PG/IVS/MTM-401/13

M.Sc. 4th Semester Examination, 2013

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

(Topology, Data Structure and Design and Analysis of Algorithms)

PAPER – MTM - 401

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

GROUP– A

(Topology)

[*Marks* : 25]

1. Answer any *two* questions : 1×2

(*a*) Let $X = \{ a, b, c \}$ and $\zeta = \{ \phi, X, \{a\}, \{b\}, \{a, b\} \}$. Let $A = \{a, c\}$. Find the subspace topology on A.

(*b*) Give an example of a T_1-space which is not T_2.

(*c*) Define a 1st countable space.

2. Answer any *three* questions : 4 × 3

(*a*) Show that $\mathbb{R}^{\omega}$ in the box topology is not metrizable.

(*b*) Prove that a compact T_2-space is normal.

(*c*) Let $p : x \to y$ be a continuous map. Show that if there is a continuous map $f : y \to x$ such that (pof) equals the identity map of y, then p is quotient map.

(*d*) Prove that every second countable space is a Lindelöf space.

(*e*) Show that continuous image of a compact set is compact.

3. Answer any *one* question : 6 × 1

(*a*) Define Homeomorphism between two topological spaces. Show that no two of the spaces (0, 1), (0, 1) and [0, 1] are homeomorphic.

(*b*) Which of the following subsets of $\mathbb{R}^2$ are compact ?

(*i*) $X_1 = \{(x, y) \in \mathbb{R}^2 : |x| + |y| < 10^{-100}\}$;

(*ii*) $X_2 = \{(x, y) \in \mathbb{R}^2 : |x| + |y| \leq 10^{100}\}$;

(*iii*) $X_3 = \{(x, y) \in \mathbb{R}^2 : 1 \leq x^2 + y^2 \leq 3\}$;

(*iv*) $X_4 = \{(x, y) \in \mathbb{R}^2 : x^2 + y^2 = 1 \text{ and } xy \neq 0\}$.

[*Internal Assessment* : 5 Marks]

GROUP– B

(*Data Structure and Design and Analysis of Algorithms*)

[*Marks* : 25]

Answer **Q.No. 4** and any **two** from the rest.

4. Answer any *two* questions : 2×2

(*a*) Define data structure with example.

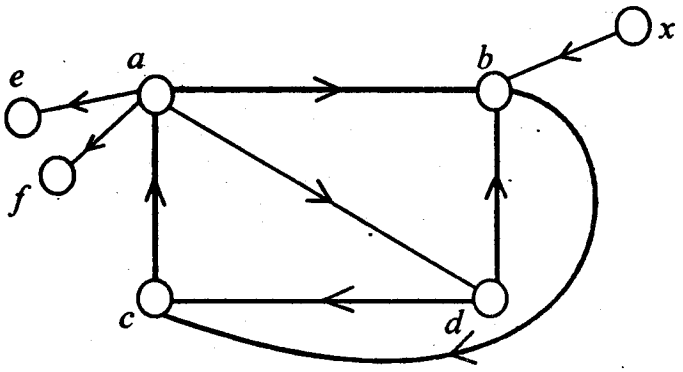
(*b*) Compare the data structure array and linked list.

(*c*) Define time and space complexities of an algorithm.

(*d*) Define tree and binary tree. Also, define height of a tree.

5. Write an algorithm to arrange a set of numbers in ascending order using quick sort technique. Write the time complexity of this algorithm. 7 + 1

6. Describe DFS and BFS. Find the DFS tree for the following graph starting from the vertex *x*. (2 + 2) + 4



7. Describe a method to store a polynomial into a linked list. Write an algorithm to add two polynomials without using a third list. 2 + 6

8. Define queue and stack. What are the differences between strem ? Describe circular queue. What is its advantage over linear queue ? How we can add an element into a circular queue ?
2 + 1 + 2 + 1 + 2

[*Internal Assessment* : 5 Marks]
