Computer Science & Information Systems

**DESIGN AND ANALYSIS OF ALGORITHMS – Lab Sheet # 4**

1. **Objective**:

The students will be able to store, traverse and operate on any graph.

1. **Problem:** (**Number Triples**)

In this problem you will be given a sequence of triples of positive integers.

For example:

1 2 5

5 2 6

1 3 8

8 1 11

1 1 6

10 1 6

11 3 6

10 4 8

10 1 11

Given a pair of numbers **A** and **B**, a chain connecting A and B is a sequence of triples

A0 W0 A1, A1 W1 A2, A2 W2 A3, ….... Ak-2 Wk-2 Ak-1, Ak-1 Wk-1Ak

Such that

* + A0 = A
  + Ak = B
  + For each i, 0 ≤ i < k, either the triple Ai Wi Ai+1 or the triple Ai+1 Wi Ai is in the given set of triples.

The value of such a chain is the sum of the Wis in the chain. For example, here is a chain connecting 1 and 11 using the triples listed above:

1 1 6, 6 3 11

The value of this chain is 1+3 = 4.

Here is another chain connecting 1 and 11.

1 1 6, 6 1 10, 10 1 11

The value of this chain is 1+1+1 = 3. You can verify that among all chains connecting 1 and 11 this is the one with least value.

Sometimes there may be no chains connecting the given pair of numbers. For example, there is no chain connecting 1 and 2.

You will be given a sequence of triples and a pair of numbers. Your task is to find the value of the least value chain connecting the two numbers.

1. **Solution hint**

Construct a graph from the triples and use Dijkstra's algorithm for single-source shortest paths. [Full solution](http://www.iarcs.org.in/inoi/contests/apr2005/Advanced-1-solution.php). (*Click to get complete description*)

1. **Input format**

The first line of the input has three numbers M, A and B. M is the number of triples. The next M lines (lines 2, 3,...,M+1) describe the triples. Line i+1 contains the three positive integers Xi, Yi and Zi that make up the ith triple. Your task is to find the value of the least value chain connecting A and B.

1. **Output format**

If there is at least one chain connecting A and B the first line of the output must consist of a single word YES. In that case the second line must contain a single integer value indicating the value of the least valued chain connecting A and B. If there are no chains connecting A and B the output should contain a single line with the word NO on it.

1. **Test data**

You may assume that 1 ≤ Xi, Yi, Zi ≤ 2000 and M ≤ 4000000.

1. **Sample input**

9 1 11

1 2 5

5 2 6

1 3 8

8 1 11

1 1 6

10 1 6

11 3 6

10 4 8

10 1 11

1. **Sample output**

Yes

3

1. **Sample input2**

9 1 2

1 2 5

5 2 6

1 3 8

8 1 11

1 1 6

10 1 6

11 3 6

10 4 8

10 1 11

1. **Sample output2**

NO

1. **References**

*(IARCS OPC Archive, K Narayan Kumar, CMI)*