MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (CSE/CSIS)
END SEMESTER EXAMINATIONS, Nov 2024

Advanced Data Structures and Algorithms [CSE 5113]

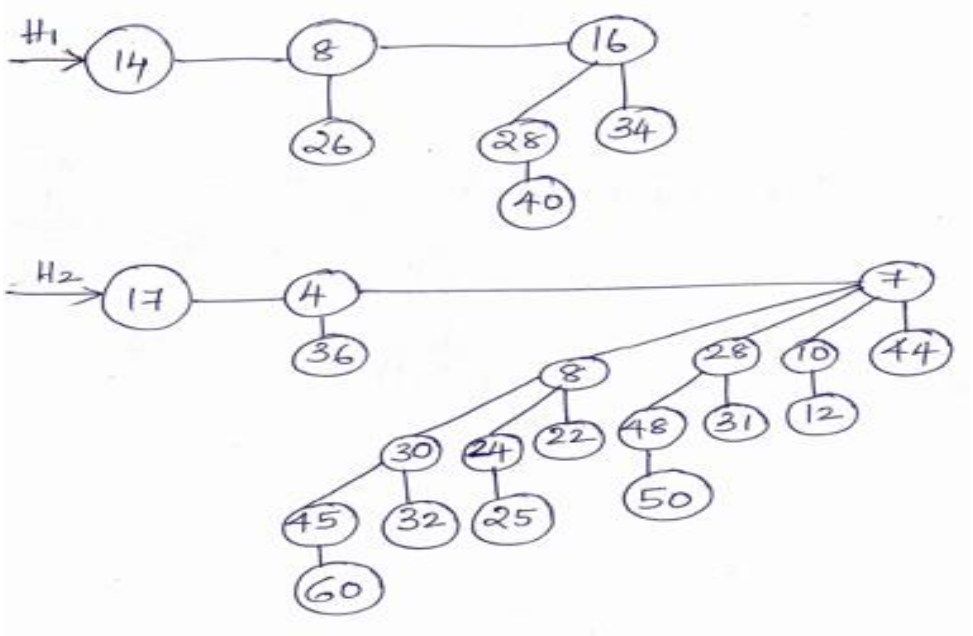
REVISED CREDIT SYSTEM

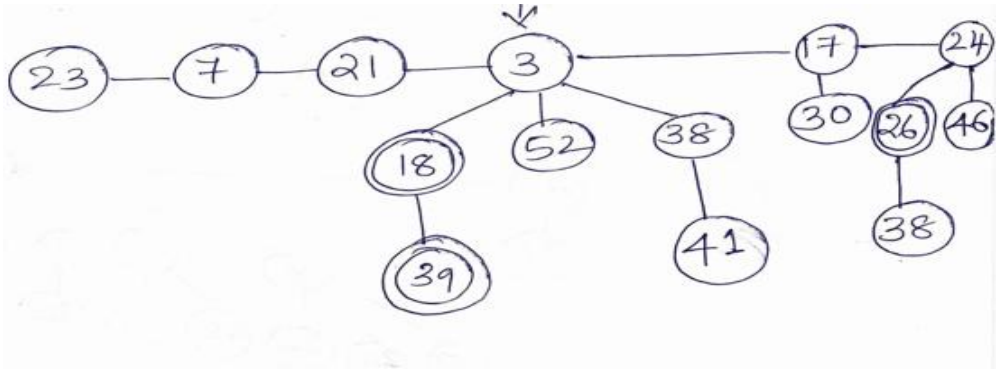
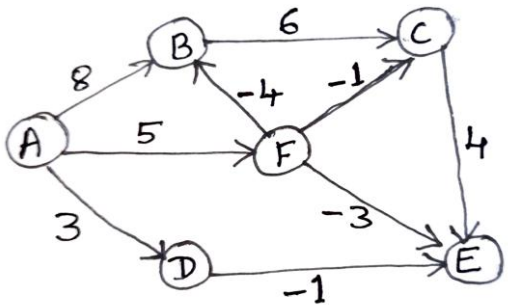
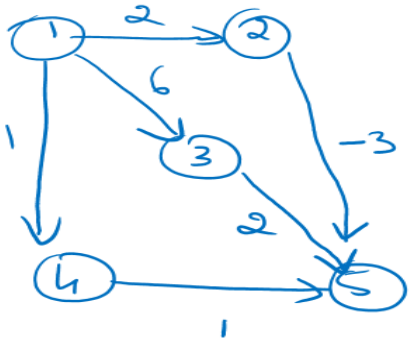
(02/12/2024)

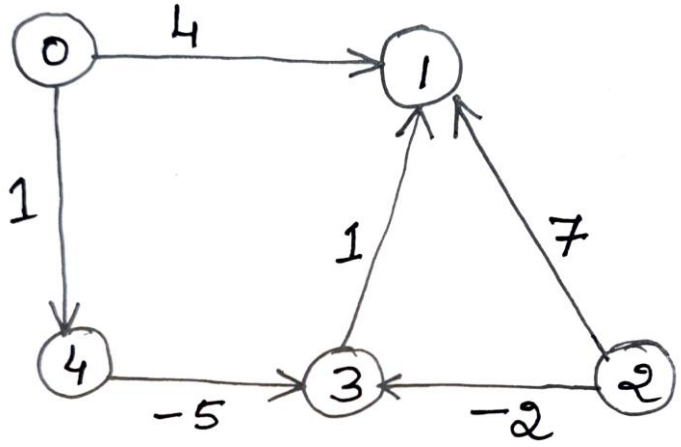
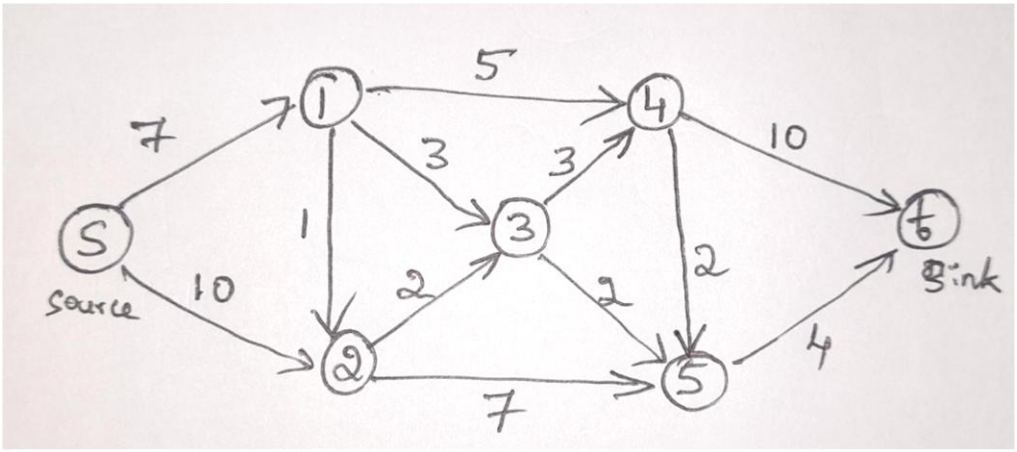
Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data, if any, may be suitably assumed.

Q. No	Questions	Mark
1A	Suppose we perform a sequence of stack operations on a stack whose size never exceeds *k*. After every *k* operation, we make a copy of the entire stack for backup purposes. Show that the cost of *n* stack operations, including copying the stack is O(*n*) by assigning suitable amortised cost to the various stack operations.	3
1B	Define potential method of amortised analysis. Also, compute the amortised cost of incrementing a binary counter using potential method.	3
1C	Define a dynamic table in data structures. Also, show that the amortised cost of dynamic table is O (1)	4
2A	Explain the various rules governing the insertion of nodes in a B-Tree. Also, construct the B-Tree with the keys 52, 32, 23, 92, 12, 15, 22, 72, 27, 94, 82, 95, 25, 30 by successive insertion in one pass method with degree t=2.	4
2B	Illustrate the merge operation step by step on the binomial heaps H1 and H2 shown in figure 2B.  Figure 2B.	3

2C	Construct a binomial heap with the following dataset 32, 23, 13, 29, 19, 20, 21, 43, 60, 20. Also, extract and delete the minimum key from the resultant binomial heap.	3
3A	List the properties of Fibonacci heap. Also, clearly showing all the steps, extract the minimum key and do consolidation for the Fibonacci heap given in Figure 3A. [18, 39, and 26 are marked nodes]  Figure 3A	4
3B	Discuss Van Emde Boas Tree and its structure in detail.	3
3C	Find the Disjoint set of the following undirected graph G(V, E) by clearly showing all the steps V={a, b, c, d, e, f, g, h, i} E={(a, b), (b, d), (d, c), (c, a), (e, f), (e, g), (g, f), (h, i) }	3
4A	Apply Bellman-Ford algorithm for the graph given in figure 4A with A as source vertex.  Figure 4A.	5
4B	Apply shortest paths in DAG for the graph given in figure 4B with A as source vertex  Figure 4B.	3

4C	Differentiate between the Dijkstra's algorithm and Bellman-Ford algorithm	2
5A	Apply Johnson's algorithm for sparse graphs for the graph given in figure 5A.  Figure 5A.	5
5B	Calculate the maximum flow from source to sink in the network shown in figure 5B using Ford-Fulkerson algorithm by clearly showing all the steps.  Figure 5B.	5