Roll Number:_____

Thapar Institute of engineering & Technology, Patiala
Department of Computer Science and Engineering

B.Tech (2ndYear): Auxiliary | Course Code: UCS301
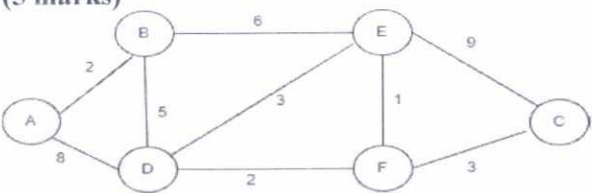--- | ---
 | Course Name: Data Structures
Time: 2 Hours, M. Marks: **50** | Faculty Name: AWK

Note: 1).Attempt **any five** out of seven questions.

Q1)	Consider inserting the keys 10, 22, 31, 4, 15, 28, 17, 88, 59 into a hash table of length $m = 11$ using open addressing with the auxiliary hash function $h'(k) = k$. Show the result of inserting these keys using: (a) linear probing and (b) double hashing with $h_1(k) = k$ and $h_2(k) = 1 + (k \bmod (m-1))$.	**5+5**
Q2)	(a) Define binary search tree (BST) and write an algorithm to find the successor of a node in a BST. **(5 marks)** (b) Draw BSTs of heights 2 and 4 for the set of keys: $\{1, 4, 5, 10, 16, 17, 21\}$.**(5 marks)**	**5+5**
Q3)	Whereas a stack allows insertion and deletion of elements at only one end, and a queue allows insertion at one end and deletion at the other end, a deque (doubleended queue) allows insertion and deletion at both ends. Write four $O(1)$ time procedures: **(a)** To insert elements into both ends of a deque implemented by an array. **(5 marks)** **(b)** To delete elements from both ends of a deque implemented by an array. **(5 marks)**	**5+5**
Q4)	a) Explain with proper reasoning whether the array A = 23, 17, 14, 6,13, 10, 1, 5, 7,12 is a max-heap. **(4 marks)** b) Apply the operation of heap sort on the array A = 5, 13; 2; 25; 7; 17; 20; 8; 4.. to arrange the number in ascending order. Show all the intermediate steps. **(6 marks)**	**6+4**
Q5)	a) Insertion sort is executed on array A = 31, 41, 59, 26, 41, 58 to arrange its element in nondecreasing order. What would be the content of the array after the 4th iteration? **(5 marks)** b) Convert the infix expression into an equivalent postfix expression using stacks. Show the content of the stack at each intermediate step. **(5 marks)**	**5+5**
Q6)	a) Determine the shortest paths to all the vertices which can be reached from source vertex 'A' (in the following figure) using Dijkstra's shortest path algorithm. Illustrate each intermediate step. **(5 marks)** b) List out five differences between AVL tree and heap **(5 marks)**	**5+5**

Q7)	a) What is the time complexity of the following program: **(3 marks)**
	 Void Fun (int n){
	 For (i=n/2; i<=n; i++)
	    For (j =1; j+n/2<= n; j= j++)
	       For (k=1; k<=n; k=k*2)
	          Count++
	 b) (i) Insert the following sequence of elements into an AVL tree, starting with an empty tree: 10, 20, 15, 25, 30, 16, 18, 19. **(4 marks)**
	 (ii) Delete 30 in the AVL tree that you got. **(3 marks)**
		3+7