2017

M.Sc. 2nd Semester Examination

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

PAPER—MTM-204

Full Marks : 50

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(*Discrete Mathematics*)

1. Answer any *five* questions : 5×2

(a) Find the maximum number of vertices of a binary tree of depth h.

(b) What do you mean by "complexity of an algorithm".

(c) Explain Tautology and Contradiction with suitable examples.

(Turn Over)

(d) Define Phrase-Structure Grammar.

(e) Show that the relation " ≥ " is a partial order on the set of integers, Z.

(f) State the converse, inverse and contrapositive of the statement "If n is odd, then n + 1 is even".

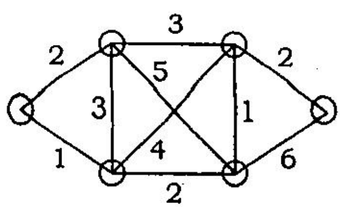
(g) Give an example of a Hamiltonian graph which is not Eulerian graph with proper justifications.

(h) Define the following terms ;
(i) "Ecentricity of a vertex" (ii) "Rooted tree".

2. Answer any *five* questions : 5×4

(a) Define inference rules. Show that $\sim r$ is a valid conclusion from the given $p \vee \sim q$, $\sim q \rightarrow r$, q ; when p, q and r are given statements.

(b) Illustrate the steps for determine the minimal spanning tree of the following graph :



(c) Prove that the following proposition is a tantology (without establishing a truth table)

$[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$, where, p, q and r are given statements.

(d) Express the Boolean function $f(x, y, z) = (x + y) \cdot (x + z) + y + z'$ in its disjunctive normal form.

(e) Show that any connected graph with n vertices and $(n - 1)$ edges is a tree.

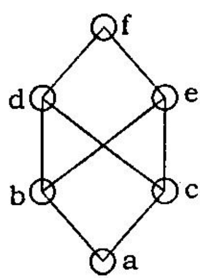
(f) Analyze the time complexity of a Binary search algorithm. What are the conditions under which sequential search of a given list is preferred over binary search ?

(g) How many positive integers between 1 to 1000 which are

(i) not divisible by either 3 or 4 ?

(ii) divisible by 3 but not by 4 ?

(h) Define lattice. Test whether the partial order set represented by the following Hasse-diagram is a lattice.



3. Answer any *two* questions : 2×5

(a) State and prove the Euler formula for a planar graph.

(b) Use the generating function to solve the following recurrence relation

$$a_{n+1} - 2a_{n+1} + a_n = 2^h, a_0 = 2, a_1 = 1.$$

(c) State the strong induction principle. Show that $3^{2n+1} + 2^{n-1}$ is divisible by 7.

[Internal Assessment —10]

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