# Mandatory Exercise 3

## Show Stations, Paths and Path Lengths for a system where m = 3 and n = 4

M equals the number of stations in zone Z2 and n equals the number of stations in Z3. The entire system and its connections can be visualized as follows (some paths and path lengths omitted for clarity):

c1 = 3

b11 = 1

a2 = 1

a3 = 3

a1 = 2

Zone

**Z4**

Zone

**Z3**

Station

**V1**

Station

**V2**

Station

**V3**

Station

**V4**

Zone

**Z1**

Zone

**Z2**

Station

**X**

Station

**U3**

Station

**U2**

Station

**Y**

Station

**U1**

## Specify instances in a table

Below is the complete station map with path lenghths, in table form:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Z1 | ai | Z2 | bij | Z3 | cj | Z4 | length |
| 0 | X | 2 | U1 | 1 | V1 | 3 | Y | 6 |
| 1 | X | 2 | U1 | 2 | V2 | 2 | Y | 6 |
| 2 | **X** | **2** | **U1** | **1** | **V3** | **2** | **Y** | **5** |
| 3 | X | 2 | U1 | 3 | V4 | 3 | Y | 8 |
| 4 | X | 1 | U2 | 4 | V1 | 3 | Y | 8 |
| 5 | X | 1 | U2 | 5 | V2 | 2 | Y | 8 |
| 6 | **X** | **1** | **U2** | **2** | **V3** | **2** | **Y** | **5** |
| 7 | **X** | **1** | **U2** | **1** | **V4** | **3** | **Y** | **5** |
| 8 | X | 3 | U3 | 4 | V1 | 3 | Y | 10 |
| 9 | X | 3 | U3 | 3 | V2 | 2 | Y | 8 |
| 10 | X | 3 | U3 | 2 | V3 | 2 | Y | 7 |
| 11 | X | 3 | U3 | 1 | V4 | 3 | Y | 7 |

The shortest path is obtained in three ways. The first is by utilizing the solution on row 3. Start at station X and travel to Y via stations U1 and V3. The second solution is on row 7. Travel from X to Y via stations U2 and V3. Finally, the last solution is to travel between X and Y via stations U2 and V4. This is illustrated by row 8.

All of these routes gives a total travel distance of 5 units.

## Describe an algorithm that solves the general case

### Problem

Find the shortest route between stations X and Y, passing through one station in zone 2 and 3 respectively.

### Algorithm

### Preconditions

Algorithm must be provided with amount of stations in the respective zones. The algorithm also needs the total distance between the stations.

### Postconditions

A the stations forming the shortest path can be found in the array Stations.

### Steps in the algorithm

Calculate the total lengths possible from station X and Y.

Find the shortest result of these calculations. If more than one, choose the first.

Display what stations were passed on the chosen shortest path.

Show how long the shortest path is.

### Steps in the algorithm – Pseudocode

Intermediatestations (a[], b[][], c[])

{

totaldistance = a[0] + b[0][0] + c[0]

currentdistance = 0

stationU = 1

stationV = 1

for i = 0 to total stations in a

for j = 0 to total stations in b

currentdistance = a[i] + b[i][j] + c[j]

if currentdistance < totaldistance

totaldistance = currentdistance

stationU = i

stationV = j

stations[0] = stationU

stations[1] = stationV

return stations

}

length (a[], b[][], c[])

{

distance = a[0] + b[0][0] + c[0]

currentdist = 0

for i = 0 to total stations in a

for j = 0 to total stations in b

distance = a[i] + b[i][j] + c[j]

if currentdistance < totaldistance

totaldistance = currentdistance

return distance

}