

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2018

FIRST YEAR [BATCH 2017-20]

COMPUTER SCIENCE (General)

Date : 29/05/2018

Time : 11 am – 1 pm

Paper : II

Full Marks : 50

[Use a separate Answer Book for each group]

Group - A

Answer any one question from Question Nos. 1 & 2 :

[1×5]

1. Suppose an array A[-15 ... 64] is stored in a memory whose starting address is 459. Assume that the word size for each element is 2. Then obtain the following :
 - a) How many number of elements are there in the array A? [1]
 - b) If one word of the memory is equal to 2 bytes, then how much memory is required to store the entire array? [1]
 - c) What is the location of A[50]? [1]
 - d) What is the location of the 10th element? [1]
 - e) Which element is located at 589? [1]
2. Write an algorithm/pseudocode to delete the second last node from singly linked list. Assume that the list contains at least three nodes. [5]

Answer any two questions from Question Nos. 3 to 6 :

[2×10]

3.
 - a) Prove that for a non-empty binary tree, the number of terminal nodes is one greater than the number of nodes having maximum degree. [2·5]
 - b) What is a full binary tree? Find the number of nodes present in a full binary tree of height 'h'? [2+2]
 - c) Is it possible to represent a binary tree using an array? Justify. [2]
 - d) What is external sorting? [1·5]
4.
 - a) A recursive procedure has 'last-in-first-out' characteristic. What data structure should be used to handle such cases? Justify with a simple example. [4]
 - b) What is a circular queue? Give an algorithm to insert an item in a circular queue. [2+4]
5.
 - a) Write an algorithm/pseudocode to search an element from a binary search tree. It is also to be noted that the element to be searched may not be present in the BST. [4]
 - b) Compare and contrast sequential allocation and dynamic allocation of memory. [3]
 - c) What is the time complexity of push() function of a stack implemented using an array? [3]
6.
 - a) Evaluate the following postfix expression :
7 5 2 + * 4 1 5 - / -
Assume that all the operands have single digit. [3]
 - b) What is the best case time complexity of insertion sort algorithm? [1]
 - c) The in-order and pre-order traversals of a binary tree are given as follows: [3]
In-order : 2 7 4 11 8 12 1 5 3 9 6 10
Pre-order : 1 2 4 7 8 11 12 3 5 6 9 10
 - d) Prove that for any non-empty binary tree, if n is the number of nodes and e is the number of edges, then $n = e + 1$. [3]

Group - B

Answer any one question from Question Nos. 7 & 8 :

[1×5]

7. What is internal fragmentation of memory? Mention a method to remove internal fragmentation of memory with proper explanation. [2+3]
8. a) Why deadlock is called a probabilistic event? [2]
b) What are the criteria for selecting deadlock detection and recovery, deadlock avoidance as deadlock handling mechanism? [3]

Answer any two questions from Question Nos. 9 to 12 :

[2×10]

9. a) An operating system uses the Banker's algorithm for deadlock avoidance when managing the allocation of three resource types X, Y and Z to three processes P0, P1 and P2. The table given below presents current system state. Here, the Allocation matrix shows the current number of resources of each type allocated to each process and the Max matrix shows the maximum number of resources of each type required by each process during its execution.

	Allocation			Max		
	X	Y	Z	X	Y	Z
P0	0	0	1	8	4	3
P1	3	2	0	6	2	0
P2	2	1	1	3	3	3

There are 3 units of type X, 2 units of type Y and 2 units of type Z still available. The system is currently in a safe state.

Consider the following request for additional resources in the current state.

REQ : P1 requests 2 units of X, 0 units of Y and 0 units of Z.

Check whether the system will be in safe state after granting REQ.

[6]

- b) What is the advantage of associating Translation Look-aside Buffer (TLB) with paging hardware? [2]
c) What do you mean by Zombie process? [2]
10. a) Consider 3 processes, P1, P2 and P3 as shown in the table below.

Process	Arrival Time (millisecond)	Burst Time (millisecond)
P1	0	5
P2	1	7
P3	3	4

Calculate average waiting time for the processes considering round robin scheduling with time slice = 2 millisecond.

[4]

- b) Draw and explain the state transition diagram of a process. [4]
c) Write down the advantages of shared memory over message passing as Inter Process Communication (IPC) mechanism. [2]
11. a) Consider a main memory with five page frames and the following sequences of page references. 3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3.
Find out the number of page faults considering Least Recently Used (LRU) page replacement policy. [4]
b) Explain starvation and its solution considering CPU scheduling. [2+1]
c) What is the advantage of paging? [2]
d) What is virtual memory? [1]

12. a) Explain indexed allocation of directory briefly. [4]
b) What is a semaphore? Briefly explain different functions of a semaphore. [2+3]
c) What do you mean by critical section? [1]

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