# Lab6 Questions

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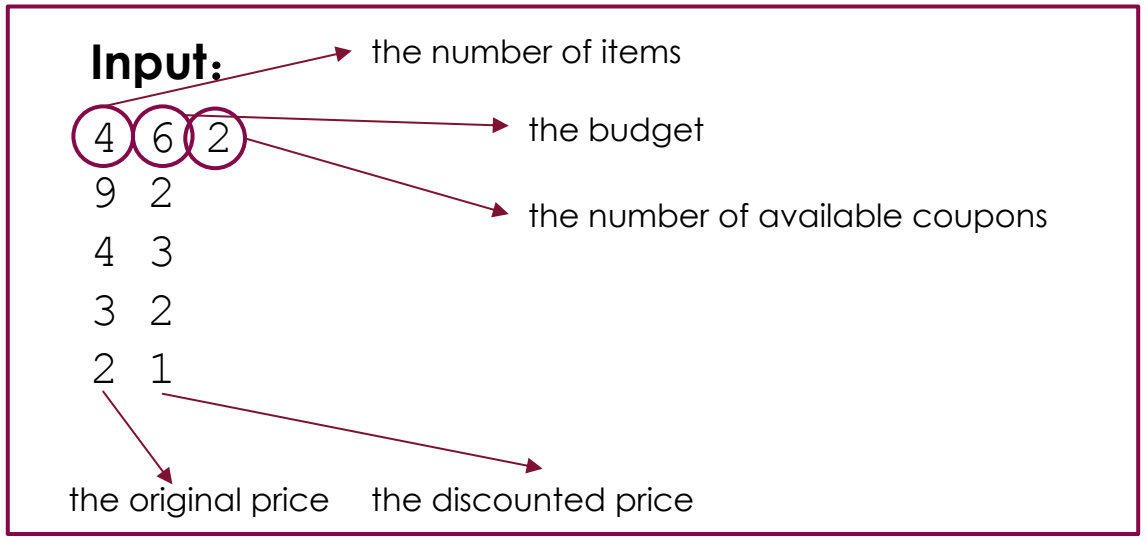
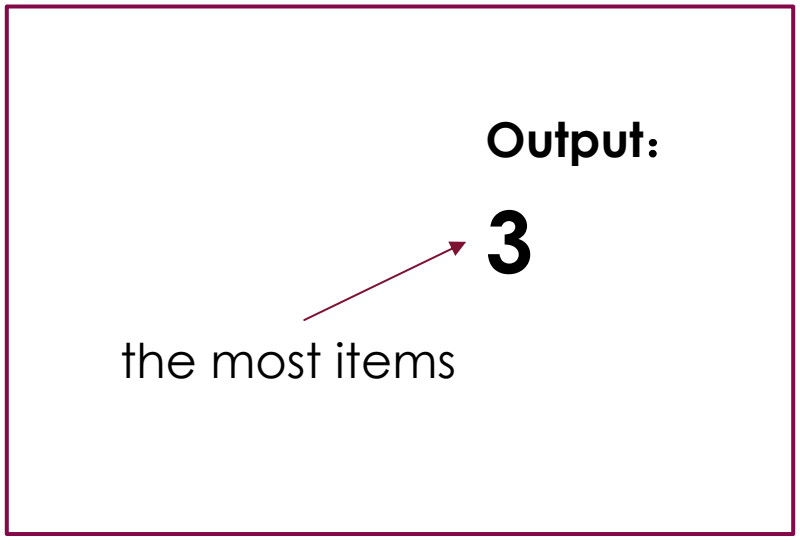
# Lab6.A Michael's Shopping Challenge

- Michael is excited about the annual sale at his favorite store, where he can use coupons to get discounts on items he's been eyeing for months. The store has $n$ items with original prices $p_i$, and Michael has $k$ coupons that can reduce the price of the $i^{th}$ item to $c_i$ . Each coupon can only be used once. With a budget of $m$ dollars, Michael wants to know how many items he can purchase while using the coupons optimally. Can you help him figure out the best way to use his coupons and get the most items?




Case 1:

9 2
4 3
3 2
2 1

using coupons

the most items:2

Case 2:

9 2
4 3
3 2
2 1

using coupons

the most items:2

Case 3:

9 2
4 3
3 2
2 1

using coupons

the most items:2

Case 4:

**9 2**
4 3
**3 2**
**2 1**

using coupons

the most items:3

Case 5:

**9 2**
4 3
**3 2**
**2 1**

using coupons

the most items:3

Case 6:

9 2
**4 3**
3 2
**2 1**

using coupons

the most items:2

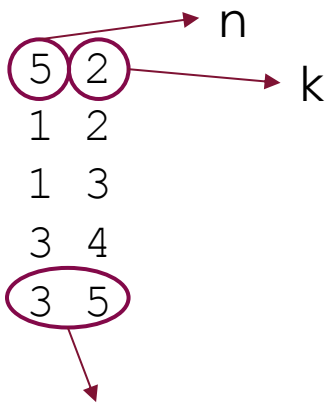
# Lab6.B Urban Planning(1)

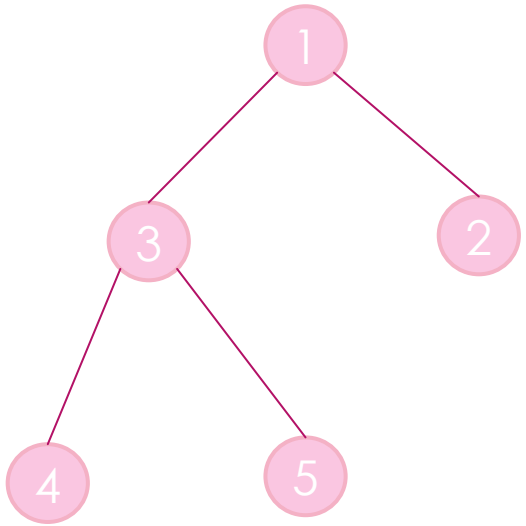
- **Justin** is very rich and he owns a city. The road forms a tree consisting of $n$ vertices.
- A tree's vertex is called a leaf if it has exactly one vertex adjacent to it. The distance between two vertices is the number of edges on the shortest path between them.
- As suggested by **sjkmost**, **Justin** forces the citizens to trip by zipline. He built a residential area on the leaves and zipline stations on other vertices. Adjacent vertices are connected by ziplines.

# Lab6.B Urban Planning(2)

- Now **Justin** wants to group residential areas into regions. He wants to offer the residents convenient traffic, so the distance between every two residential areas in the region should not be greater than $k$. He also wants to group them into as few regions as possible, or it will be disturbing to manage.
- This problem is too easy for **Justin**, so he solved it in a second.
- **Ihyyy** traveled to this city to visit **Justin**. However, he is not good at graph theory at all and he got lost. Can you find out how many regions there are in the city for **Ihyyy**?
- In other words, given a tree, you should split the leaves into sets such that the distance between any two leaves in the same set is not greater than $k$, and find out the minimal number of sets.

Input:




2->5: 3 > 2
2->4: 3 > 2

{2}
{4, 5}

Output:

**2**

the minimal number of sets