

## Dynamic Programming Practice problems

1. i) Suppose you are a motorcycle dealer buying cars wholesale and then selling them at retail price for a profit. You have a budget of **10 lac Tk**. You went to the wholesale market, and you saw the following items on sale:

Car Name	Yamaha R15	Harley Davidson	Apache RTR 160	Honda CBR 150R R
Wholesale price (in lac Tk)	3	6	1	4
Retail price (in lac Tk)	5	14	2	6

You want to get the **maximum profit** from selling all these motorcycles, but your budget restricts you from buying all of them. Find the maximum profit you can obtain by buying some of these motorcycles and then selling them, provided the total wholesale cost of the motorcycles you selected **do not exceed your budget of 10 lac Tk**. Note that you can only buy one of these motorcycles at a time, so if you purchased a Yamaha R15 from the wholesale market, you cannot purchase it again. Find the solution to this problem by using **dynamic programming**.

**Expected output:**

Max profit: 11 lac

Selected motorcycles:

Apache RTR 160, wholesale price: 1 lac, profit: 1 lac

Harley Davidson, wholesale price: 6 lac, profit: 8 lac

Yamaha R15, wholesale price: 3 lac, profit: 2 lac

ii) Suppose now you have an **infinite supply** of motorcycles in the wholesale market, which means that if you purchased a Yamaha R15 from the wholesale market, you could purchase it again (if you have the required amount of money). Now, find the maximum profit you can gain in this case and also find out which motorcycles you should buy with your **10 lac** budget.

**Expected output:**

Max profit: 12 lac

Apache RTR 160, wholesale price: 1 lac, profit: 1 lac

Apache RTR 160, wholesale price: 1 lac, profit: 1 lac

Apache RTR 160, wholesale price: 1 lac, profit: 1 lac

Apache RTR 160, wholesale price: 1 lac, profit: 1 lac

Harley Davidson, wholesale price: 6 lac, profit: 8 lac

2. You are planning a hiking trip in the mountains and need to bring some water for your team. As you are an environmentalist, you are concerned about the number of waste bottles you are going to produce along the way. There are 3 types of bottled water available in the market: 1L, 4L, and 6L, and your team needs 9 liters of water in total to survive the hike. Using Dynamic Programming, determine how many bottles you should buy from each type so that it fulfills the need of your team and the total number of waste bottles is minimized. Also print the size of bottles you buy.

**Expected output:**

Minimum bottles: 3

Bottle taken: 1L, 4L, 4L

3. After obtaining your BSCSE degree, you embarked on an entrepreneurial journey and established your own thriving software company. You've been consistently successful in securing projects from a variety of clients, ensuring a steady flow of profits. However, suddenly a situation arises where your decision-making and leadership skills are put to the test. You have just received 5 project offers from different clients, but you have only 7 days to complete the projects. Your project manager prepares the following estimates for each of the projects and presents them to you for your decision.

Net profit (in million dollars)	200	150	100	50	300
Duration (in Days)	3	2	1	2	5

Being an adept CSE graduate, you decide to approach the problem using **dynamic programming**. Determine which of the projects can be taken to **maximize the net profit**.

*Note that you cannot partially complete a project. Also, you are unable to work on two projects at the same time on a particular day*