No. of Printed Pages : 5 **MMTE-002**

M. SC. (MATHEMATICS WITH APPLICATIONS IN COMPUTER SCIENCE) (MACS)

Term-End Examination

December, 2020

MMTE-002 : DESIGN AND ANALYSIS OF ALGORITHMS

Time : 2 Hours *Maximum Marks : 50*

Note : *Attempt any **four** questions from Question Nos. **1** to **5**. Question **No. 6** is compulsory.*

1. (a) Sort the following numbers using Radix sort technique : 5

789, 346, 125, 800, 543, 179, 555

(b) Construct a B-tree with min degree 2 when the numbers are inserted in the following order : 5

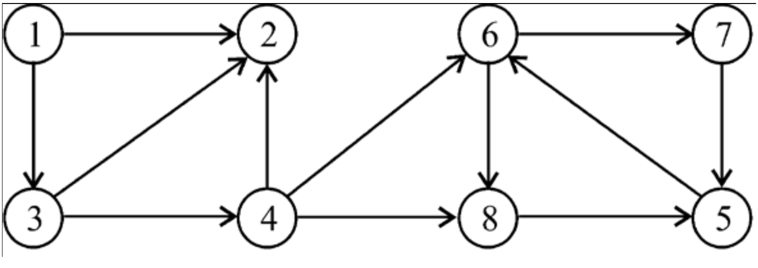
1, 12, 8, 2, 25, 6, 14, 28, 17, 7

2. (a) Construct a Huffman tree for the following characters : 5

Value	Frequency
A	5
B	25
C	7
D	15
E	4
F	12

Further, give the Huffman codes for each character corresponding to the tree you have constructed.

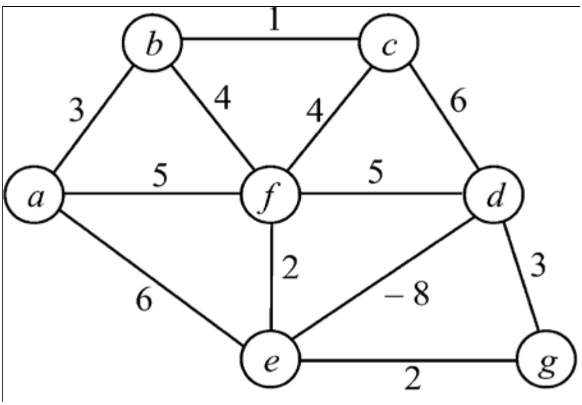
(b) Let $d(v)$ be the distance of the vertex v from the source vertex and $\pi(v)$ be the predecessor vertex of v. Obtain the d and π values that result from running the breadth-first search on the graph given below, using vertex 4 as the source. 5



3. (a) Solve the following activity selection problem : 5

Activity	**Start Time**	**Finishing Time**
A1	1	3
A2	0	4
A3	1	2
A4	4	6
A5	2	9
A6	5	8
A7	3	5
A8	4	5

(b) Find the minimum spanning tree for the following graph, using Kruskal's algorithm : 5



4. (a) Briefly explain each stage involved in using the fast Fourier transform algorithm for multiplying two polynomials of degree 250. 5

(b) Rank the following functions, in order of growth : 5

$$n!,\ 3^n,\ 2n+3,\ e^n,\ n^{\log(\log(n))}$$

5. (a) Search the given pattern in the following text using the naive string matching algorithm : 3

Pattern : BARBER

Text : BERTRAND_RUSSELL

Also report the number of comparisons done by the algorithm.

(b) Find all the solutions to the following equation : 2

$$35x \equiv 20 \pmod{52}$$

(c) For the set of keys {3, 7, 9, 4, 6, 8, 12}, draw binary search trees of heights 2, 3, 4, 5 and 6. 5

6. Which of the following statements are true ? Give reasons for your answers in the form of a short proof *or* a counter-example. 10

(i) All comparison based sorting algorithms have the same worst case running time.

(ii) A topological sort of a Directed Acyclic Graph (DAG) can be created by performing a depth-first-search on the DAG.

(iii) $\phi(p) = p \; \forall$ odd primes p, where ϕ is the Euler-phi function.

(iv) There is a unique min binary heap on the set $\{1, 2, ..., 9\}$.

(v) Two sequences can have several common subsequences of the same maximum length.