COMSATS University Islamabad
Abbottabad

Department of Computer Science

Final Examination **Subject: Data Structure and Algorithms** **Sections: BCS- 4C**

Total Marks: 80

SECTION-A

(Time allowed: 20 Minutes) CLO-1 (10 Marks)

Question 1

a) What is advantage of a doubly linked list over a singly linked list? CLO-1

b) Write the code for Linear Search? CLO-1

SECTION-B

(Time allowed: 30 Minutes) CLO-2 (20 Marks)

Question 2: **Marks 5**

a) Convert the following infix expression to prefix and postfix notation: CLO-2

$$A \times B / C - D + E / F$$

Question 3 (a) Write down the implementation code for Generic Stack ADT using Arrays. **10 Marks**

(b) Build an Expression Tree from the following expression: (Step-by-Step) **5 Marks**

$$2 \times 10 / 5 - 2 + 8 / 4$$

SECTION-C

(Time allowed: 120 Minutes) CLO-3 (50 Marks)

Question 4 **5 Marks**

a) Differentiate between binary tree and binary search tree? CLO-3

b) What is complete binary tree? Give one example by drawing a complete binary tree. CLO-3 **5 Marks**

c) Apply Huffman Coding to the following string including '_': (Step-by-Step) **10 Marks**

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Question 5 (a) Insert 57,71,61,41,47,31,27,97 into an empty AVL tree. CLO-3 **5 Marks**

After making the tree do the following

- Insert 37 and 10
- Remove 41

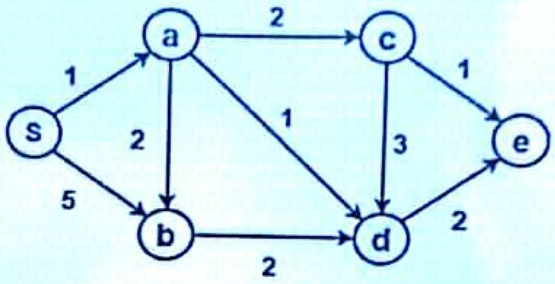
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Hint: After each step, check your tree whether it is balanced or not and make rotations accordingly to make the tree balanced.

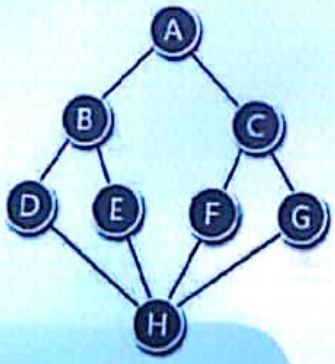
b) Draw a graph for the following adjacency matrix **Marks 5**

	A	B	C	D	E
A	0	1	1	1	0
B	1	1	0	1	0
C	0	1	0	1	0
D	0	1	0	1	1
E	0	1	1	1	0

Question 6 (a). Using Dijkstra's Algorithm, find the shortest distance from source vertex 'S' to remaining vertices in the following graph- **CLO-3** **Marks 5**



(b) Consider the following example graph to perform BSF traversal step by step.
(Note start the traversal from node A) **CLO-3** **Marks 5**



Question 7:(10 Marks) **CLO-3**

a) Dry Run Merge Sort on the given array showing how it runs in O (n log n). (Step-by-Step)

9	32	54	22	55	7	8	3

b) Write the Java Code for Selection Sort Algorithm that sorts in $O(n^2)$