x,y,z) = (0.125, -1.25, 2.125) is a solution by using any direct method.
(1/8, -5/4, 17/8)

(ii) Determine whether a solution can be found using an iterative method.

(iii) What can you conclude from the above results?

[1+1+3 marks]

Question 3 (20 marks)

(a) The number of disk Input/Output and processor times of seven programs are measured as shown in the following table:

Disk I/O's (x_i)	CPU Time (y_i)
14	2
16	5
27	7
42	9
39	10
50	13
83	20

For this data: $n=7$, $\Sigma xy = 3375$, $\Sigma x = 271$, $\Sigma x^2 = 13855$, $\Sigma y = 66$, $\Sigma y^2 = 828$

(i) Determine the linear regression model in the form $y = mx + c$.

(ii) Compute the correlation coefficient (R^2) between x and y.

[3 + 2 Marks]

(b) (i) An electronic firm manufactures LEDs that have a lifetime approximately normally distributed, with mean equal to 800 hours and a standard derivation of 40 hours. Find the probability that a random sample of 16 LEDs will have an average life less than 775 hours.

(ii) If a random sample of 30 LEDs with an average lifetime of 780 hours, find a 96% confidence interval for the population mean for all LEDs produced by this firm?

[5 + 5 Marks]

(c) In 2010, an employment report claimed that the monthly salary of fresh graduates working as software engineers had a mean of Rs 16540. To investigate this, the software engineering society (SES) sent 300 questionnaires for 300 randomly chosen graduates. 100 people replied and upon analysis of the 100 data, it was found to have a mean of Rs 16080 and a standard deviation of Rs 900. Did the claim of the employment report justified? Test at the 5% significance level.

[5 marks]

Question 4 (20 marks)

(a) A = { a,b,c,d,f} B={b,d,r,s}

Find (i) $A \cap B$ (ii) A + B (iii) A – B using arrays. **[3 marks]**

(b) Show that if a divides b and a divides c then a^2 divides bc. **[3 marks]**

(c) Using the Euclidean algorithm find,

GCD (190, 34). **[5 marks]**

(e) Express

GCD(190,34) in the form = s(190) + t (34). **[4 marks]**

(f) Compute 312^{216} mod 7. Show all your workings **[5 marks]**

Question 5 (20 marks)

(a) Using backtracking, find an explicit formula for:

$G_n = nG_{n-1}$ $G_1 = 6$. **[4 marks]**

(b) A = { 1,2,3,4}

R = { (1,1), (1,2),(2,1),(2,2),(2,3),(2,4),(3,4),(4,1)}

(i) Show that R^2 is a subset of A X A.

(ii) Draw the digraph of R^2.

(iii) Calculate in degree and out degree of R^2

(iv) Find M^{∞}

[2+2+2*2+2 marks]

(c) Prove the following using mathematical induction.

$3*5^0 + 3*5^1 + 3*5^2 + \ldots + 3*5^n = 3(5^{n+1} - 1)/4$

[6 marks]

<u>Question 6</u> (20 marks)

(a) Let the symbols Θ, ¥, º be define for the set (0,1) by the following tables.

Θ	0	1
0	0	1

¥	0	1
0	0	0

x	xº
0	1

Show that:

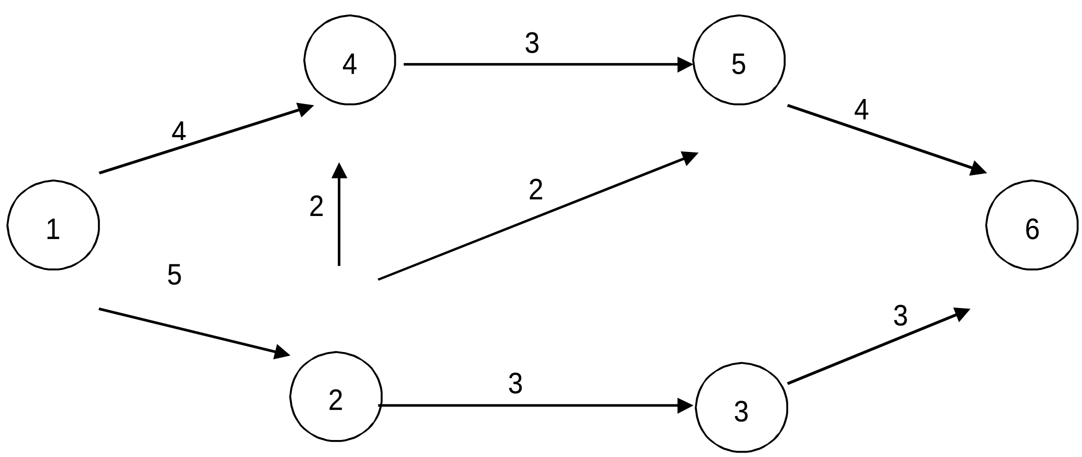
(i) Θ is commutative.

(ii) ¥, is associative.

(iii) De Morgan's law hold.

[2+2+ 3 marks]

(b) Using the Labeling algorithm find the maximal flow for the network whose capacity are shown



[13 marks]

END OF QUESTION PAPER