Problem 2: Meet Your Friend

(a)

Define friend 1 as F1 and friend 2 as F2.

State Space: All valid combinations of (City_F1, City_F2), with City_F1 and City_F2 equals to any possible city in the graph, respectively.

Successor function: F1, F2 move to any neighboring city from the current city given in the map

Goal Test: F1 and F2 are in the same city. (City_F1, City_F2), where City_F1 = City_F2.

Step cost function: Max (d(F1_From, F1_To),d(F2_From,F2_To)). The maximum road distance between F1's moving distance and F2's moving distance.

d(F1_From, F1_To) : the road distance of moving from the current city to next city of F1

d(F2_From, F2_To) : the road distance of moving from the current city to next city of F2

(b)

(i) 1 is not admissible. If two friends are at the goal state, which means they are at the same city. The heuristic function would evaluate to be 0, which is less than 1. So 1 is not admissible.

(ii) Not admissible. There could exists the case when road distance between each two cities which is smaller than the twice straight-line distance between them, then $2*D(i,j)$ is not admissible. $h(n) = 2*D(i,j) > d(i,j) = h^*(n)$, which leads to $h(n) > h^*(n)$.

(iii) $2*D(i,j)$ is admissible. $h(n) = D(i,j)/2 < D(i,j) <= d(i,j)= h^*(n)$, which leads to $h(n) < h^*(n)$.

(c) Yes, there can be no solution with completely connected maps.
Suppose there are only two cities in the map, as following:
City1 ------City2
The map is a completely connected map since there is edge between every pair of edges.
At the initial state, two friends live in different city respectively. For each term, they move to the city the other one lives since they could not stay in the same city for two consecutive runs. So they would be switching cities indefinitely and there is no solution for them to meet each other.