RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, SEPTEMBER 2020

SECOND YEAR (BATCH 2018-21)

Date : 26/09/2020 **COMPUTER SCIENCE (Honours)**

Time : 11.00 am – 7.00 pm **Paper : IV** Full Marks : 75

Group - A [30 marks]

(Answer all the questions) [10×3]

1. a) Consider the following set of processes, with the arrival times and the CPU-burst times given in milliseconds:

Process	Burst Time
P1	3
P2	8
P3	9
P4	3

Calculate average waiting time and average turnaround time for round robin scheduling with time slice of 2 milliseconds. [4]

b) What would be the impact if all processes in a computer are suddenly scheduled in First Come First Serve (FCFS) manner irrespective of their priority and other properties? Will it improve the overall system performance or not? Explain your answer. [4]

c) What is the necessity of several different types of kernel design in operating system? [2]

2. 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 the current system state.

	Allocation			**Max**		
	X	Y	Z	X	Y	Z
P0	1	0	1	8	4	3
P1	2	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. Check whether the system is in safe state or not. [5]

b) Explain how semaphores can be used to solve critical section problem in Producer-Consumer process paradigm. [5]

3. a) What would be the behaviour of a system if we stop the service of swapping in a running operating system? Explain your answer? [3]

b) What is the relation between long term scheduler and degree of multiprogramming? [2]

c) Will the performance of a computer keep increasing monotonically if we continue adding more primary memory to the system? Explain your answer? [3]

d) How does JVM follow the theoretical concepts of a virtual machine? [2]

Group - B [20 marks]

(Answer all the questions) [10×2]

4. a) Construct DFA for binary strings of numbers which are not divisible by 5. [5]

b) Consider the grammar with following productions

$S \rightarrow AB \mid \varepsilon$

$A \rightarrow aB$

$B \rightarrow Sb$

Show the derivations to check whether the input string aabbbb is accepted by this grammar or not.

Give a verbal description of the language generated by this grammar. [5]

5. a) Find the regular expression for the set $\{ a^n b^m : n \geq 3 , m \text{ is even } \}$ [3]

b) Construct Turing machine that will accept the non empty strings of a and b with length n, where n is divisible by 3. Explain the purpose of each state. Also show the sequence of ID's of your Turing Machine, when given input string is aabbba. [7]

Group - C [25 marks]

(Answer all the questions)

6. Solve the following recurrence relation using recursion tree. Give proper explanation also.

$$T(n) = \sqrt{n}T\left(\sqrt{n}\right) + n$$ [5]

7. a) Find out the time complexity of the following code segment: [4]

```
i = 2;
while(i <= n)
{
    i = i^2;
}
```

b) Find an optimal parenthesization of a matrix chain product whose sequence of dimensions is <4,5,3,2,7,2>. Use dynamic programming approach. [6]

8. a) Apply quicksort algorithm on the following list of numbers 6,12,4,9,1,7,5,10,3 by selecting the first element as pivot. Also explain the disadvantage of this pivot selection strategy (if any). [3+2]

b) Explain how a vertex u of a directed graph can end up in a DFS tree containing only u, even though u has both incoming and outgoing edges in G. [5]

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