

Lab 5 - OJ

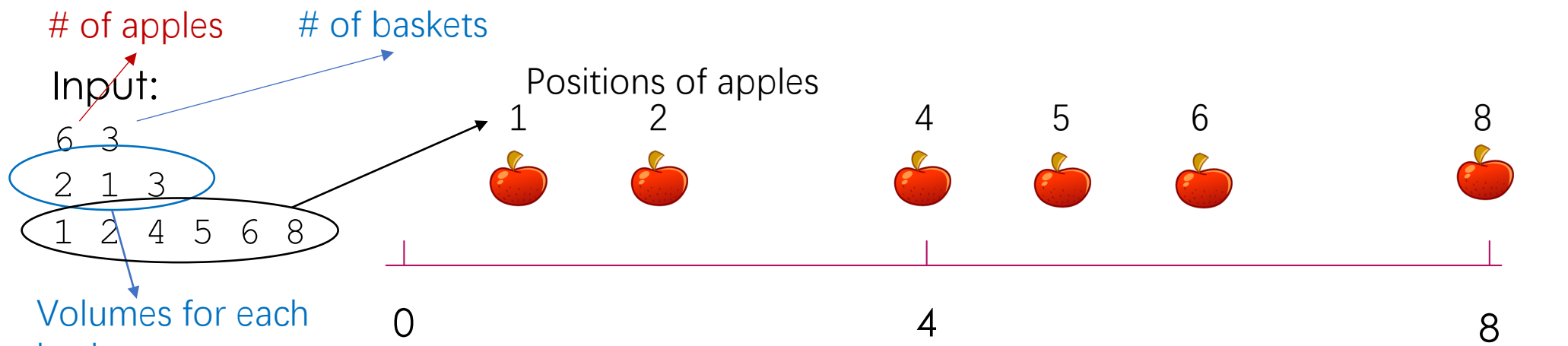
Greedy Algorithms

CS208 Algorithm Design and Analysis

Instructor: Yang Xu, xuyang@sustech.edu.cn

Question 1: A Careless Boy

- ▶ Dy is a careless boy. One day, on the way of delivering apples, Dy pays all attention on playing Nihneg on his phone. Dy is so focused on playing that he doesn't realize that all apples drop out from the baskets! Now Dy needs to collect apples along the way and take them back to the truck. All tools he can use are the baskets on the truck and himself.
- ▶ Dy need to set off from the truck to collect apples with his baskets. Every basket has its own volume v_i , representing the number of apples it can hold. At any time, Dy can carry only one basket. The truck and the apples are on the same line. The line can be considered as a number axis and the truck is its origin. Every apple has its own position p_i on the number axis. Once Dy passes by an apple, he can pick up the apple and keep collecting apples if the basket is not full. Once the basket is full, Dy must take it back to the truck.
- ▶ Dy wonders how far it would take him to fill up all the baskets (If the total number of apples is less than the sum of basket volume ($n < \sum_1^m v_i$), then Dy just need to collect all apples). And he wants the total distance to be as small as possible.



Different orders of using baskets

- 2 → 1 → 3: $2+2+4+4+8+8 = 28$
- 1 → 2 → 3: $1+1+4+4+8+8 = 26$
- 3 → 2 → 1: $4+4+6+6+8+8 = 36$
- ...

All possible total distance, 26 is the smallest.

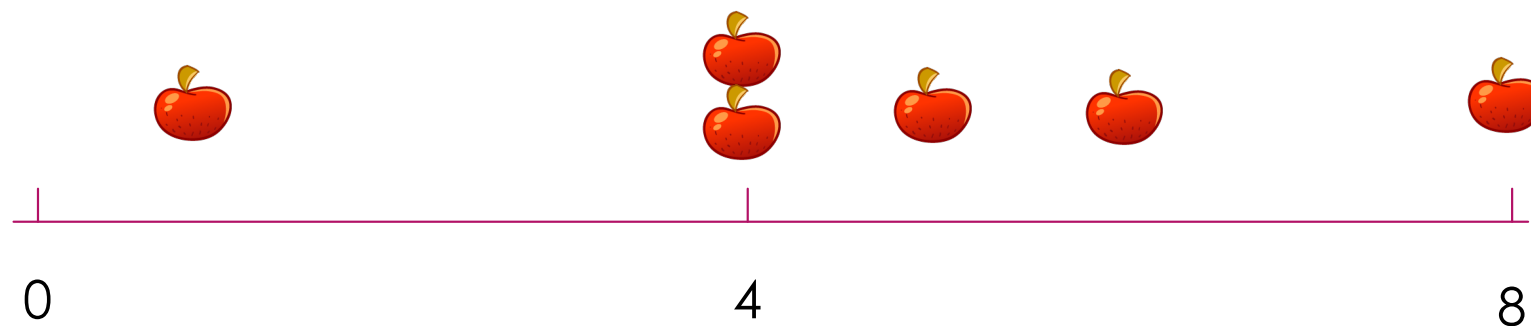


Output:
26

大篮子拿远处的苹果

Input:

6 3
1 2 2
1 4 4 5 6 8



$$\begin{aligned} 1 \rightarrow 2 \rightarrow 2: & 1+1+4+4+6+6 = 22 \\ 2 \rightarrow 1 \rightarrow 2: & 4+4+4+4+6+6 = 28 \\ 2 \rightarrow 2 \rightarrow 1: & 4+4+5+5+6+6 = 30 \end{aligned}$$

All possible total distance
22 is the smallest.

Question 2: Kruskal's algorithm

- To find a minimal spanning tree (MST) of a graph

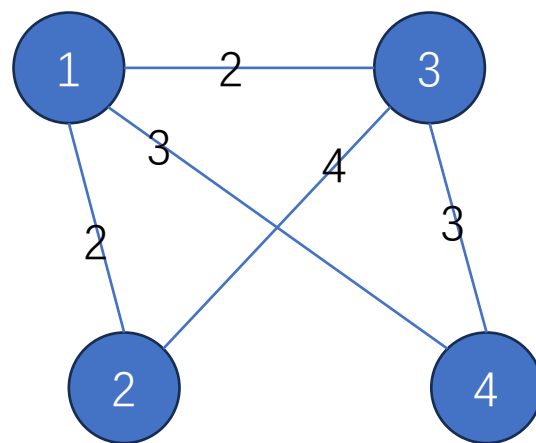
Description

You are given an **undirected connected graph**, you need to find a minimal spanning tree of it and output an integer, representing the sum of weights of all edges of the minimum spanning tree.

Question 2: Kruskal's algorithm

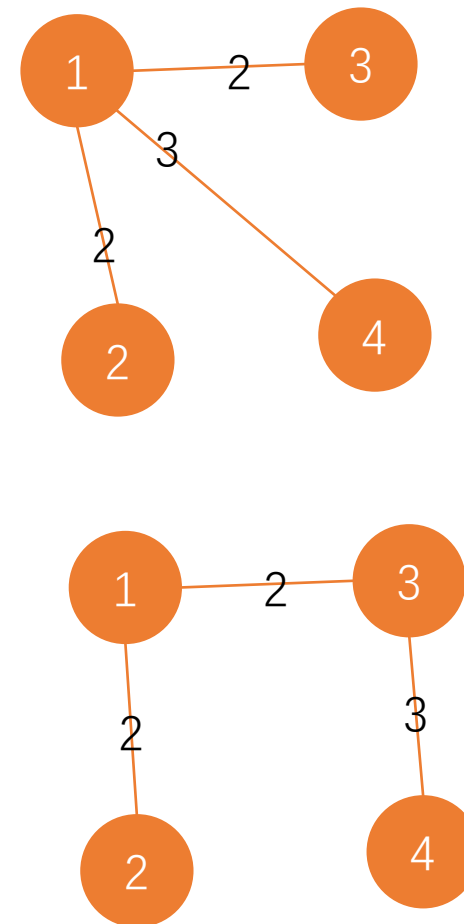
Sample Input 1

```
2
4 5
1 2 2
1 3 2
1 4 3
2 3 4
3 4 3
6 8
1 2 1
2 4 2
1 4 2
4 5 2
2 5 1
2 6 5
3 6 2
1 3 2
```



Sample Output 1

```
7
8
```



Question 2: Kruskal's algorithm

Sample Input:

```
6 8
1 2 1
2 4 2
1 4 2
4 5 2
2 5 1
2 6 5
3 6 2
1 3 2
```

