RAMAKRISHNA MISSION VIDYAMANDIRA
(Residential Autonomous College affiliated to University of Calcutta)

SECOND YEAR [BATCH 2015-18]
B.A./B.Sc. FOURTH SEMESTER (January – June) 2017
Mid-Semester Examination, March 2017

Date : 15/03/2017

Time : 11 am – 1 pm

COMPUTER SCIENCE (Honours)

Paper : IV

Full Marks : 50

[Use a separate Answer Book for each group]

Group – A

(*Answer any two questions*) [2×10]

1. a) What are the two models of Interprocess Communication? Explain strengths and weaknesses of two approaches. [5]
   b) What is the purpose of interrupts? What are the differences between a trap and an interrupt? [3]
   c) Define Bootstrap program. [2]

2. a) Write short note on PCB. [5]
   b) Consider the following set of processes, with the length of the CPU burst given in milliseconds :

Process	Burst Time	Arrival Time
P1	18	0
P2	16	1
P3	12	2
P4	25	3

   Also consider 10 milliseconds for every context switch. Draw Gantt chart to illustrate SRTF and calculate average waiting time and average turn around time. [5]

3. a) Explain why implementing synchronization primitives by disabling interrupts is not appropriate in a single processor system if the synchronization primitives are to be used in user level programs. [3]
   b) Explain critical section problem using Producer-Consumer paradigm. [4]
   c) Explain buffering. [3]

Group – B

(*Answer any two questions*) [2×7·5]

4. a) State and prove Arden's theorem. [3]
   b) Find a C.F.G generating $\{a^j b^n c^n \mid n >= 1, j >= 0\}$. [3]
   c) Write the R.E for the language $L = \{w \text{ where} \mid w \mid \bmod 3 = 0, w \in (0,1)^*\}$. [1·5]

5. a) Find the R.E for the following transition diagram. [5]
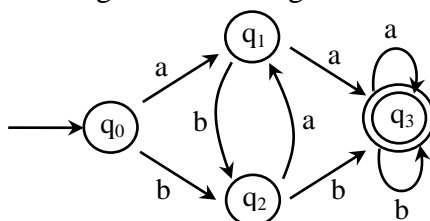
   b) Convert the C.F.G to C.N.F. [2·5]

   $S \rightarrow bA \mid aB$

 $A \rightarrow bAA \mid aS \mid a$

   $B \rightarrow aBB \mid b$

6. a) Explain Chomsky hierarchy of languages. [5]
   b) Convert the C.F.G to G.N.F. [2·5]

   S → ABb | a

   A → aaA | B

   B → bAb

Group – C

(*Answer any two questions*) [2×7·5]

7. a) Compute the time complexity for the following algorithm : [3]

$$T(n) = \begin{cases} 2T(\sqrt{n}) + \lg n, & n > 1 \\ 1 & \text{otherwise} \end{cases}$$

   b) Explain the problem solution technique using any two of the following classes of algorithms:
   (i) Brute force   (ii) Transform and conquer   (iii) Greedy approach, and
   (iv) Dynamic programming [4]
   c) What do you mean by efficiency of an algorithm? [0·5]

8. a) Explain the drawback of the adjacency matrix representation of the graph? Suggest a suitable array based graph representation technique with proper explanation. [3]
   b) Compute the time complexity for the following algorithm: [3]

   Algo-unknown (n)
   {   k=0;
   for (i=n/2; i<=n; i++)
   {   for (j=2; j<=n; j++)
   {   k = k+n/2;}
   }
   return k;
   }

   c) Give the geometric interpretation of Big-θ. [1·5]

9. a) Compute a minimum cost spanning tree for the graph of following figure using (i) Prim's algorighm   (ii) Kruskal's algorithm [2+2]
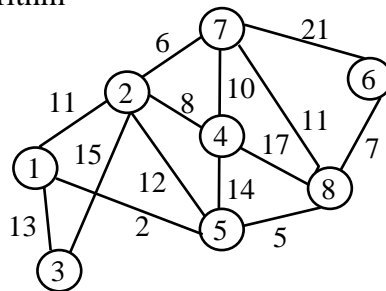
   b) Obtain a set of optimal Huffman codes for the messages (M_1, ...,M_7) with relative frequencies (q_1,....,q_7) = (4,5,7,8,10,12,20). Draw the decode tree this set of codes. [2·5]
   c) Show that if all internal nodes in a tree have degree k, then the number n of external nodes is such that, n mod (k–1) = 1. [1]

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