Assignment 1 Part 2

1. Explanation of the problem (1.5 points)
   There is a graph representing Spain's cities and roads. The problem is finding path from Malaga which is starting node to Valladolid which is ending node. Apply two search algorithms Greedy Best-First Search(GBFS) and A*. A* finds the optimal solution but GBFS gives the first solution it finds.

   a. Give the representation of a solution(answer) of the problem, as explained during the course.(0.5)

      Solution can be represented with list of nodes(cities) of the graph which represents the path.

      $S = \{x_1, x_2, \dots, x_n\}$ x_1 is the starting node (Malaga) and x_n is the destination(Valladolid)

      The order of the nodes in the S represents the path between starting node (Malaga) and destination (Valladolid)

   b. Give the equation of f(n) used in GBFS (or explain how to calculate f(n))(0.25)

      f(n) = h(n) (heuristic function)
      h(n) = Straight line distance to Valladolid from city n
      GBFS expands the node that is estimated to be closest to goal.
      GBFS is using only heuristic function to calculate f(n)
      h(n) is given in the problem's input.

   c. Give the equation of f(n) used in A* (or explain how to calculate f(n))(0.25)

      f(n) = g(n) + h(n)
      h(n) = straight line distance to Valladolid from city n
      g(n) = the path length so far from Malaga

      A* avoids expanding paths that are already far away, it combines the predicted length and actual length to calculate f(n).

   d. Explain both algorithms and the differences between them.

Both algorithms are used to find path between two nodes, they are trying to find the next node to go with their evaluation function. They put the neighborhood node's evaluated values to fringe and for the next node of the iteration takes the smallest valued node from fringe and continue their evaluation. The difference between the algorithm comes from their evaluation functions. GBFS calculates f(n) evaluation function with only using the heuristic information,(straight line distance to Valladolid is heuristic information for the city in this problem). But A* using heuristic information and estimated cost(the path length so far) so far to calculate f(n) and that makes the difference between two algorithms.