Final Assessment Test (FAT) – November/December 2022

Programme	**M.Tech. (Integrated)**	Semester	**Fall Semester 2022-23**
Course Title	**DESIGN AND ANALYSIS OF ALGORITHMS**	Course Code	**CSE3037**
Faculty Name	**Prof. Smrithy G S**	Slot	A1+TA1
		Class Nbr	**CH2022231000983**
Time	**3 Hours**	Max. Marks	**100**

Section A (10 X 10 Marks)
Answer All questions

1. What is a binomial heap?. State the properties of binomial heaps. **(2 Marks)** **[10]**
   Insert the elements 7, 2, 4, 17, 1, 11, 6, 8, 15, 10, 20, 5 one by one into an empty minimum binomial heap. **(4 Marks)**
   Delete the elements 1, 2, 4, 15 one by one from the above constructed binomial heap. **(4 Marks)**
2. State the properties of Red Black tree. **(2 Marks)** **[10]**
   Insert the elements 10, 18, 7, 15, 16, 30, 25, 40, 60 one by one into an empty red black tree. **(4 Marks)**
   Delete the elements 16, 7, 10, 30, 18 one by one from the above constructed Red Black tree. **(4 Marks)**
3. Given two strings. design an algorithm to determine longest common subsequences (LCS) using dynamic programming approach. **(4 Marks)** **[10]**
   Illustrate the algorithm developed for the strings S1= BDCABA, S2= ABCBDAB. Also print all the possible LCS string sequences. **(6 Marks)**
4. Given two positive integers x and n, write a function to compute x^n. For example, if x=2 and n=4 then $x^n=16$. **[10]**
   Design a brute force algorithm to solve the given problem and analyse the time complexity. **(5 Marks)**
   Design a Divide and Conquer algorithm to solve the same problem and analyse the time complexity. **(5 Marks)**
5. Given a 3×3 board with 8 tiles (every tile has one number from 1 to 8) and one empty space. The objective is to place the numbers on tiles to match the final configuration using the empty space. You can slide four adjacent (left, right, above, and below) tiles into the empty space. **[10]**
   Consider the following initial and final configuration,
   Initial configuration

2	8	3
1	6	4
7		5

   Final configuration

1	2	3
8		4
7	6	5

Apply least cost branch and bound strategy and find the minimum number of moves required to reach the final configuration from the initial configuration. **(10 Marks)**

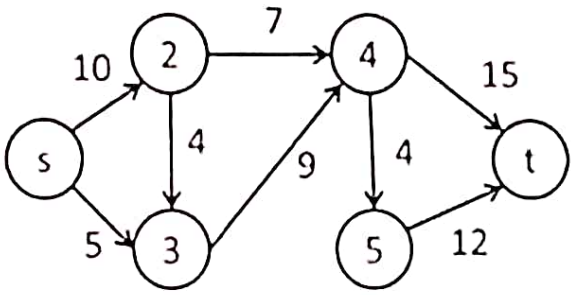
6. a. State KMP pattern matching algorithm. Find the shift for the pattern P: "ABAABABA" in the given text T: "ABAABCABAABABAE" using KMP string pattern matching algorithm **(6 Marks)** [10]

   b. How does KMP algorithm differs from naïve string matching algorithm. Analyse the best and worst case time complexity of both algorithms. **(4 Marks)**

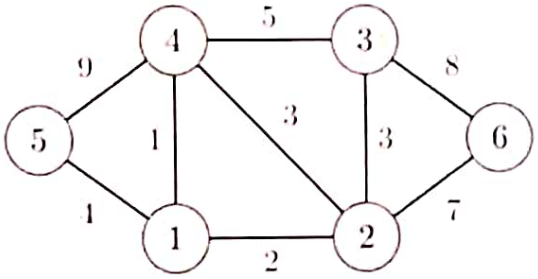
7. a. Given two line segments (A, B) and (C, D) design an algorithm to find whether the given line segments intersect with each other or not. **(6 Marks)** [10]

   b. Illustrate your algorithm for various intersecting and non-intersecting line segments. **(4 Marks)**

8. Find maximum flow using Ford-Fulkerson algorithm for the given graph. For each iteration, specify the flow network, residual network and selected augmenting path and its capacity. **(10 Marks)** [10]



9. Determine minimum spanning tree for the given graph using Prim's algorithm. Illustrate step by step procedure and analyse the time complexity of the algorithm. **(10 Marks)** [10]



10. What is reducibility? State 3-SAT and Clique problem. Reduce a 3-SAT problem into Clique problem with an example. **(10 marks)** [10]