1 Annual Clearance Sale Offers

Sales Manager, Scott, wants to clear all the old stock from the shop without much loss and get new stock. He has asked a MBA trainee, Steve, to devise offers on the products under Annual Clearance Sales (ACS) scheme that will maximize both sales and earnings. Steve came up with the following offers for ACS.

- There will be several combo offers each valid for a week's time.
- Each Combo Offer consist of N number of products of different types.
- Customers must purchase N products to avail an offer. They can select multiple products of same type.
- Cost of a product shall be same as its type ID.
- A combo offer is defined as
  - N - Number of products in an offer.
  - T - Number of types of products in that offer. For every offer, Item Type IDs are always **1 to T**.
  - S - Number of products in a group.
  - U - Minimum number of unique types of products in any group of S products purchased.
- Among **N** products purchased, in a group of any **S** number products, there must be a minimum of **U** number of distinct types of products.

Steve gave the list of offers for some weeks. Scott knows the capability of Steve, so he want to verify them to check if they are purchasable and also wants to know the maximum earning per offer. Given the list of offers in the above format, write a program to find out the maximum earning every offer can make for availing for once. Return -1 if an offer is not purchaseable.

Input/Output

Input	Output	Comments
2 8 4 3 2 3 2 4 3	20 -1	• First line (2) corresponds to Total Number of Combo Offers • Next (2) lines has information in N T S U format. • **8 4 3 2** ○ 8 – Number of products to be purchased. (N) ○ 4 – Types of products (1, 2, 3, 4) for that offer. (T) ○ 3 – Number products in a group. (S) ○ 2 – Minimum number of unique types of products in any S group of products purchased. (U) ○ This offer can make a maximum of 20 if 8 products (1+1+2+2+3+3+4+4) are purchased. ○ The above purchase satisfies the condition of U(2) distinct product types in any group of S(3) products. See below

		▪ ((1+3)+(2+4+2)+(4+3+1)) • 2 distinct types (1 & 3) • 2 distinct types (2 & 4) • 3 distinct types (1, 3 & 4) ▪ ((1+1+2)+(2+3+3)+(4+4)) • 2 distinct types (1 & 2) • 2 distinct types (2 & 3) • 1 distinct type (4) [**acceptable because in a group of 3 there must be 2 distinct product types]** • 3 2 4 **3** Among **3** items purchased, for any group of four (4) products in a set, there must be a minimum of **three (3)** unique product types but there are only **two (2)** product types in this combo offer. The offer is not purchaseable and hence, **-1** is the answer

2 Gold Rush in Mahishmati

In Mahishmati, the capital city of the kingdom of Avanti, there were many amusement and fun game parlors. One of them was 'Lucky Golden Cave', where maximum gold coins are won by showing minimum coins. The cave has several containers filled with gold coins. Visitors must show gold coins they have with them, select and take the containers filled with gold coins.

Every container in the cave is labelled with the number of gold coins it contains and the minimum number of coins that the visitor must possess (or show) for selecting it. At the entrance of the cave, visitors *are asked to pick a token from a box*. The token number **C** indicates that the visitor can only *select at most C distinct containers* before exiting from the cave. Visitors can enter into the cave with 0 or N coins (initial coins).

Kumara Varma, prince of Kunthala kingdom is in Mahishmati. He went into Lucky Golden Cave with some initial number of gold coins and the token he picked at the entrance but he is not able to figure out the maximum number of gold coins he can win. Help him with a program.

Sample Input/Output

Input	Output	Comments
2 4 **12 15 20** **4 10 8**	**36**	• First line (**2 4**): **2** indicates maximum number of distinct container selections that can be made, **4** indicates the initial number of gold coins. • **12 15 20** – indicates the gold coins in each container • **4 10** 8 – indicates the gold coins that must be possessed or shown for selecting the corresponding container. i.e., 1st has 12 gold coins. To select, show a minimum of 4 gold coins. 2nd has 15 gold coins. To select show a minimum of 10 gold coins. 3rd has 20 gold coins. To select, show a minimum of 8 gold coins. • First Kumar Varma can show 4 coins and select the first container. He will now have 16 (4 + 12) coins. • Now, he can select either 2nd or 3rd containers. He can select the one that has more coins i.e., the 3rd container with 20 gold coins. **Now, he has 36 (4+12 + 20) coins. He completed his number of selections (2).**
3 20 **50 65 40 30** **18 30 22 15**	**175**	• First show 18 from 20 and select 1st container. 20 + 50 = 70 coins. • Second, show 30 coins and select 2nd container. 70 + 65 = 135 coins • Third, show 22 coins and select 3rd container. 135 + 40 = **175** coins.
2 4 **12 15 20** **8 10 12**	**4**	• Since initial coins is 4 and no container can be selected in the cave with those 4 coins, so, Kumar Varma must leave the cave with **4** coins only.

3 Gabbar Singh's Robbery

Aamiristhan, the land of kings, had several small and rich kingdoms numbered **1 to N**. Every kingdom has some precious diamonds ($\mathbf{D_n}$) with them.

For business and security, some kings formed alliances with others and have laid bidirectional roads between them and also have appointed their respective foreign ambassadors (or messengers) in each other's kingdoms. *For example, if there a road between Xn and Yn kingdoms then Xn will have an ambassador of Yn and Yn shall have an ambassador of Xn*. In a kingdom, the number of ambassadors would be equal to the number of kingdoms that are directly connected to it. *Also, they agreed to use only those roads to move between the kingdoms. S*ome kings stayed away from that group so there is no connectivity with other kingdoms and no ambassadors in their kingdoms.

All kingdoms were facing a serious problem of robberies by dreaded dacoits because they knew all routes to all kingdoms and they could enter (without using roads also) into any kingdom anytime.

After facing several instances of robberies of diamonds, the kings of that region made an agreement. In case of robbery attack or entry by a dacoit in a kingdom, all ambassadors of other kingdoms (directly connected by roads), would travel by roads to their respective kingdoms and inform about the robbery so that security can be tightened to protect precious diamonds before their kingdoms are attacked by dacoits. Dacoits cannot rob diamonds guarded by heavy security and leave those kingdoms without any diamonds.

Gabbar Singh was the most dreaded and intelligent dacoit. Once in a while, he used to choose a random kingdom, rob it and move on to rob all other kingdoms as well. Given the number of kingdoms, number of roads among them, the amount in precious diamonds of those kingdoms, and the road connectivity information, write a program for Gabbar Singh to find out the maximum number of diamonds he will get after robbing all possible kingdoms and also the number of ways to get those maximum number of diamonds.

Input/Output

Input	O/P	Comments

4 3
5 15 10 25
1 3
2 4
3 4
	30 1	• First line (4 3): 4 represents total number of kingdoms (1, 2, 3, 4). 3 represents the total number of roads
		• Second line (5 15 10 25) represents the total number of precious diamonds in each of those 4 kingdoms
		• Next 3 lines represents direct bi-directional roads between kingdoms
		• For the road connectivity and ambassadors, the following stands true.
		  ○ If diamonds from (1) are robbed then (3) cannot be robbed.
		  ○ If diamonds from (2) are robbed then (4) cannot be robbed.
		  ○ If diamonds from (3) are robbed then (1) and (4) cannot be robbed.
		  ○ If diamonds from (4) are robbed then (2) and (3) cannot be robbed.

		• If Gabbar starts robbery from (1) and rob (4) then he will get **5+25=30** diamonds • If he starts robbery from (3)and then (2) then he will get **15 + 10 = 25** • **30** is the maximum and only one (**1**) way to get it.
5 4 **10 0 30 30 40** **1 2** **1 3** **3 4** **1 4**	**70 4**	• Kingdoms (1), (2), (3) and (4) are inter connected. • Among those 4, kingdom (3) and (4) have maximum diamonds. • Kingdom (5) is not connected to any other kingdom it can be always robbed. • The maximum diamonds Gabbar can get after robbing all possible kingdoms is **70** • Gabbar can get 70 diamonds by robbing in the following **4** ways: ○ (2) (3) (5) -> 0 + 30 + 40 = 70 ○ (2) (4) (5) -> 0 + 30 + 40 = 70 ○ (3) (5) -> 30 + 40 = 70 ○ (4) (5) -> 30 + 40 = 70