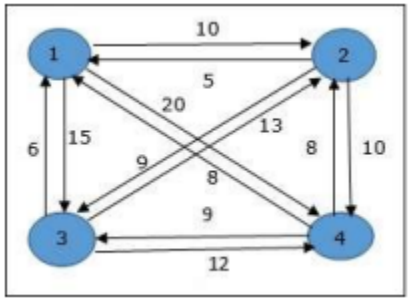
1. Suppose you are a delivery driver for a company and need to deliver packages to 4 different cities. Your boss wants you to find the shortest possible route that will allow you to visit all 4 cities exactly once and return to your starting point. Using dynamic programming, write an algorithm to solve this Travelling Salesman Problem, and then use it to find the shortest possible route for the cities in the following Graph, given their respective distances:

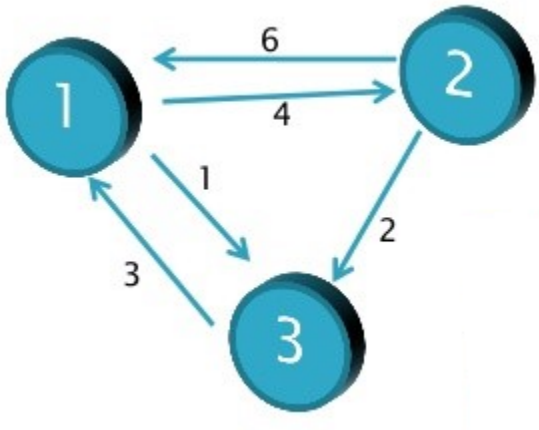


2. Suppose you are given two strings s1 and s2, representing the DNA sequences of two organisms. You want to find the longest common subsequence (LCS) of the two sequences that contains only the nucleotides A, C, G, and T.

suppose s1 = "ACGTAGC" and s2 = "GTCACGTCA"
Find the LCS.

3. Suppose you are given a map of cities and highways in a country. Each city is represented as a node in the following graph, and each highway is represented as an edge between two cities with a weight that represents the distance between them. Some of the highways are closed due to road maintenance, and you need to find the shortest path between every pair of cities given the current state of the highways.

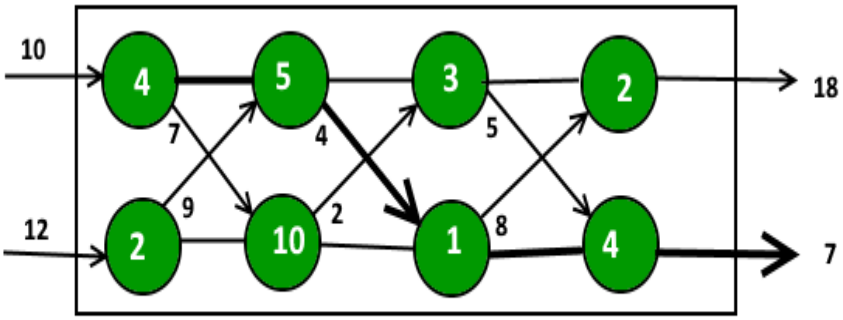
Apply a suitable algorithm to find the shortest path between every pair of cities.



4. A company is manufacturing smartphones that require the assembly of multiple components, such as the display, battery, camera, and motherboard. The manufacturing process involves several tasks, such as component assembly, testing, and packaging. The company has two assembly lines (line 1 and line 2) with different capabilities and

capacities. The following diagram shows the time required for each task on each assembly line:

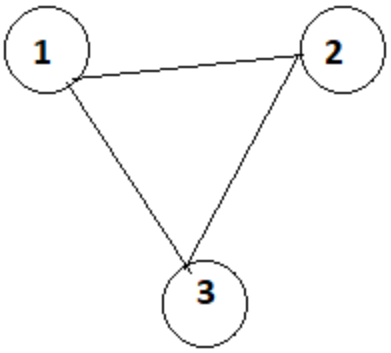
Assuming that the company wants to maximize the total production volume subject to the capacity constraints of the assembly lines, how would you use dynamic programming to determine the optimal assignment of tasks to each assembly line?



5. Suppose you are a teacher and you want to divide a class of 20 students into two equal groups for a class project. Each student is assigned a numerical score between 1 and 10 based on their performance in class. Your goal is to find two groups of 10 students each such that the sum of the scores in each group is as close as possible.
   Find the two groups with the closest possible sum of scores. You can assume that there are no ties in the scores and that all scores are distinct. Use suitable algorithm to find the two groups with the closest possible sum of scores for the following scores:
   1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20.

6. You are given a list of numbers [5, 7, 10, 12, 15, 18, 20] which represent the size of each file and the size of a USB drive 35 units. You need to transfer all the files to another computer using a USB drive. The USB drive can hold a maximum of 35 units of data. Find all possible ways of transferring the files.

7. A university wants to schedule classes such that no two classes that are taught by the same professor overlap in time. The classes and professors can be represented as nodes in an undirected graph, and edges connect nodes if the corresponding professors have overlapping schedules. How can dynamic programming be used to solve this graph coloring problem using colors m=3,{R,G,B}?



8. Draw the state space tree for the N queens problem where n=4. Write all valid configurations of 4*4 chess boards.

9. Identify which algorithm is suitable for given scenarios:

i) Computer passwords-A computer needs to verify a user's identity before allowing him or her access to an account. The simplest system would have the machine keep a copy of the password in an internal file, and compare it with what the user types. A drawback is that anyone who sees the internal file could later impersonate the user. What is another alternative to this method?

ii) Message verification-A sender (S) wants to send messages to a receiver (R). Keeping the message secret is not important. However, R wants to be sure that the message he is receiving is not from an imposter and has not been tampered with.

iii) Fast Communication in sensor networks Using Radio Labeling.

iv) Guarding an art gallery- identify minimum number of guards needed to protect art gallery

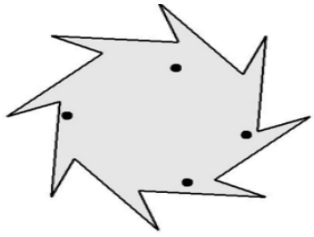


Figure 2.1: The Sunflower Art Gallery

v) traffic control

vi) load balancing in multiprocessor computer

10. Consider the following text and pattern T= ABCDABCDABDE P=ABCDABD Apply naive based and KMP algorithm on it. Comment on the complexity of both algorithms.

11) write complexity of all algorithms studied under dynamic programming, backtracking and string matching.