# Quiz:

**1. What is the Knapsack Problem?**

a) A problem in which you pack a backpack with a limited weight capacity.

b) A problem in which you sort items based on their weights.

c) A problem in which you find the maximum sum of a subset of elements.

d) A problem in which you find the shortest path in a graph.

**Answer:** a) A problem in which you pack a backpack with a limited weight capacity.

Explanation: The Knapsack Problem involves selecting items with given weights and values to maximise the value without exceeding a weight limit.

**2. Which of the following variants of the Knapsack Problem allows fractional parts of items to be taken?**

a) 0/1 Knapsack Problem

b) Fractional Knapsack Problem

c) Unbounded Knapsack Problem

d) Subset Sum Problem

**Answer: b)** Fractional Knapsack Problem

Explanation: In the Fractional Knapsack Problem, you can take fractional parts of items, unlike the 0/1 Knapsack Problem.

**3. In dynamic programming, what is memoization used for in the context of the Knapsack Problem?**

a) Sorting the items

b) Reducing the time complexity

c) Handling fractional items

d) Calculating the total number of items

**Answer:** b) Reducing the time complexity

Explanation: Memoization reduces redundant calculations, making the dynamic programming approach more efficient.

**4. What is the time complexity of the dynamic programming solution for the 0/1 Knapsack Problem?**

a) O(n)

b) O(n log n)

c) O(n^2)

d) O(nW), where n is the number of items and W is the knapsack capacity

**Answer:** d) O(nW), where n is the number of items and W is the knapsack capacity

Explanation: The time complexity of the dynamic programming solution is O(nW), where n is the number of items and W is the knapsack capacity.

**5. What is the primary drawback of the recursive approach to the Knapsack Problem?**

a) It is difficult to implement.

b) It has exponential time complexity.

c) It requires additional memory.

d) It only works for the 0/1 Knapsack Problem.

**Answer:** b) It has exponential time complexity.

Explanation: The recursive approach has exponential time complexity due to redundant calculations.

**6. Which of the following is NOT a variant of the Knapsack Problem?**

a) 0/1 Knapsack Problem

b) Unbounded Knapsack Problem

c) Travelling Salesman Problem

d) Fractional Knapsack Problem

**Answer:** c) Travelling Salesman Problem

Explanation**:** The Travelling Salesman Problem is a different combinatorial optimization problem.

**7. What is the key idea behind dynamic programming in solving the Knapsack Problem?**

a) Greedy selection of items

b) Recursive division of the knapsack

c) Optimal substructure and overlapping subproblems

d) Exhaustive search through all subsets

**Answer:** c) Optimal substructure and overlapping subproblems

Explanation:Dynamic programming relies on optimal substructure and overlapping subproblems to efficiently solve the Knapsack Problem.

**8. In the context of the Knapsack Problem, what does "optimal substructure" mean?**

a) Each item can be divided into subitems.

b) The problem can be divided into smaller subproblems.

c) The smallest item should be chosen first.

d) There is only one optimal solution.

**Answer:** b) The problem can be divided into smaller subproblems.

Explanation: Optimal substructure means that the problem can be broken down into smaller, similar subproblems.

**9. Which approach is used to solve the Knapsack Problem when the items can be taken multiple times?**

a) Dynamic programming

b) Recursive approach

c) Greedy approach

d) Brute force approach

**Answer:** a) Dynamic programming

Explanation: The dynamic programming approach is used to solve the Unbounded Knapsack Problem, where items can be taken multiple times.

10. What is the primary advantage of the dynamic programming approach over the recursive approach for the Knapsack Problem?

a) It requires less memory.

b) It is easier to implement.

c) It guarantees the optimal solution.

d) It reduces redundant calculations.

**Answer:** d) It reduces redundant calculations.

Explanation: Dynamic programming avoids redundant calculations through memoization.

**11. Which Knapsack Problem variant allows you to take either 0 or 1 of each item?**
**a) 0/1 Knapsack Problem**

b) Fractional Knapsack Problem

c) Unbounded Knapsack Problem

d) Subset Sum Problem

**Answer:** a) 0/1 Knapsack Problem

Explanation: In the 0/1 Knapsack Problem, you can take either 0 or 1 of each item.