# Q1-Q2

## Question 1

Max. score: 5

This problem is no longer available for practice. Apology for any inconvenience!

A number of students would like to send gifts to a particular faculty. Each student has a gift that is associated with a weight. The distance from every student to every faculty and between every student is known. The students collectively hire a volunteer to collect gifts from the students and send the gifts to the faculty. The volunteer can pick up gifts worth a maximum of *W* grams. Calculate the total cost of navigation by the volunteer using **Uniform Cost Search**. The volunteer always starts its journey from the location of the faculty.

**Input Format**: The first line of input is *T*, the number of test cases. For every test case, the first line is *n* the number of persons (1 faculty and *n*-1 students). The next *n* lines with *n* integers each contain the cost to navigate between every person. The $j^{th}$ integer in $i^{th}$ line contains the distance between student/faculty *i* and student/faculty *j*. The index of the faculty is fixed to 0, while the students have indices 1 to *n*-1. The next line contains *n*-1 integers that is the weight of the gift with the student in their order of indices. The last line for every test case contains the weight limit *W*.

**Output Format:** For every test case, print the total cost of the tour.

**Limits:** $0<n\leq 15$

Assume the input graph is pre-processed for the validity of the triangle law of inequality. So you cannot get a shorter route via an intermedia student/faculty between any two points in the graph.

**Sample Input:**

1 *<number of test cases>*

5 *<1 faculty indexed 0 and 4 students indexed 0 to 3>*

*<distance matrix as per index follows>*

0 2 3 4 10

2 0 5 4 8

3 5 0 7 9

4 4 7 0 10

10 8 9 10 0

9 2 4 5 *<weights of gifts in the order of student index>*

12 *<maximum weight that the volunteer can pick up>*

**Sample Output**

30

**Explanation**

Step 1: Start from source (fixed to faculty or 0)

Step 2: Go to person 1 (student 0) to pick gift with cost 2

Step 3: Since the volunteer is carrying 9 worth of weight (with a limit of 12), return to faculty (or 0) with cost 2

Step 4: Go to person 2 (student 1) to pick gift with cost 3

Step 5: Go to person 4 (student 3) to pick gift with cost 9

Step 6: Go to person 3 (student 2) to pick gift with cost 10

Step 7: Since the volunteer is carrying 2+5+4 worth of weight (with a limit of 12), return to faculty (or 0) with cost 4

No more gifts to deliver, terminate

| SAMPLE INPUT | SAMPLE OUTPUT |
| --- | --- |
| 1<br>5<br>0 2 3 4 10<br>2 0 5 4 8<br>3 5 0 7 9<br>4 4 7 0 10<br>10 8 9 10 0<br>9 2 4 5<br>12 | 30 |

| | |
| --- | --- |
| **Time Limit:** | 10.0 sec(s) for each Input file. |
| **Memory Limit:** | 5000 MB |
| **Source Limit:** | 1024 KB |
| **Marking Scheme:** | Score is assigned if any testcase passes. |

# Question 2

Max. score: 5

This problem is no longer available for practice. Apology for any inconvenience!

In question 1 print the tour as a list of vertices visited instead of the cost. In case of a tie print the lexicographically shortest route.

**Sample Input:**

1

5

0 2 3 4 10

2 0 5 4 8

3 5 0 7 9

4 4 7 0 10

10 8 9 10 0

9 2 4 5

12

**Sample Output**

0 1 0 2 4 3 0

# Q3-Q4

## Question 3

Max. score: 5

This problem is no longer available for practice. Apology for any inconvenience!

A number of students would like to send gifts to a particular faculty from a set of available faculties. Each student has a gift that is associated with a weight and a faculty to which the gift is to be given. The distance between every person is known. The students collectively hire a volunteer to collect gifts from the students and send the gifts to the faculties. The volunteer can pick up gifts worth a maximum of *W* grams. Calculate the total cost of navigation by the volunteer using **Uniform Cost Search**. The volunteer always starts its journey from the location of the faculty indexed 0.

**Input Format**: The first line of input is *T*, the number of test cases. For every test case, the first line is *m* and *n* the number of persons (*m* faculty and *n* students). The next *m*+*n* lines with *m*+*n* integers each contain the cost to navigate between every person. The $j^{th}$ integer in $i^{th}$ line contains the distance between student/faculty *i* and student/faculty *j*. The index of the faculty is from 0 to *m*-1, while the students have indices *m* to *m*+*n*-1. The next *n* lines contain weight of the gift and the index of the faculty in the order of indices of the student. The last line for every test case contains the weight limit *W*.

**Output Format:** For every test case, print the total cost of the tour.

**Limits:** $0<m,n \leq 15$

**Sample Input**

1 *<number of test cases>*

2 5 *<2 faculty indexed 0 and 1, 5 students indexed 2, 3, 4, 5 and 6>*

*<distance matrix>*

0 6 5 4 2 7 8

6 0 1 3 5 1 8

5 1 0 4 4 2 7

4 3 4 0 5 4 9

2 5 4 5 0 6 8

7 1 2 4 6 0 9

8 8 7 9 8 9 0

4 1 *<student index 0, weight=4, faculty=1 and so on>*

10 0

6 1

10 0

4 0

11 *<total weight limit for the volunteer>*

## Sample Output

39

**Explanation**

Faculty index 0 = person index 0

Faculty index 1 = person index 1

Student index 0 = person index 2

Student index 1 = person index 3

Student index 2 = person index 4

Student index 3 = person index 5

Student index 4 = person index 6

Step 1: Start from 0 (fixed)

Step 2: Go to person 3 (student index 1) to collect gift with cost 4

Step 3: Since volunteer is carrying weight 10 (limit 11), return to the faculty 0 to deliver gift with cost 4

Step 4: Go to person 4 (student index 2) to collect gift with cost 2

Step 5: Go to person 2 (student index 0) to collect gift with cost 4

Step 6: Since volunteer is carrying weight 6+4 (limit 11), return to the faculty 1 to deliver gift with cost 1

Step 7: Go to person 5 (student index 3) to collect gift with cost 1

Step 8: Since volunteer is carrying weight 10 (limit 11), return to the faculty 0 to deliver gift with cost 7

Step 9: Go to person 6 (student index 4) to collect gift with cost 8

Step 10: Since volunteer is carrying weight 4 (limit 11), return to the faculty 0 to deliver gift with cost 8

No more gifts, terminate

SAMPLE INPUT

```
1
2 5
0 6 5 4 2 7 8
6 0 1 3 5 1 8
5 1 0 4 4 2 7
4 3 4 0 5 4 9
2 5 4 5 0 6 8
7 1 2 4 6 0 9
8 8 7 9 8 9 0
4 1
10 0
6 1
10 0
4 0
11
```

SAMPLE OUTPUT

```
39
```

| | |
|---|---|
| **Time Limit:** | 10.0 sec(s) for each input file. |
| **Memory Limit:** | 5000 MB |
| **Source Limit:** | 1024 KB |
| **Marking Scheme:** | Score is assigned if any testcase passes. |
| **Allowed Languages:** | C++, C++14, C++17, Java, Java 8, Java 14, Python, Python 3, Python 3.8 |

# Question 4

Max. score: 5

This problem is no longer available for practice. Apology for any inconvenience!

In question 3 print the tour as a list of vertices visited instead of the cost. In case of a tie print the lexicographically shortest route.

**Sample Input**

1

2 5

0 6 5 4 2 7 8

6 0 1 3 5 1 8

5 1 0 4 4 2 7

4 3 4 0 5 4 9

2 5 4 5 0 6 8

7 1 2 4 6 0 9

8 8 7 9 8 9 0

4 1

10 0

6 1

10 0

4 0

11

**Sample Output**

0 3 0 4 2 1 5 0 6 0

| SAMPLE INPUT | SAMPLE OUTPUT |
| --- | --- |
| 1<br>2 5<br>0 6 5 4 2 7 8<br>6 0 1 3 5 1 8<br>5 1 0 4 4 2 7<br>4 3 4 0 5 4 9<br>2 5 4 5 0 6 8<br>7 1 2 4 6 0 9<br>8 8 7 9 8 9 0<br>4 1<br>10 0<br>6 1<br>10 0<br>4 0<br>11 | 0 3 0 4 2 1 5 0 6 0 |

| | |
| --- | --- |
| **Time Limit:** | 10.0 sec(s) for each input file. |
| **Memory Limit:** | 5000 MB |
| **Source Limit:** | 1024 KB |
| **Marking Scheme:** | Score is assigned if any testcase passes. |
| **Allowed Languages:** | C++, C++14, C++17, Java, Java 8, Java 14, Python, Python 3, Python 3.8 |