RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [BATCH 2017-20]

B.A./B.Sc. FOURTH SEMESTER (January – June) 2019

Mid-Semester Examination, March 2019

Date : 25/03/2019 — **COMPUTER SCIENCE (Honours)**

Time : 2 pm – 4 pm — Paper : IV — Full Marks : 50

[Use a separate Answer Book for each group]

Group – A

(*Answer any two questions*) [10×2]

1. a) Calculate the average waiting time and average turnaround time using Round Robin scheduling for the following scenario with time slice of 3 ms.

Process	Burst time(ms)
P_0	18
P_1	7
P_2	12
P_3	4

b) For above problem find out the final completion time of four processes if context switch delay is 2 ms for each switch.

c) What do you mean by 'starvation' in process scheduling? Also provide a solution for this.

d) Write down the steps of process creation in an operating system. [3+2+3+2]

2. a) Consider following four operations:

$S1: a = x + y$

$S2: b = a + 2$

$S3: c = a - 3$

$S4: d = b + c$

Serialize the operations using necessary semaphores.

b) Show how Peterson's solution satisfies three requirements of critical section problem.

c) What is the use of resource allocation graph? [5+3+2]

3. a) Write short note on monolithic and microkernel.

b) Consider a system with 3 processes that share 4 instances of the same resource type. Each process can request a maximum of K instances. Resource instances can be requested and released only one at a time. What would be the largest value of K that will always avoid deadlock?

c) Show how deadlock can be prevented using circular wait condition? [4+3+3]

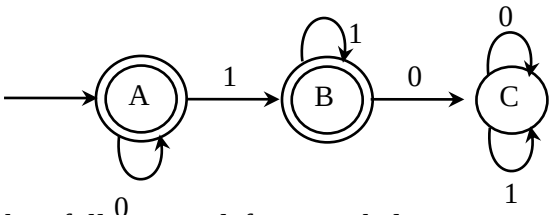
Group – B

(*Answer any two questions*) [2×7.5]

4. a) How many substring (of all length inclusive) can be formed from a character string of length 'n'? Assume all characters to be distinct. Prove your answer.

b) If G is a context-free grammar and 'w' is a string of length 'n' is L(G) , how long is a derivation of 'w' in G, if G is Chomsky Normal form?

c) The regular expression for the language recognized by the finite state automation of the following figure is —

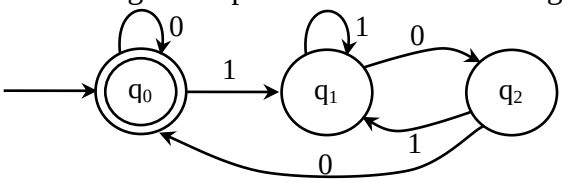


d) Which of the following definition below generates the same language as L, where $L = \{x^n y^n \text{ much that } n >= 1\}$?

(i) $E \rightarrow xEy|xy$ (ii) $xy|x^+xyy^+$ (iii) x^+y^+ [3+2+1+1.5]

5. a) Which regular expression over {0,1} does not contain 100 as a substring?
   b) Let L be the set of all binary strings whose last two symbols are the same. What is the number of states in the minimum state deterministic finite state automation accepting L?
   c) Define Chomsky classification of grammar. [2.5+2+3]

6. a) Define language over {a, b} such that it should contain at least one double letter.
   b) Find the regular expression for the following transition diagram.



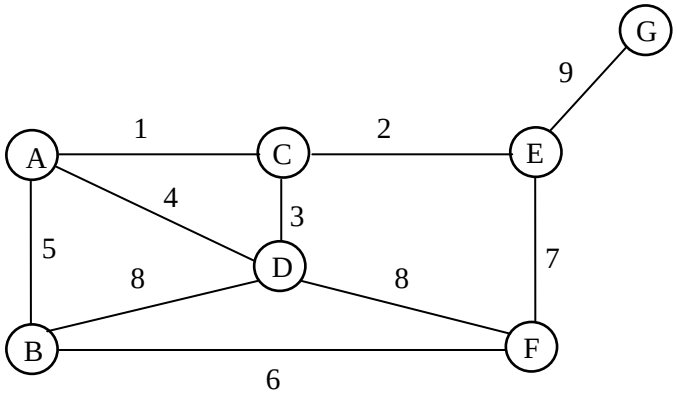
   c) Write the C.F.G for generating strings which contains at least 2 'a's. [2+4+1.5]

Group – C

(*Answer any three questions*) [3×5]

7. a) Prove that, $n\sqrt{n} + n\log_2 n + 2 = \theta\left(n\sqrt{n}\right)$
   b) State Master theorem for decreasing function. [2+3]

8. a) Execute Prim's algorithm on the following graph. Consider C as source vertex. Show the result stepwise.



   b) Differentiate between Kruskal's and Prim's algorithm. [4+1]

9. Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is $\langle 4,10,3,12,20,7 \rangle$. [5]

10. a) Differentiate between dynamic programming and greedy as algorithm design techniques.
    b) Give a dynamic programming solution to the 0-1 knapsack problem that runs in O(nW) time, where n is the number of items and W is the maximum weight of items that the thief can put in his Knapsack. [2+3]

———— × ————