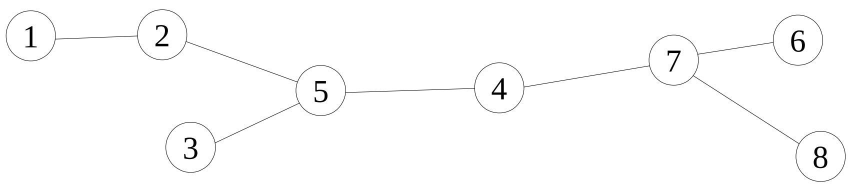
Shipping

Time limit: 3 second.

Your company has N factories building innovative "Super Meals for Programmers." Since you are also an expert in logistics, you have established N - 1 direct product shipment routes between these factories in such a way that any products from any factory can be shipped to any other factories. For any two factories A and B, the distance between them is measured in hops as the minimum number of direct shipment routes from factory A to factory B.

For example, the following picture shows the case with N=8 factories. The distance between factories 1 and 2 is 1 hop, the distance between factories 2 and 8 is 4 hops, and the distance between factories 6 and 4 is 2 hops.



Since each factory has different production conditions, the quality of the products varies among the factories. Factory i, for 1 <= i <= N, has production quality rating of Q_i.

To make the best programmer's meal, ingredients must be mixed at the right temperature. Currently, the whole product is made in each factory individually, so you have to include the wait time in the production process. You want to save the wait time by shipping incomplete products between factory and let them cold down in the shipping trucks. You have conducted many experiments and are certain that the right time for cooling is 4 hops.

With this information, you want to create a high-end line of product, called "Superior Meals for Programmer." You want to find two factories A and B, such that (1) the distance between A and B is **exactly** 4 hops, and (2) the sum of their product quality ratings Q_A and Q_B is as high as possible.

As an example, the following table shows the production quality ratings of 8 factories in the above example situation.

i	1	2	3	4	5	6	7	8
Rating Q_i	110	100	10	110	7	100	15	30

The best pair of factories are factories 2 and 6, because the distance is 4 hops and the sum is 200. While Q_1+Q_2=210 or Q_2+Q_4=210 or Q_1+Q_4=220, their distances are not 4 hops.

You task is to write a program that finds A and B and reports the maximum sum $Q_A + Q_B$.

Input

The first line of the input contains an integer T, the number of test cases (1 <= T <= 10). Then T test cases follow in the format described below.

The first line of each test case contains on integer N (5 <= N <= 100,000). The next line describes the quality ratings, i.e., line 2 contains N integers: Q_1 Q_2 … Q_N (0 <= Q_i <= 1,000,000,000). The next N - 1 lines describe the shipment routes: each line contains two integers U V (1<=U<=N; 1<=V<=N; U is not equal to V) meaning that there is a direct shipment route between factories U and V.

Output
There are T lines. Each line contains the maximum quality rating sum Q_A+Q_B for each test case. If it is impossible to find a pair of factories that satisfies the requirement, your program should output -1.

Example

Input	Output
2 8 110 100 10 110 7 100 15 30 1 2 2 5 5 3 5 4 4 7 7 6 7 8 5 1 2 3 4 5 1 2 1 3 1 4 1 5	200 -1