

CSE 202 Midterm 3 Part (b)

Olcay Taner YILDIZ

I. MULTIPLE CHOICE QUESTIONS (40 POINTS)

1. Given the following data $a = (16-14-10-8-7-9)$ as a max-heap. What will be the heap after the following operations?

```
a.deleteMax();
a.insert(3);
a.insert(12);
a.deleteMax();
```

- 12-10-9-8-7-3
- 12-10-9-3-8-7
- 12-9-10-7-8-3
- 12-9-10-8-7-3
- 12-9-10-8-3-7

2. What is the time complexity of deleteMax and insert for the min-heap?

- $\mathcal{O}(\log N)$, $\mathcal{O}(\log N)$
- $\mathcal{O}(1)$, $\mathcal{O}(N)$
- $\mathcal{O}(N)$, $\mathcal{O}(1)$
- $\mathcal{O}(1)$, $\mathcal{O}(1)$
- $\mathcal{O}(\log N)$, $\mathcal{O}(1)$

3. If the height of the min-heap is h , what is the minimum number of elements that can we store in that heap?

- 2^h
- $2^h - 1$
- 2^{h-1}
- $2h - 1 + 1$
- $2^h + 1$

4. If the index of a node is t , what are the indexes of the grandchildren of that node?

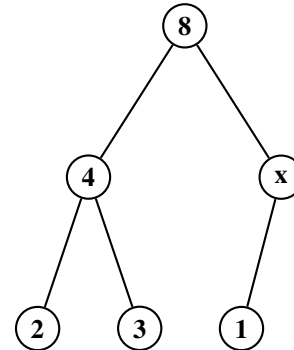
- $4t, 4t + 1, 4t + 2, 4t + 3$
- $4t + 1, 4t + 2, 4t + 3, 4t + 4$
- $4t + 2, 4t + 3, 4t + 4, 4t + 5$
- $4t + 4, 4t + 5, 4t + 6, 4t + 7$
- $4t + 3, 4t + 4, 4t + 5, 4t + 6$

5. If the height of the d -heap is h , what is the maximum number of elements that can we store in that heap?

- d^h
- $\frac{d^h - 1}{d - 1}$
- $\frac{d^h}{d - 1}$
- $\frac{d^{h+1} - 1}{d - 1}$
- $d^h - 1$

6. For heap above, what can be the maximum and minimum value of x ?

- 7, 5
- 7, 4
- 4, 2
- 5, 2



e) 7, 2

7. In the beginning of the disjoint set algorithm, what are the number of disjoint sets in terms of N (number of sets)?

- N
- $N - 1$
- $N + 1$
- $2N$
- $2N + 1$

8. What is the time complexity of finding the (i) parent of a set, (ii) child of a set, given the index of the set?

- $\mathcal{O}(\log N)$, $\mathcal{O}(\log N)$
- $\mathcal{O}(1)$, $\mathcal{O}(N)$
- $\mathcal{O}(N)$, $\mathcal{O}(1)$
- $\mathcal{O}(1)$, $\mathcal{O}(1)$
- $\mathcal{O}(\log N)$, $\mathcal{O}(1)$

9. If heights of two disjoint sets are 4 and 7, what is the height of the resulting set if those sets are merged?

- 5
- 6
- 7
- 8
- 9

10. Given a disjoint set of a contains 10 elements initially (0 to 9), what is the number of disjoint sets after the following operations?

```
a.union(0, 2);
a.union(1, 4);
a.union(2, 5);
a.union(4, 7);
a.union(0, 5);
```

- a) 3
- b) 4
- c) 5
- d) 6
- e) 7

11. Given a disjoint set of N elements initially, what is the maximum number of children of a set?

- a) $N/2$
- b) N
- c) 2
- d) $N - 1$
- e) $N - 2$

12. Which of the following conditions will be true if a node with index i is a representative set?

- a) `sets[i] == i`
- b) `sets[i] != i`
- c) `sets[i].parent == i`
- d) `sets[i].parent != i`
- e) `sets[i].parent.parent != i`

13. What is the minimum number of edges in a graph with N nodes?

- a) 0
- b) N
- c) $2N$
- d) N^2
- e) N^3

14. What is the maximum number of connected components of a graph with N nodes?

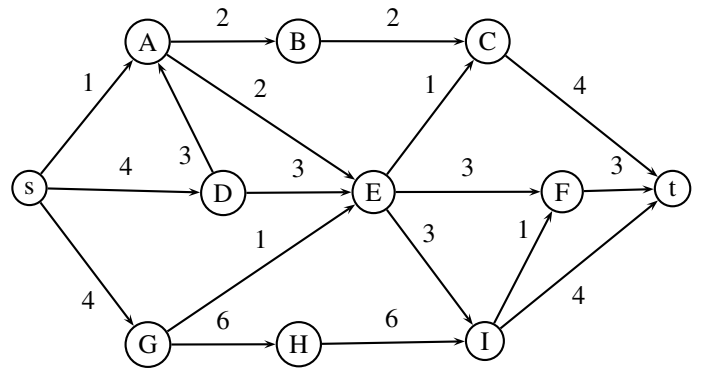
- a) $N / 4$
- b) N
- c) $N / 2$
- d) $N - 1$
- e) $N + 1$

15. What is the time complexity of the algorithm (for a graph with N nodes) which checks if node i is adjacent to node j for (i) adjacency matrix, (ii) adjacency list representation?

- a) $\mathcal{O}(\log N)$, $\mathcal{O}(\log N)$
- b) $\mathcal{O}(\log N)$, $\mathcal{O}(1)$
- c) $\mathcal{O}(N)$, $\mathcal{O}(1)$
- d) $\mathcal{O}(1)$, $\mathcal{O}(1)$
- e) $\mathcal{O}(1)$, $\mathcal{O}(N)$

16. For an unweighted undirected graph G with N nodes and E edges, what is the sum of the elements of the adjacency matrix of G ?

- a) E
- b) $2E$
- c) N
- d) $2N$
- e) N^2



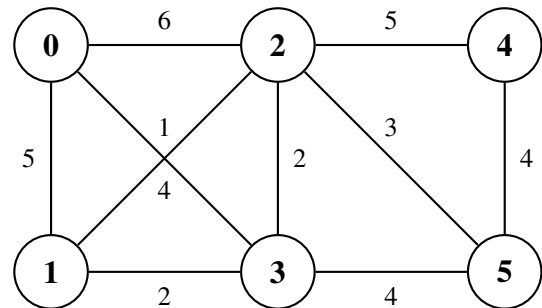
17. In the graph above, what is the shortest path from s to t ?

- a) 11
- b) 10
- c) 9
- d) 8
- e) 7

18. If you want to solve the single source shortest path problem for negative weights, which algorithm should you use?

- a) Dijkstra
- b) Floyd-Warshall
- c) Bellman-Ford
- d) Kruskal
- e) Prim

19. Given the graph above, what is the length of the minimum



spanning tree?

- a) 14
- b) 15
- c) 16
- d) 17
- e) 18

20. What is the time complexity of Floyd-Warshall all pairs shortest path algorithm?

- a) N^4
- b) N^2
- c) $N^2 \log N$
- d) $N^3 \log N$
- e) N^3