Code: AC64/AT64/AC115/AT115
Subject: DESIGN & ANALYSIS OF ALGORITHMS

AMIETE – CS/IT (Current & New Scheme)

Time: 3 Hours   **JUNE 2017**   **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 **Choose the correct or the best alternative in the following:**   **(2×10)**

   a. Euclid's algorithm is used to find_____
      (A) Factorial   **(B)** Prime number
      (C) GCD   **(D)** Fibonacci number

   b. A tree is a connected acyclic_____.
      (A) Graph   **(B)** Stack
      (C) Queue   **(D)** Linked list

   c. The theoretical evaluation of time complexity of a program is based on the _____operation.
      (A) basic   **(B)** input
      (C) output   **(D)** complex

   d. How many comparisons will be made by the brute-force algorithm in searching for the pattern 01010 in the binary text of one thousand zeros?
      (A) 999   **(B)** 996
      (C) 1992   **(D)** 2000

   e. The data structure used in breadth-first search traversal in graph is_____.
      (A) Stack   **(B)** Array
      (C) Priority queue   **(D)** Queue

   f. The space complexity of Selection sort algorithm is_____.
      (A) $O(1)$ **(B)** $O(2^n)$
      (C) $O(n)$ **(D)** $O(n^3)$

   g. An AVL tree is a_____.
      (A) Free Tree   **(B)** 3-node Tree
      (C) Binary search Tree   **(D)** Unbalanced Tree

   h. Warshall's algorithm is used to find the _____of a graph.
      (A) length   **(B)** Transitive closure
   **(C)** spanning tree   **(D)** shortest path

i. The value of d2= 1 in a good-suffix table for the pattern BARBER is_____.
   (A) 6   (B) 0
   (C) 3   (D) 4

j. The _____is not a principle of Greedy techniques.
   (A) feasible solution   (B) Backtracking
   (C) locally optimal solution   (D) Irrevocable

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Explain the Algorithm design and analysis process with a neat diagram.   **(10)**

     b. Write Euclid's algorithm to find the GCD of two numbers.   **(6)**

Q.3 a. Solve the following recurrence relations using backward substitution method.   **(3+3)**
        (i) $X(n) = X(n-1) + 5$ for $n > 1$, $X(1) = 0$
        (ii) $M(n) = 2M(n-1) + 1$ for $n > 1$, $M(1) = 1$.

     b. Write a recursive algorithm for finding the factorial of a given number and
        analyze its complexity using backward substitution method.   **(6+4)**

Q.4 a. Write a brute-force string matching algorithm. Determine the number of
        character comparisons made by the brute-force algorithm in searching for the
        pattern **GANDHI** in the following text.   **(6+4)**
        THERE_IS_MORE_TO_LIFE_THAN_INCREASING_ITS_SPEED

     b. Apply quicksort to sort the list *E, X, A, M, P, L, E* in alphabetical order. Draw
        the tree of the recursive calls made.   **(6)**

Q.5 a. Apply the DFS-based algorithm to solve the topological sorting problem for the
   following digraphs: **(6)**
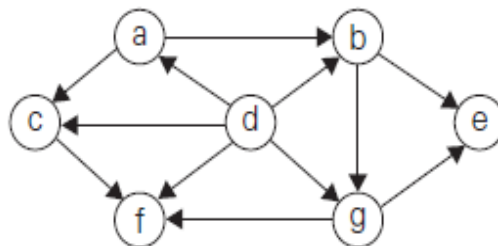
     b. Write Johnson-Trotter algorithm for generating permutations. Generate the next
        4 permutations of the following sequence.   **(10)**

$$\overleftarrow{4}\ \overleftarrow{2}\ \overrightarrow{3}\ \overleftarrow{1}$$

Q.6 a. Construct **2-3 tree** for the list **C,O, M, P,U, T, I,N,G**. Use the alphabetical
        order of the letters and insert them successively starting with the empty tree.   **(6)**

     b. Write a Bottom-up heap construction algorithm and analyze its worst case
        complexity.   **(5+5)**

**Q.7** a. Find the minimum spanning tree of the following graph using Prim's algorithm. **(8)**
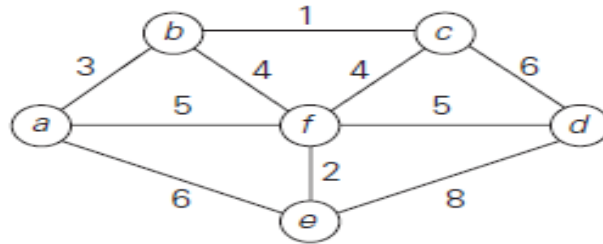
b. Write Floyd's algorithm and analyze its complexity. **(8)**

Q.8 a. Define B tree by mentioning its properties. Insert the value 65 for given B tree of order 4. **(10)**
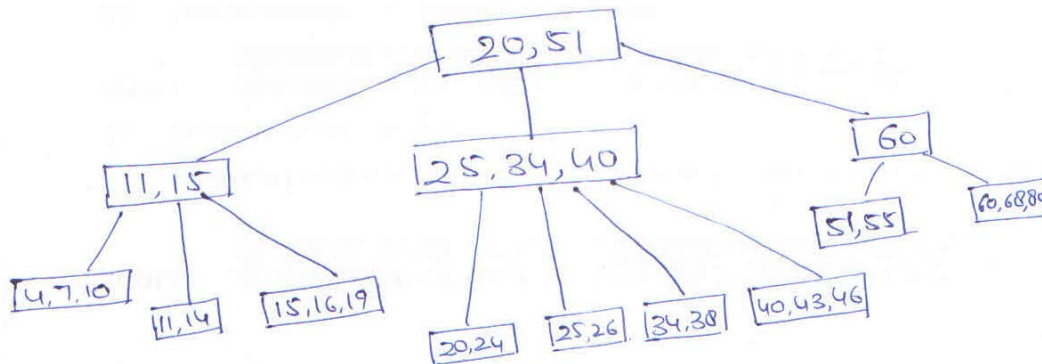
b. Write a note on P and NP problem types. **(6)**

Q.9 a. Apply backtracking to the problem of finding a Hamiltonian circuit in the following graph. **(6)**
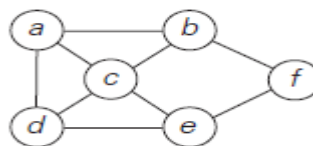
b. Solve the following instance of the knapsack problem by the branch-and bound Algorithm: **(10)**

item	weight	value	value/weight	
1	4	$40	10	
2	7	$42	6	The knapsack's capacity W is 10.
3	5	$25	5	
4	3	$12	4	