S.No.: 01DLSK_CS_ABCD_29062026

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ALGORITHMS

COMPUTER SCIENCE & IT

Date of Test : 29/06/2026

ANSWER KEY ➤

1.	(b)	7.	(c)	13.	(b)	19.	(a)	25.	(a)
2.	(d)	8.	(b)	14.	(d)	20.	(c)	26.	(a)
3.	(d)	9.	(a)	15	(c)	21.	(a)	27.	(b)
4.	(c)	10.	(b)	16.	(c)	22.	(b)	28.	(c)
5.	(c)	11.	(b)	17.	(b)	23.	(c)	29.	(d)
6.	(d)	12.	(a)	18.	(b)	24.	(b)	30.	(b)

DETAILED EXPLANATIONS

1. (b)

Apply Master Theorem:

$$T(n) = aT(n/b) + f(n)$$

$$f(n) = n^{1/2}$$

and here $a = 2, b = 4$

So, $(n^{\log_b a}) = (n^{\log_4 2})$

Will gives $(n^{1/2})$

So, $f(n) = \theta(n^{1/2})$

So, $T(n) = O(\sqrt{n}\log n)$

2. (d)

Selection sort in worst and best case take same time i.e., $O(n^2)$. So all the input take same time.

3. (d)

In best case merge sort time complexity = $O(n \log n)$

For quick sort in best case = $O(n \log n)$

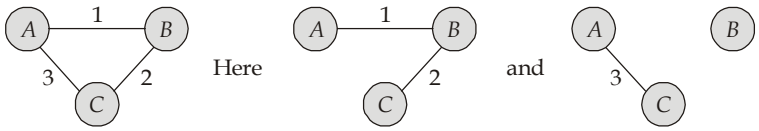
For selection sort = $O(n^2)$

For insertion sort = $O(n)$

4. (c)

(i) For a directed graph, the absence of back edge in DFS tree means no cycle present. **So false**.

(ii)



Two paths are possible but cost is same. **So false**.

(iii) Depth of any vertex in BFS always less than equals to depth of same vertex in DFS. **So true**.

5. (c)

$$g(n) \geq c_1 n,\ h(n) \leq c_2 n$$

$$\therefore \quad g(n) \cdot h(n) \geq c_3 n$$

$$\Rightarrow \quad g(n) \cdot h(n) = \Omega(n)$$

$$f(n) + [g(n) \cdot h(n)] = \max(\Omega(n), \Theta(n))$$

$$f(n) + [g(n) \cdot h(n)] = \Omega(n)$$

6. (d)

$$T(n) = 2T\left(\frac{n}{\sqrt{2}}\right) + n$$

Using Master's theorem, $a = 2$, $b = \sqrt{2}$, $f(n) = n$

$$n^{\log_b a} = n^{\log_{\sqrt{2}} 2} = n^{\left(\frac{\log 2}{\log \sqrt{2}}\right)}$$

$$= \frac{1}{n^{(1/2)}} = n^2$$

$\Rightarrow \quad n^{\log_b a} = n^2$

$\Rightarrow \quad n^2 > f(n)$

$\Rightarrow T(n)$ is $O(n^2)$

7. (c)

First sort the intervals by their finish time

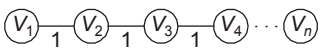
T_1	T_2	T_3	T_5	T_4	T_7	T_6
(1,4)	(2,4)	(1,5)	(4,6)	(3,7)	(6,7)	(7,8)

First any of (1, 4), (2, 4) start, at T = 4 T_5 start then T_7 after that T_6 will be completed.
Total 4 task completed

8. (b)

Prim's algorithm will pick up the edge with least weight for a particular node, [provided it does not form a cycle] weight of edge (V_{i-1}, V_i) or $(V_i, V_{i-1}) = 1$

$\therefore$ MST will be



$\therefore$ Total edge weight = $2 \times (n - 1) = 2n - 2$.

9. (a)

Dijkstra's algorithm will output same as breadth first search on graph and will take $O(m + n)$ time.

10. (b)

$W = 8$ (capacity)

Feasible solutions:

(i) $\{I_1, I_3, I_4\}$,

(ii) $\{I_2, I_3\}$

Profit of $\{I_1, I_3, I_4\}$ is 23

profit of $\{I_2, I_3\}$ is 15

Optimal solution is $\{I_1, I_3, I_4\}$ with capacity of 8 and maximum profit 23 produced.

$\therefore I_2$ is not selected in the solution.

11. (b)

$A_1 A_2 A_3 = A_1 \times (A_2 \times A_3)$

$3 \times 100, 100 \times 2, 2 \times 2$

By **Person X applying Greedy:**

$A_1 \times (A_2 \times A_3)$

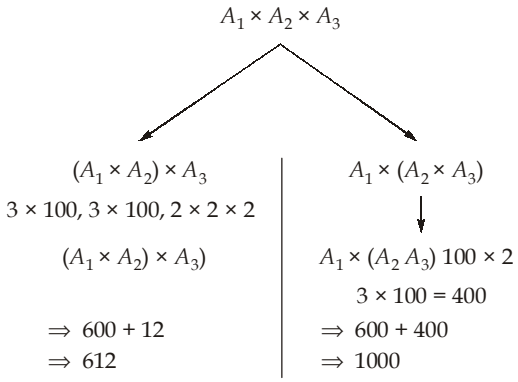
$3 \times 100, 100 \times 2, 2 \times 2$

$(A_2A_3) \rightarrow 100 \times 2, 2 \times 2 = 200 \times 2 = 400$

$A_1 \times (A_2A_3) \rightarrow 3 \times 100, 100 \times 2 = 300 \times 2 = 600$

Total number of multiplication required = 600 + 400 = 1000

Person Y with Dynamic:



Number of multiplication saved by Person Y = 1000 – 612 = 388

12. (a)

Starting vertex is D

	A	B	C	D	E	F	G	H
D	∞	∞	∞	0 Nill	∞	∞	∞	∞
F	16	17 D	13 D	–	∞	3 D	∞	8 D
B	16	7 E	13 D	–	∞	–	∞	8 D
H	16	–	13 D	–	∞	–	12 B	8 D
E	16	–	13 D	–	10 H	–	12 B	
G	16	–	13 D	–	–	–	12 B	
C	16	–	–	–	–	–	–	–
A	–	–	–	–	–	–	–	–

So the order of relaxed the vertices by using Dijkastra's algorithm is DFBHEGCA.

13. (b)

Algorithm is choosing median = $\frac{n}{2}$ smallest element as pivot

Hence, the array is divided as:

$\left(\frac{n}{2}-1\right)$ elements	Median at $\frac{n^{\text{th}}}{2}$ location	$\left(n-\frac{n}{2}\right)$ elements

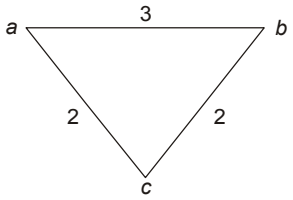
Therefore quick sort recurrence relation is given by

$$T(n) = T\left(\frac{n}{2}-1\right)+T\left(n-\frac{n}{2}\right)+\Theta(n)=\Theta(n\log n)$$

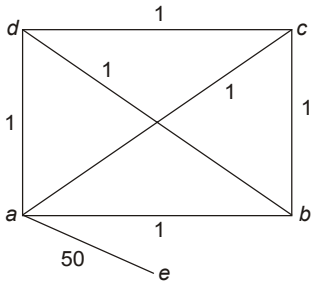
Hence, option (b) is the correct answer.

14. (d)

I. MST contain *ac* and *bc* but not contain *ab*, which is the shortest path between *a* and *b*



II. We may be forced to select the edges with weight much higher than average



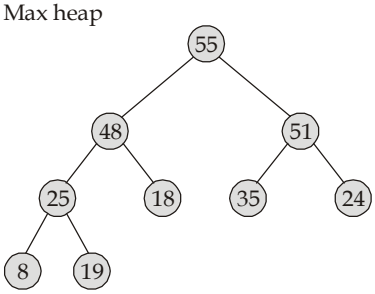
$$\text{Average weight} = \frac{50+6}{7} = 8$$

$$\text{Expected MST weight} = 4 \times 8 = 32$$

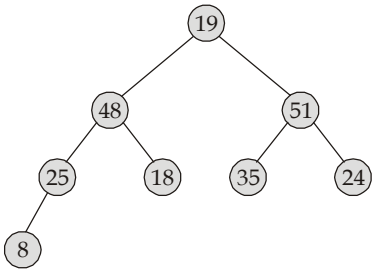
$$\text{Actual MST weight} = 50 + 6 = 56$$

15. (c)

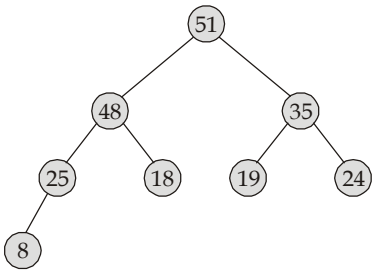
Max heap



On deletion perform the heapify operation and root will be deleted.



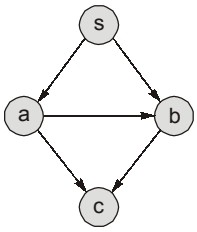
After performing heapify.



Max heap (51, 48, 35, 25, 18, 19, 24, 8).

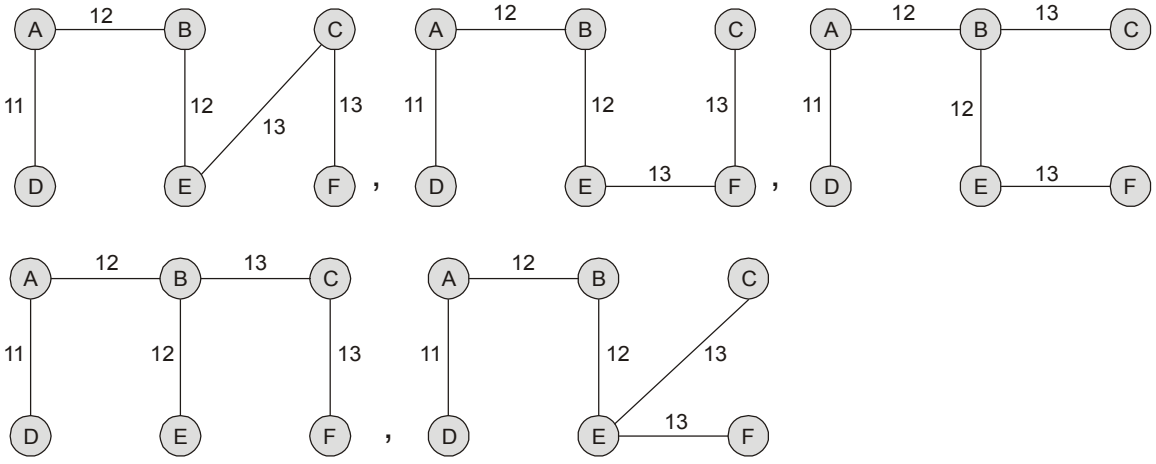
16. (c)

Consider the following graph:



- Vertices 'a' and 'b' both will be on the stack at the same time if at least one of them have an edge on the other vertex. Hence, If there is no directed path from 'a' to 'b' then there exist a directed path from 'b' to 'a'.
- Since, vertices 'a' and 'b' are traversed while performing DFS at vertex 's', so it can be said that there exist directed path from 's' to 'a' and 's' to 'b'. Hence, There exist directed path from 's' to 'a' and directed path from 's' to 'b'.

17. (b)



All above trees MST with cost: 11 + 12 + 12 + 13 + 13 = 61

18. (b)

$$S_1 = \sum_{r=0}^{\log n-1} \frac{nr}{2^r} \text{ and } S_2 = \sum_{r=0}^{\log n-1} r2^r$$

$$S_1 = 0 + \frac{n}{2} + \frac{2n}{2^2} + \ldots\ldots + \frac{n\times(\log n-2)}{2^{(\log n-2)}} + \frac{n\times(\log n-1)}{2^{(\log n-1)}}$$

$\therefore \quad S_1 \cong \Theta(n)$

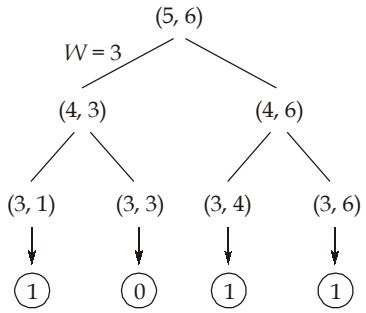
$S_2 = 0 + 2^1 + 2 \cdot 2^2 + \ldots + (\log n - 2)\, 2^{(\log n - 2)} + (\log n - 1)\, 2^{(\log n - 1)}$

$\therefore \quad S_2 \cong \Theta(n \log n)$

19. (a)

Feasible solutions $\rightarrow$ All combinations of items where added weight = 6.

(Number of items, remaining weight)



$\Rightarrow \quad 3 + 2 + 1 = 6$

$2 + 4 = 6$

$1 + 5 = 6$

20. (c)

Time complexity to sort n elements using merge sort = $\Theta(n\log n)$

$$\Theta(n) = \Theta\left(\frac{n}{\log n}\log\frac{n}{\log n}\right)$$

$$\Theta(n) = \Theta\left(\frac{n}{\log n}\left[\log n - \log\log n\right]\right)$$

$$\Theta(n) = \Theta\left(\frac{n}{\log n}\log n\right) \quad [\log n - \log\log n = O(\log n)]$$

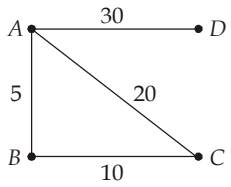
$$\Theta(n) = \Theta(n)$$

21. (a)

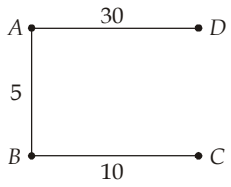
Since edges costs are distinct, so cheapest edge must be present in every minimum spanning tree while expensive edge is may not excluded from every minimum spanning tree.

Statement S_2 is false

Example:



MST will be:



So, most expensive edge is not excluded.

22. **(b)**

S_1 : Fully sorted array in case of quick sort becomes worst case.
Hence, time taken = $O(n^2)$.

S_2 : Insertion sort on almost sorted array takes $O(n)$ time.

S_3 : Selection sort always takes $O(n^2)$ time.

S_4 : Merge sort always takes $O(n\log n)$ time.

23. **(c)**

Average case:

Insertion Sort: $O(n^2)$

Merge Sort: $O(n \log n)$

Quick Sort: $O(n \log n)$

Bubble Sort: $O(n^2)$

24. **(b)**

For n time, inner loop will execute for n times.

For $\frac{n}{2}$ time, inner loop will execute for $\frac{n}{2}$ times.

For $\frac{n}{4}$ time, inner loop will execute for $\frac{n}{4}$ times.

and do on .....

So time complexity: $T(n) = O\left(n + \frac{n}{2} + \frac{n}{4} + ... + 1\right)$

$= O(n)$

25. (a)

Since by looking through options, we get to know 'b' will be the start vertex.

	a	b	c	d	e	f	g	h
	∞	0	∞	∞	∞	∞	∞	∞
b	5	–	∞	1	3	∞	∞	∞
(b – d) d	5	–	∞	–	3	6	∞	∞
(d – e) e	5	–	4	–	–	6	9	∞
(e – c) c	4	–	–	–	–	6	9	7
(c – a) a	–	–	–	–	–	6	9	7
(d – f) f	–	–	–	–	–	–	9	7
(c – h) h	–	–	–	–	–	–	9	–
(e – g) g	–	–	–	–	–	–	–	–

So, correct sequence will be (b – d), (b – e), (e – c), (c – a), (d – f), (c – h), (e – g).

26. (a)

We can find the middle element of the heap, by simply accessing the $n/2^{th}$ element of the array which can be done in O(1) time. Further that element is replaced by the last element of the array in O(1) time. Now, perform the heapify operation which will take O(log n) time.

$$\text{Time taken} = O(1) + O(1) + O(\log n)$$
$$= O(\log n)$$

27. (b)

Job sequencing algorithm:

Time required to sort in order to profit = $\Theta(n \log n)$

Find the max deadline = $\Theta(n)$

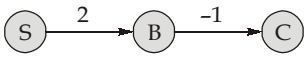
For each slot i apply linear search to find a job containing deadline $\geq i$

$$= \Theta(n^2)$$

$$T(n) = \Theta(n \log n) + \Theta(n) + \Theta(n^2)$$
$$= \Theta(n^2)$$

28. (c)

(a) Consider following graph



Here, Dijkstra's algorithm will give correct output from S as source.

(b) Bellman-Ford algorithm report for negative weight cycle if and only if it s reachable from source node.

(d) Time complexity of Bellman-Ford algorithm is O(VE) and E = $O(V^2)$
So, $O(VE) = O(V.V^2) = O(V^3)$.

29. (d)

Insertion sort: 15, 12, 7, 20, 25, 42, 6, 2

After 1st iteration: 12, 15, 7, 20, 25, 42, 6, 2

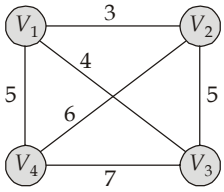
After 2nd iteration: 7, 12, 15, 20, 25, 42, 6, 2

After 3rd iteration: 7, 12, 15, 20, 25, 42, 6, 2

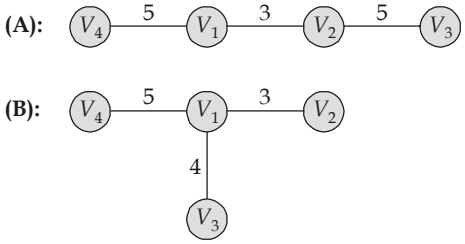
After 4th iteration: 7, 12, 15, 20, 25, 42, 6, 2

30. (b)

S_1 : Consider the following graph:

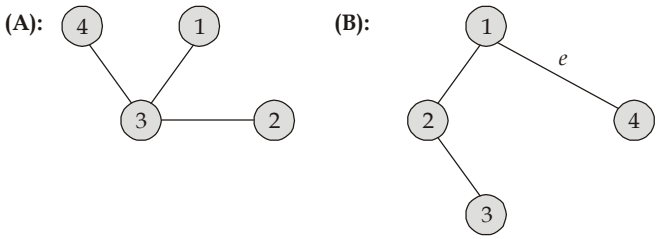


Minimum bottleneck spanning tree:



However only (b) is MST therefore S_1 is false.

S_2 : Consider 2 MST's:



Where A has a lighter bottleneck edge. This means that B has an edge 'e' that is heavier than every edge of A. If we include this edge in A, it will form a cycle in which e would be heaviest. This contradicts the definition of MST.

Thus, 'e' cant be present in B, meaning that both A and B have same bottleneck edge.

Thus, S_2 is true.

■■■■