Sri Lanka Institute of Information Technology

B.Sc. Special Honors Degree/ Diploma
in
Information Technology

Final Examination
Year 1, Semester I (2019)

IT 1030 – Mathematics for Computing

Duration: 2 Hours

June, 2019

Instructions to Candidates:

♦ This paper contains 4 questions.

♦ **Answer all** the questions in the paper itself.

♦ Total marks for the paper is 100 and the paper carries 50% weight for the final mark.

♦ This paper contains nine pages without the cover page.

♦ Calculators are not allowed.

Question 01   25 marks

a) Consider the following system of linear equations.

$$3x + 4y = 24 \text{ -------------- (1)}$$
$$4x - 5y = 1 \text{ ---------------- (2)}$$

i) Write down the above system of equations in matrix form $A\underline{x} = \underline{b}$.   (2 marks)

ii) Find the inverse of the coefficient matrix A.   (5 marks)

iii) Using answer in (ii) find the values of x and y.

(5 marks)

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b) A multiple-choice test contains ten questions. There are four possible answers for each question.

    i)   In how many ways can a student answer the questions on the test if the student answers every question?   **(2 marks)**

    ii)   In how many ways can a student answer the questions on the test if the student can leave answers blank?   **(4 marks)**

c) Expand the following using Binomial Theorem.
$$(x^2 + 3)^3$$
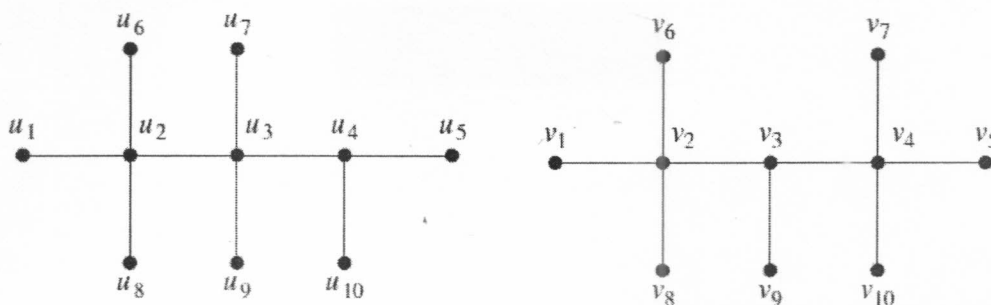   **(7 marks)**

Question 02   25 marks

a) Find the inverse of the following function   (8 marks)

$$f: R \to R \qquad\qquad f(x) = 3x - 7$$

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b) Determine whether the following graphs are isomorphic. If they are not give an isomorphic invariant that they do not share. (4 marks)

c) Determine whether the given graph has a Hamilton circuit, Hamilton path, Euler circuit and Euler path. Write down the answer in the following table. If it does not exist give reasons. (8 marks)
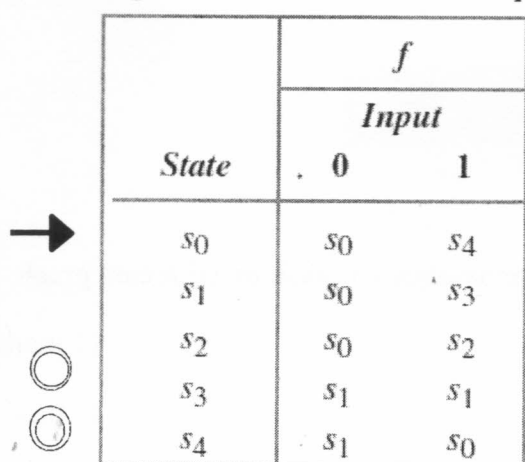

G_1
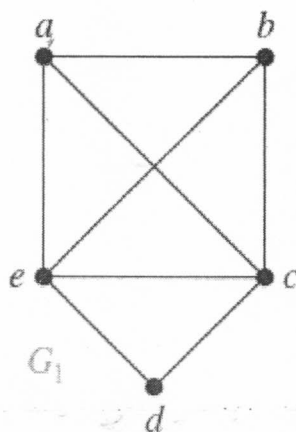
Hamilton circuit	
Hamilton path	
Euler circuit	
Euler path	

d) How many edges does a graph have if its degree sequence is 4, 3, 3, 2, 2? Draw such a graph. (5 marks)

Question 03   25 marks

a) Evaluate the following definite integral $\int_0^1 (|x - 4| + x^2)\, dx$. (8 marks)

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b) Following annotated next-state table represents the finite state machine A.

State	f Input 0	1
s_0	s_0	s_4
s_1	s_0	s_3
s_2	s_0	s_2
s_3	s_1	s_1
s_4	s_1	s_0

i) What is the initial state of A? (1 marks)

ii) What are the states of A? (2 marks)

iii) What are the input symbols of A? (2 marks)

iv) What are the accepting states of A? (2 mark)

v) Draw the state diagrams for the finite-state machine with the above annotated next-state tables. (5 marks)

c) Consider the following adjacency matrix.

$$\begin{bmatrix} 0 & 3 & 0 & 2 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 1 & 2 \\ 2 & 1 & 2 & 0 \end{bmatrix}$$

i) Determine whether this matrix represents an undirected graph or a directed graph.

(1 marks)

ii) How many loops are in the above graph?   (1 marks)

iii) How many parallel edges are in the above graph?   (1 marks)

iv) How many edges are in the above graph?   (2 marks)

Question 04   25 marks

a) Using Cramer's rule find the solution of the following system of linear equations.

$$2x + 2y + z = 0$$

$$2x - y - z = 2$$

$$y + z = 0.$$

(10 marks)

b) Consider the following linear system.

$$x + y + z = 3$$
$$x - y + \beta z = \alpha$$
$$x - y - z = 1$$

i) Write down the augmented matrix of the above system of linear equations.   (2 marks)

ii) Determine the complete set values for α and β that make the equations,
   a. Has a unique solution.
   b. No solution.
   c. An infinite set of solutions.   (13 marks)

End of the Paper

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