CODE : FS-17

COMPUTER APPLICATIONS/SCIENCE

Time : 3 Hours   *Maximum Marks : 200*

Note :— (1) There are two parts in this question paper, each containing *four* questions. Question No. **1** in Part I and Question No. **5** in Part II are compulsory. Attempt any *five* questions, at least *two* questions from each part, including the compulsory one.

(2) Parts of same questions must be attempted together and not to be attempted in between the answers to other questions.

Part I

1.   (*a*)   How many representations are there for a negative integer in binary number system ? Convert the decimal number $(-0.35)_{10}$ into binary number and the binary number $(101.1001)_2$ into decimal number.   8

(*b*)   What is the Von Neumann architecture and why is it needed ? Discuss.   8

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(c) The data sent by a computer system in a network (even over the Internet) is recognized by the recipient computer system (attached to the network) in spite of the fact that one computer system does not know how the data/instructions are stored in other computer system. How is it done ? Discuss. 8

(d) What is a process in an operating system ? Discuss its different phases. How is a process different from a thread ? 8

(e) What is an algorithm and why do you need to study the algorithms ? How is an algorithm different from a program ? Discuss. 8

2. (a) What are the combinatorial circuits ? Design a 3-to-8-Line decoder using the basic gates. 20

(b) What is the binary heap ? Applying it for creating a tree of the following data :

12, 7, 6, 3, 2, 9, 15, 10.

Also discuss the process to delete a non-terminal node and to insert an element at a non-terminal location in the heap. 20

3. (a) Discuss the layers of OSI model and their functionalities. Compare it with the TCP/IP model. 20

(b) What are the B-trees and why do you need them ? Create a B-tree of order 4 for the following data : 5, 34, 21, 9, 14, 13, 2, 7, 10, 12, 24, 18 and then delete the data 2, 21, 10, 13, 24.

20

4. (a) Why do you need the data types in a programming language and what are they ? You may discuss them with respect to a programming language convenient to you. Write the formula to access an element located at ith, jth, and kth positions in first, second, and third dimension, respectively, in a 3-dimensional array. You may assume that the first location in each dimension starts from 1. 20

(b) Consider the following set of processes, with the length of CPU burst in milliseconds : 20

Process	Burst Time	Priority
P1	2	2
P2	1	1
P3	8	4
P4	4	2
P5	5	3

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0 :

(i) Draw four Gantt charts to illustrate the execution of these processes using the following scheduling algorithms : FCFS, SJF, non-preemptive priority (a larger priority number implies a higher priority), and RR (quantum = 2).

(ii) What is the turnaround time of each process for each of the scheduling algorithms in part (a) ?

(iii) What is the waiting time of each process for each of these scheduling algorithms ?

(iv) Which of the algorithms results in the minimum average waiting time (over all processes) ?

Part II

5. (a) What is regular expression ? How is it associated with the automata ? Discuss.   8

(b) What is a transaction ? Discuss its characteristics.   8

(c) Design a Turing machine for the language :
L = $\{a^n b^n \mid n$ is a positive integer$\}$.   8

(d) What are the basic attributes of a good software ? Discuss.   8

(e) Discuss the hill climbing algorithm and its different ways of implementations.   8

6. (a) What is line clipping in graphics ? Discuss the Cyrus-Beck algorithm for line clipping in 2-dimensional space and apply it to clip the line P_1P_2 in the following shaded region : 20
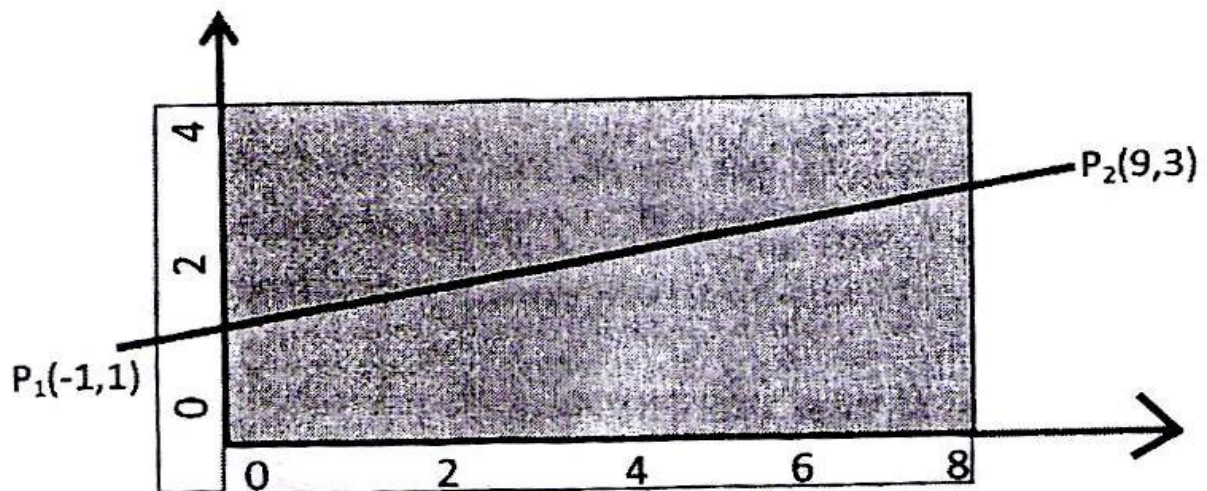
(b) What do you mean by normalization of the relations in a database ? Discuss different normal forms using suitable examples. 20

7. (a) Discuss LL(1) parsing by providing its characteristics and also its grammar. 20

(b) Discuss the Newton method for finding the roots of a polynomial equation and also compute its rate of convergence. Apply this method to find the roots of the following equation : 20

$$f(x) = x^3 - x + 1 = 0.$$

8. (a) What is the knowledge representation ? Discuss its various aspects. 20

(b) What is the software requirements engineering process ? Discuss the non-function requirements. 20