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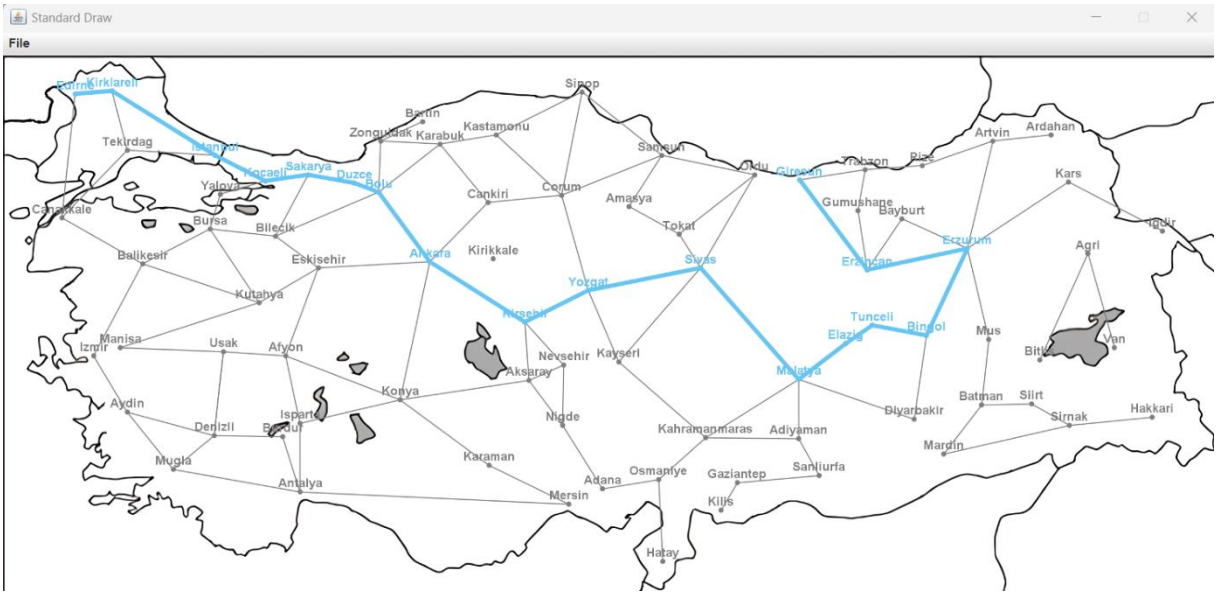

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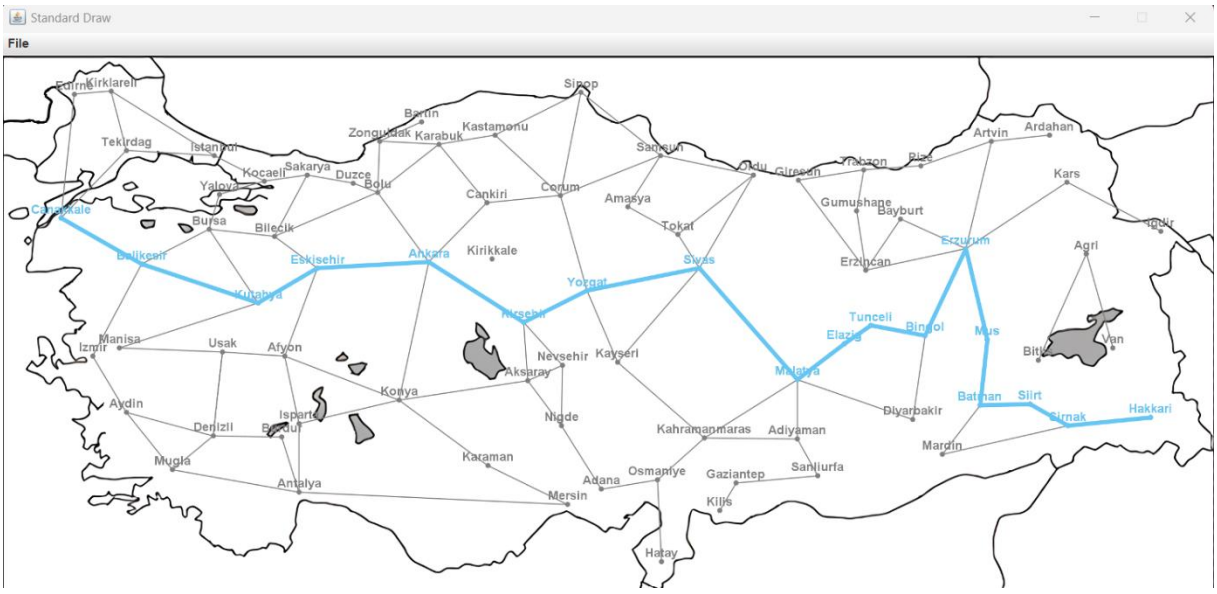

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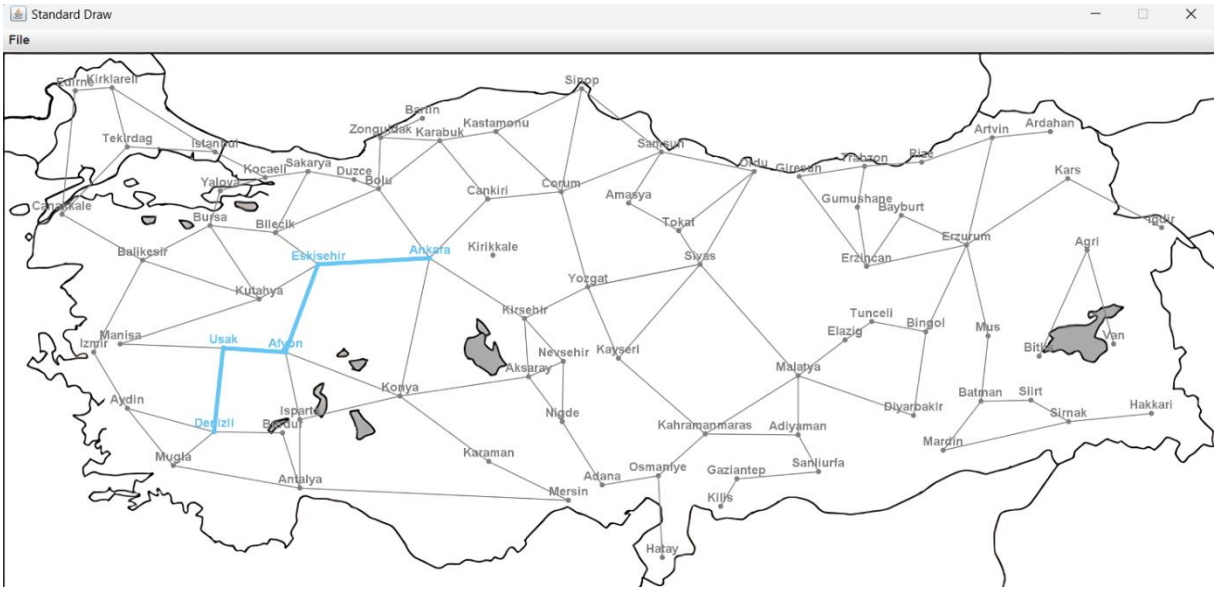

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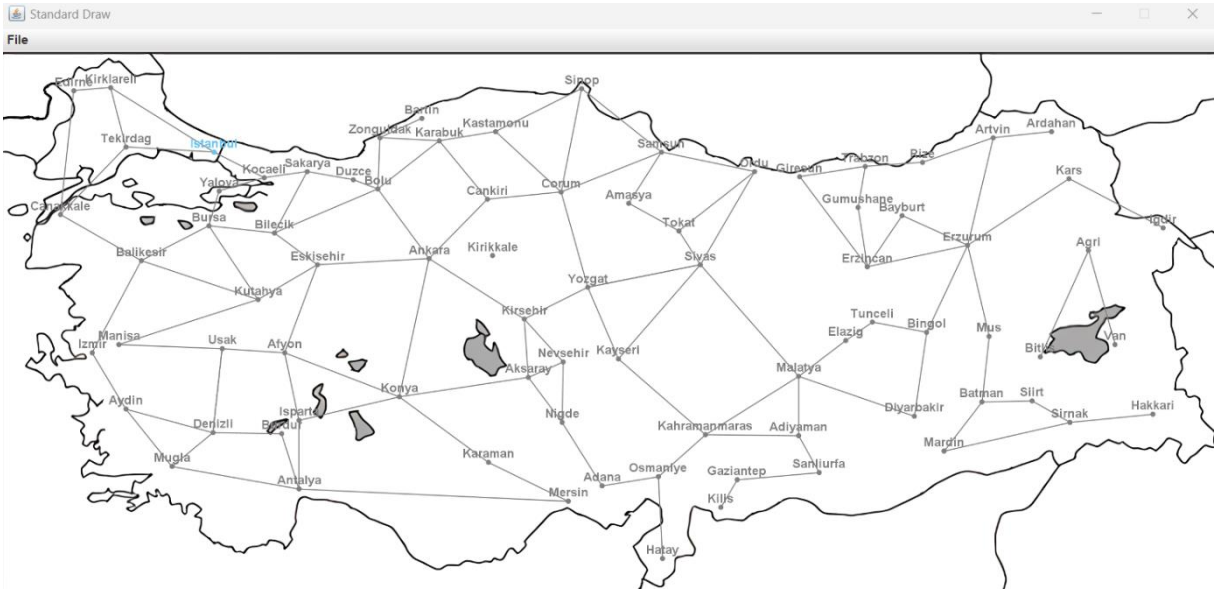

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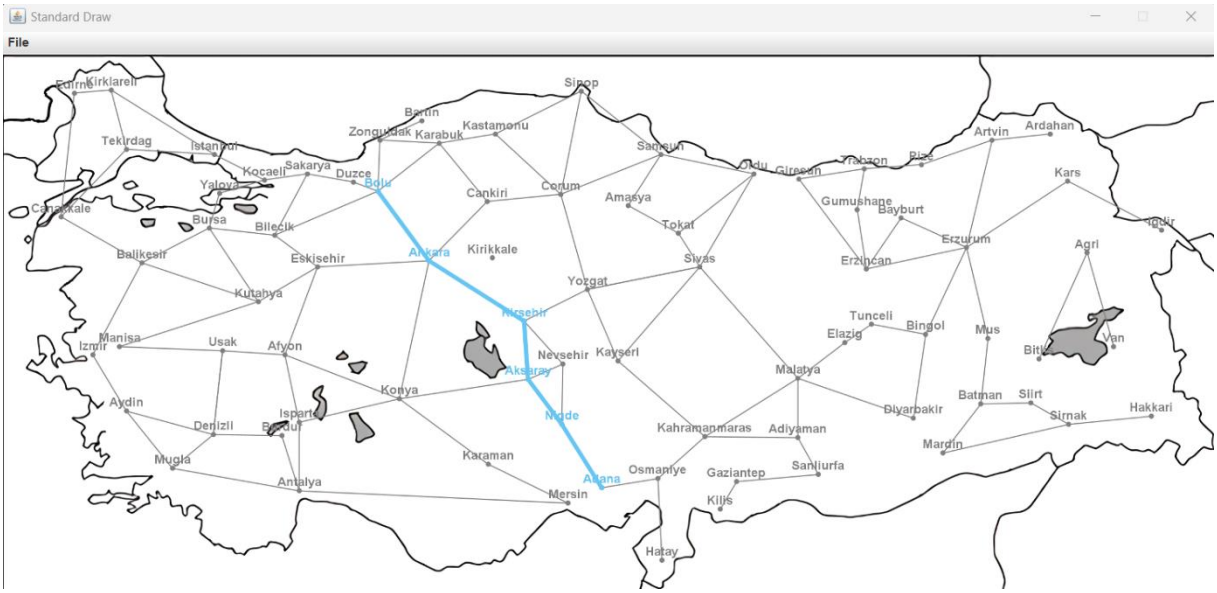

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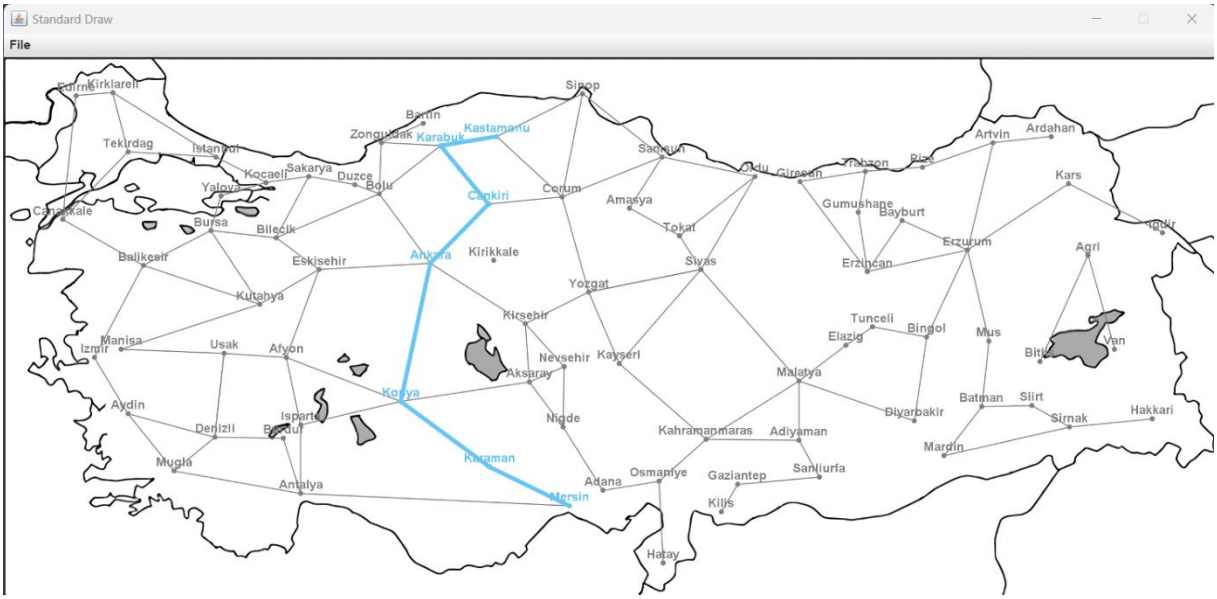
Kastamonu-Mersin



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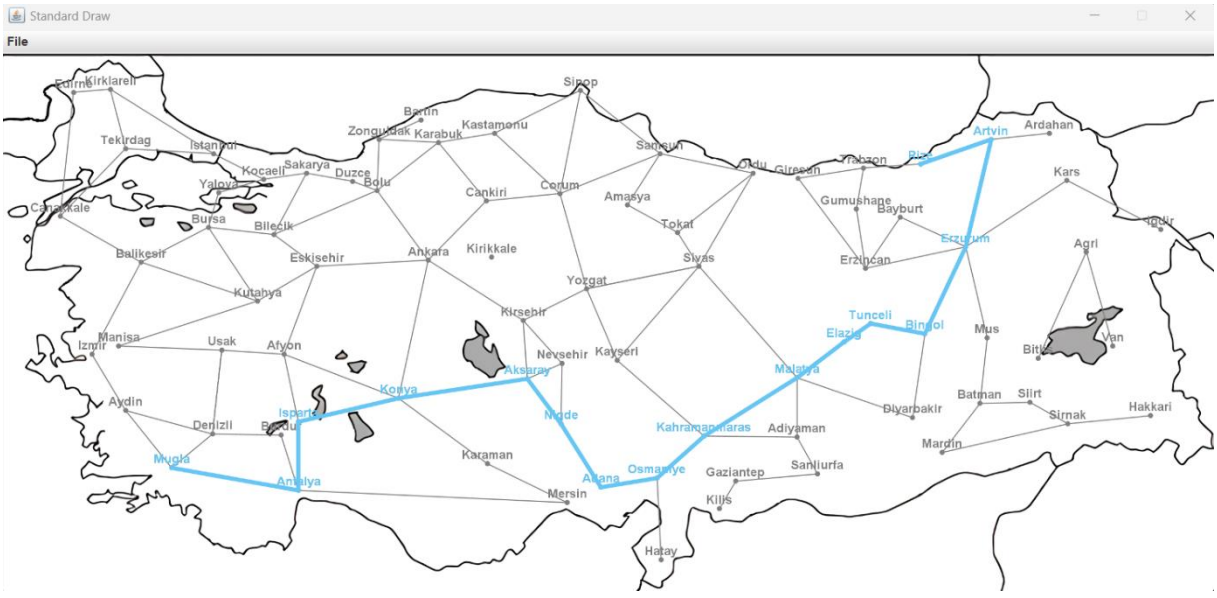

Path Finding Algorithm - Dijkstra's Algorithm Using Matrix

The idea is to generate a shortest path tree with a given starting city as a root. Maintain a matrix with two sets,

One set contains cities included in the shortest-path tree,

Other set includes cities not yet included in the shortest-path tree.

At every step of the algorithm, find a city that is in the other set (set not yet included) and has a minimum distance from the starting city.

Algorithm:

Create a set isInSpt(shortest path tree set) that keeps track of cities included in the shortest path tree, i.e., whose minimum distance from the starting city is calculated and finalized. Initially, this set is empty.

Assign a distance value to all cities in the input matrix. Initialize all distance values as INFINITE. Assign the distance value as 0 for the starting city so that it is picked first.

While isInSpt doesn't include all cities

Pick a city u that is not there in isInSpt and has a minimum distance value.

Include u to isInSpt.

Then update the distance value of all adjacent cities of u.

To update the distance values, iterate through all adjacent cities.

For every adjacent city v, if the sum of the distance value of u (from starting city) and weight of road u-v, is less than the distance value of v, then update the distance value of v.

Note: We use a boolean array isInSpt [] to represent the set of cities included in SPT. If a value isInSpt [v] is true, then city v is included in SPT, otherwise not. Array distance[] is used to store the shortest distance values of all cities.

Note: In pseudocode u is represented by minIndex variable.

PSEUDOCODE

```
function dijkstraAlgorithm(matrix,source,target,numberOfCities,cityNames)
   Initialize distance[]
   Initialize isInSpt[]
   Initialize parent[]
   for each city C in matrix:
      distance[C] = INFINITY
      isInSpt[C] = FALSE
      parent[C] = 0

   distance[source] = 0
   parent[source] = -1

   for numberOfCities - 1 times
      minIndex = call getMinDistance(distances, isInSpt,numberOfCities)
      isInSpt[minIndex] = true

      for c=0 to numberOfCities-1
         if (isInSpt[c] = false and matrix[minIndex][c] != 0 and distances[minIndex] !=
INFINITY and distances[minIndex] + matrix[minIndex][c] < distances[v])
            distances[v] = (distances[minIndex] +  matrix[minIndex][c]);
            parent.set(v,minIndex);

   printDistance(distances,target)
   Initialize zeros[]
   Initialize pathList[] = call getPath(parent,target,result,zeros)
   return call printPath(pathList,target,distances,cityNames)

function getMinDistance(distances, isInSpt,numberOfCities)
   minimumValue = INFINITY
   minIndex = -1
   for c=0 to numberOfCities-1
      if (isInSpt[v] = false and distances[v] <= minimumValue)
                  minimumValue = distances[v]
                  minIndex = v
   return minIndex

function printDistance(distances,target)
   if (distances[target] != INFINITY)
      print distances[target]
```

```
function getPath(parent,target,result,zeros)
    if (size of zeros = 2)
        return []
    if (parent[target] = 0)
        add 1 to zeros
    if (parent[target] = -1)
        add -1 to result
        return result

    add parent[target] to result
    return getPath(parent,parent[target],result,zeros)

function printPath(pathList,target,distances,cityNames)
    Initialize citiesOnTheRoute[]
    if (distances[target] = INFINITY or pathList = [])
        print "No path could be found"
    else
        print "Path: "
        for i=size of pathList-2 to 0
            cityName = cityNames[pathList[i]]
            add cityName to citiesOnTheRoute
            print cityName + "->"
        targetCityName = cityNames[target]
        add targetCityName to citiesOnTheRoute
        print targetCityName

    return citiesOnTheRoute
```

REFERENCES

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