University of Engineering & Management, Kolkata

Odd Semester Examination, December, 2017

Course: B.Tech(CSE) Semester: 5th

Paper Name: Design & Analysis of Algorithm

Paper Code: CS501

Full Marks: 70 Date: 06/12/2017 Time: 2:00pm – 5:00pm

Group - A (10 marks)

Answer any 5. Each question is of 2 marks.

1. A) How does amortized analysis differs from other time complexity analysis?
   B) Conclude the time complexity of strassen's algorithm from its recurrence relation.
   C) Is the sequence $\langle 23, 17, 14, 6, 13, 10, 1, 5, 7, 12 \rangle$ a max-heap?
   D) Recursively define minimum number of scalar multiplications needed to compute the matrix $A_{i..j}$;
   E) Mention four problems where we can use Dynamic Programming as an algorithm design method.
   F) Define Graph Coloring problem.
   G) What is Knapsack problem?
   H) What is the property of Big-Oh notation?

Group - B (15 marks)

Answer any 3. Each question is of 5 marks.

2. Show that the solution to $T(n) = 2T(\lfloor n/2 \rfloor + 17) + n$ is $O(n \lg n)$.
3. Use the master method to show that the solution to the binary-search recurrence $T(n) = T(n/2) + \Theta(1)$ is $T(n) = \Theta(\lg n)$. Also draw the recursion tree.

4. Explain tower of Hanoi problem with recursion tree and recurrence relation.

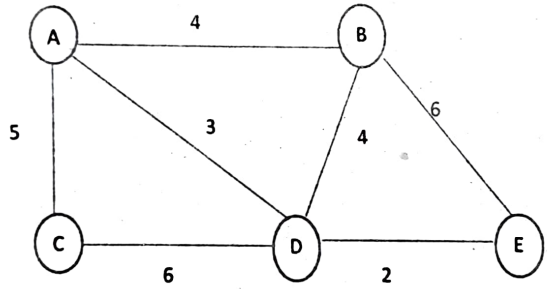
5. What is the effect of calling MAX-HEAPIFY(A, i) for i>$heap\text{-}size[A]/2$?

6. A long sequence of symbols generated from a source is seen to have the following occurrences:

Symbol	Occurrences
A1	3003
A2	996
A3	2017
A4	1487
A5	2497

Calculate the average code word length obtained from Huffman coding.

7. Write the Kruskal's algorithm. Apply it to find the MST for the following graph.



Group - C (45 marks)

Answer any 3. Each question is of 15 marks.

8. Use the master method to give tight asymptotic bounds for the following recurrences.

   a. $T(n) = 4T(n/2) + n$.

b. $T(n) = 4T(n/2) + n^2$.
c. $T(n) = 4T(n/2) + n^3$.
d. $T(n) = T(2n/3) + 1$.
e. $T(n) = 3T(n/4) + n\lg n$. **5 x 3**

9. Apply Strassen's method to multiply following two matrices:

$$A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix} \qquad B=\begin{bmatrix}7 & 9\\ -2 & 3\end{bmatrix}$$

Compare the performance if you are using general method of matrix multiplication. **12+3**

10. Solve the equation using LUP decomposition: **15**

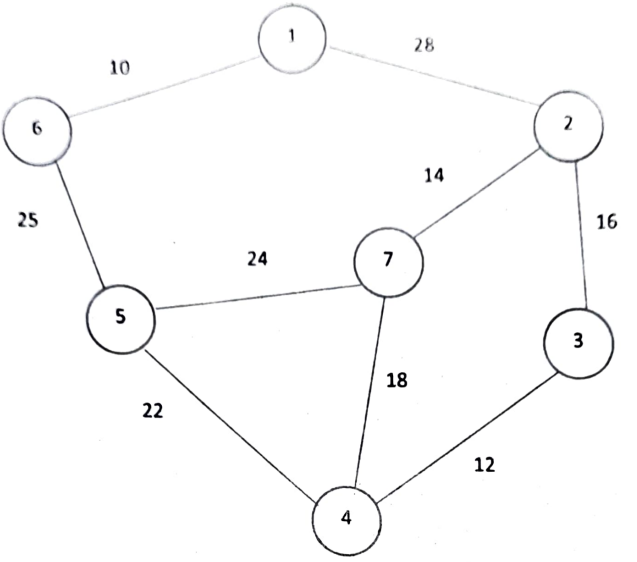
$x+5y+4z=12$, $2x+3z=9$ and $5x+8y+2z=5$

11. a) Illustrate the operation of MAX-HEAPIFY(A, 3) on the array $A = \langle 27, 17, 3, 16, 13, 10, 1, 5, 7, 12, 4, 8, 9, 0\rangle$

b) Write pseudocode for the procedure MIN-HEAPIFY(A, i), which performs the corresponding manipulation on a min-heap. **6+9**

12. Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is $\langle 5, 10, 3, 12, 5, 50, 6\rangle$. **15**

13. a) Find out MST using any algorithm



b) Difference between greedy and dynamic algorithm.

c) Write an algorithm to find a minimal spanning tree of undirected graph. 5+5+5

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