# Data Structure, Quiz 2 (2026)

## A. Single Choice Questions (5% each, 60%)

### (1) Which change would most likely break the three laws of recursion?

(A) Adding a direct answer for the smallest input.

(B) Making the recursive call work on a smaller input.

(C) Making the recursive call use exactly the same input as the current call.

(D) Combining the result of a smaller subproblem with the current item.

### (2) Selection sort is used to sort this list in increasing order:

```
[42, 17, 29, 8, 35]
```
What is the list after the first two passes?

(A) `[8, 17, 29, 42, 35]`

(B) `[8, 17, 29, 35, 42]`

(C) `[17, 29, 8, 35, 42]`

(D) `[8, 29, 17, 42, 35]`

### (3) Suppose binary search is applied to the sorted list

```
[2, 6, 9, 14, 18, 21, 27, 31, 35, 42, 50]
```
to search for `30`. The midpoint is chosen by integer floor division. Which sequence of values is compared?

(A) `21, 35, 27, 31`

(B) `21, 31, 27, 35`

(C) `18, 27, 31, 35`

(D) `21, 35, 31`

### (4) A stable sorting algorithm sorts the following records by the second value:

```
[("B", 2), ("A", 1), ("C", 2), ("D", 1)]
```
Which result preserves stability?

(A) `[("D", 1), ("A", 1), ("C", 2), ("B", 2)]`

(B) `[("A", 1), ("D", 1), ("B", 2), ("C", 2)]`

(C) `[("A", 1), ("D", 1), ("C", 2), ("B", 2)]`

(D) `[("B", 2), ("C", 2), ("A", 1), ("D", 1)]`

### (5) Which statement correctly compares separate chaining and open addressing for hash-table collision resolution?

(A) Separate chaining stores colliding items outside the table slot, while open addressing searches for another slot in the table.

(B) Open addressing always uses a linked list at each slot.

(C) Separate chaining requires the table size to be a prime number, but open addressing does not.

(D) Both methods require all colliding keys to be discarded.

## (6) Which statement about quicksort using the median-of-three pivot idea is TRUE?

(A) It guarantees worst-case `O(n log n)` time for every input.

(B) It chooses a pivot from three candidate positions to reduce the chance of a very poor split.

(C) It turns quicksort into a stable sorting algorithm.

(D) It removes the partitioning step from quicksort.

## (7) For a sparse graph with many vertices and relatively few edges, which representation is usually more space efficient?

(A) Adjacency matrix, because it stores only existing edges.

(B) Adjacency list, because it stores each vertex's actual neighbors rather than every possible pair.

(C) Both always use exactly the same amount of memory.

(D) A stack, because it stores all edges in sorted order.

## (8) The following is the adjacency-list representation of an undirected graph. Each row lists the neighbors of one vertex. Neighbors are processed in alphabetical order.

```
A: B, C
B: A, D, E
C: A, F
D: B
E: B, F
F: C, E
```

What is the BFS visitation order starting from `A`?

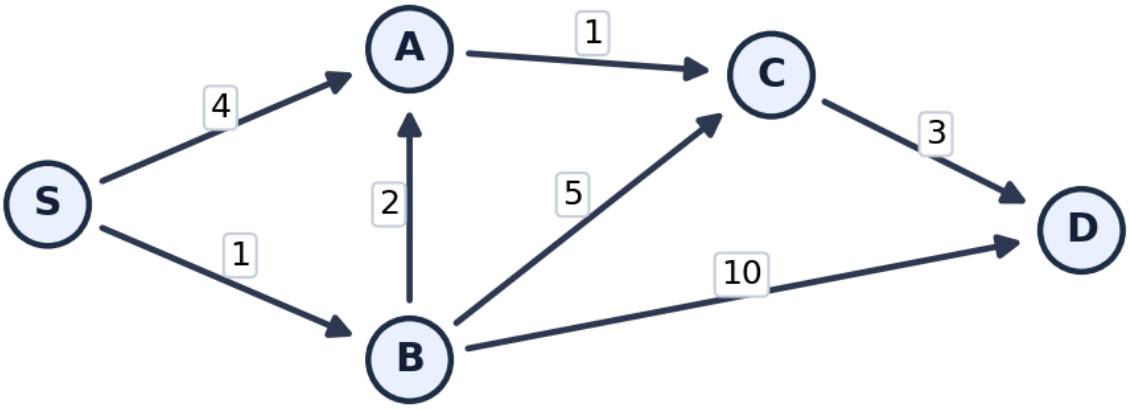
(A) `A, B, D, E, F, C`

(B) `A, C, F, E, B, D`

(C) `A, B, C, D, E, F`

(D) `A, B, C, F, E, D`

## (9) Consider the following directed weighted graph with nonnegative edge weights.




Using Dijkstra's algorithm from `S`, what is the order in which vertices are finalized?

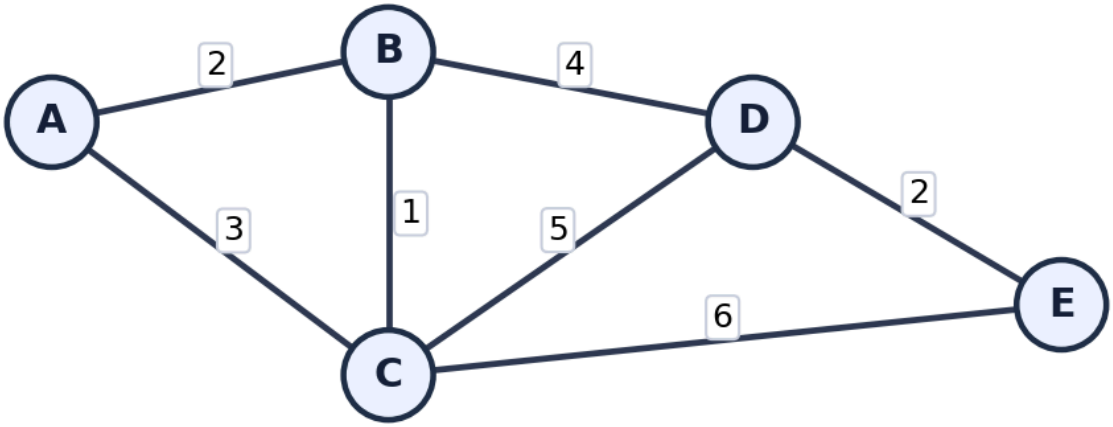
(A) `S, A, B, C, D`

(B) `S, B, A, C, D`

(C) `S, B, C, A, D`

(D) `S, A, C, B, D`

(10) Prim's algorithm starts from `A` on the following undirected weighted graph.



Which sequence of edges is selected?

(A) `(A, C), (C, B), (B, D), (D, E)`

(B) `(A, B), (B, C), (B, D), (D, E)`

(C) `(A, B), (A, C), (C, D), (D, E)`

(D) `(A, C), (C, D), (D, E), (B, C)`

## (11) A min-heap is stored in a 1-indexed array:

```
index:  1  2  3  4  5  6
value:  3  8  5 14 10  9
```

Which statement is TRUE?

(A) The parent of the value `10` is `8`.

(B) The parent of the value `10` is `5`.

(C) The value `14` is the right child of `5`.

(D) The array violates the min-heap property because `8 > 5`.

## (12) Which traversal of a binary search tree visits the keys in ascending sorted order?

(A) Preorder traversal

(B) Inorder traversal

(C) Postorder traversal

(D) Level-order traversal

# B. Short-answer questions, please provide the derivation for each question along with your answer (8% each, 40%).

## (13) Briefly explain each of the following terms.

(a) Base case

(b) Stable sort

(c) Adjacency list

(d) Complete binary tree

## (14) Suppose a hash table has size 7 and uses separate chaining. The hash function is `h(k) = k % 7`, and new keys are appended to the end of each chain.

Insert the keys in this order:

```
10, 21, 32, 14, 25, 17, 6
```

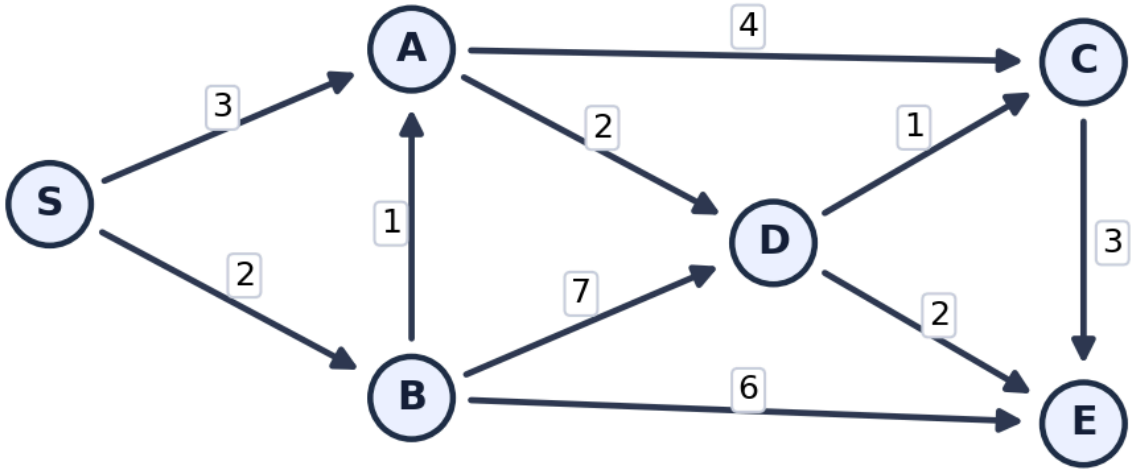
Show the final contents of every bucket from index 0 to index 6.

## (15) Insert the following keys into an initially empty min-heap:

```
13, 6, 18, 2, 9, 20, 4
```

Show the array representation of the heap after all insertions. Include the important percolation steps.

(16) Run Dijkstra's algorithm from `S` on the following directed weighted graph.




List the vertices in the order they are finalized and give the final shortest-path distances from `S`.

(17) A binary tree has the following traversal sequences:

```
Preorder: M F B H T R Z
Inorder:  B F H M R T Z
```

Can the tree be constructed uniquely? If yes, draw the tree. If not, explain why not.