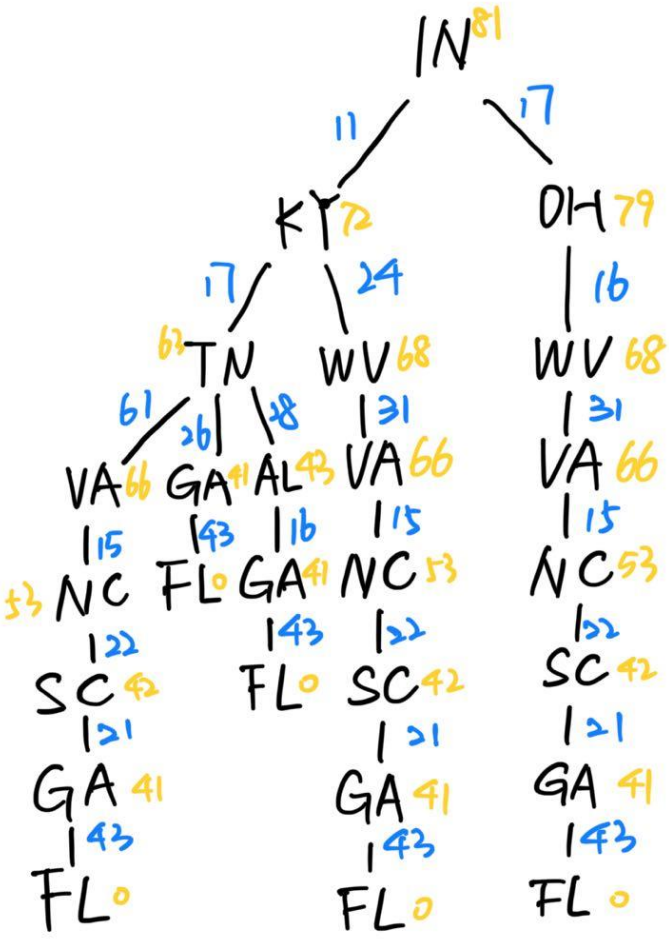
HW 1 PART 1

1(a).

The tree of the possible routes:

In this picture, the distance of the route is written in blue, the h value of each city is represented in yellow.



(i) (1). The order of the nodes expanded when executing Breadth First Search:

IN -> KY -> OH -> TN -> WV -> WV -> VA -> GA -> AL -> VA -> VA -> NC -> FL

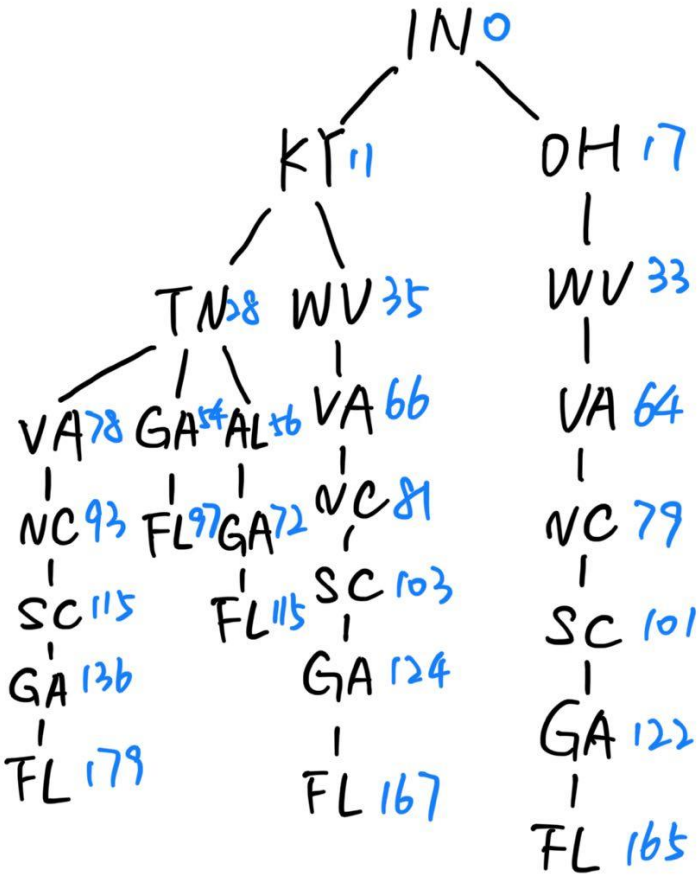
(2). The order of the node that Alice will visit is:

IN -> KY -> TN -> GA -> FL

(ii) (1). The order of the nodes expanded when executing Depth First Search:
IN -> KY -> TN -> VA -> NC -> SC -> GA -> FL
(2). The order of the node that Alice will visit is:

IN -> KY -> TN -> VA -> NC -> SC -> GA -> FL

(iii) (1). The order of the nodes expanded when executing Uniform Cost Search:



IN (0) -> KY (11) -> OH (17) -> TN (28) -> WV(33) -> WV(35) -> GA(54) -> AL(56) -> VA (64) -> VA (66) -> GA (72) ->VA (78) -> NC (79) -> NC (81) -> NC (93) -> FL (97)

(2). The order of the node that Alice will visit is:

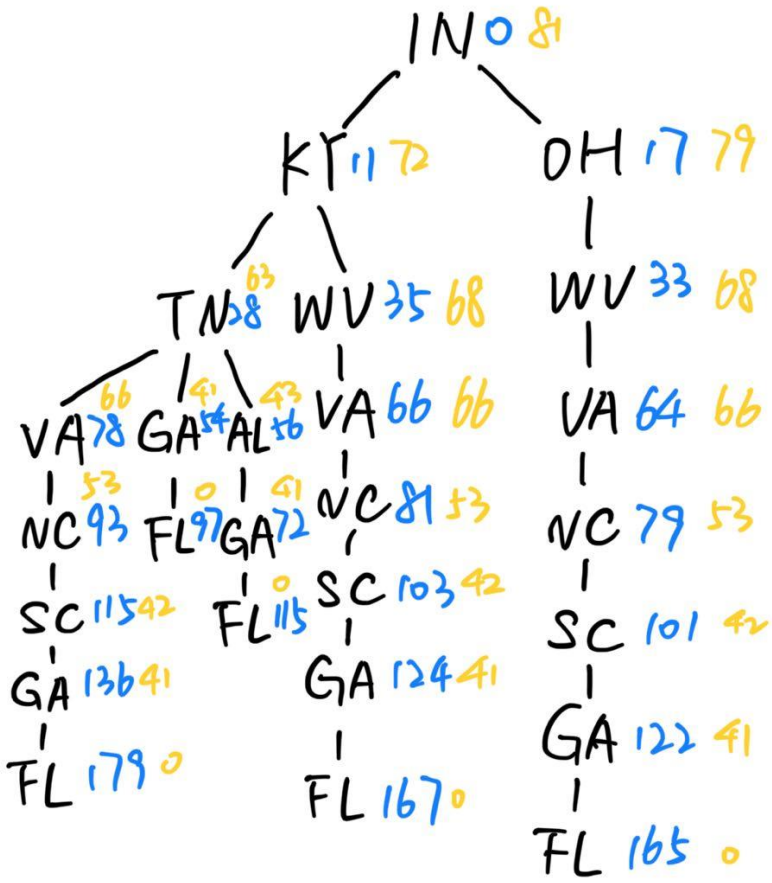
IN -> KY -> TN -> GA -> FL

(iv) (1). The order of the nodes expanded when executing Greedy Search:

IN -> KY -> TN -> GA -> FL

(2). The order of the node that Alice will visit is:

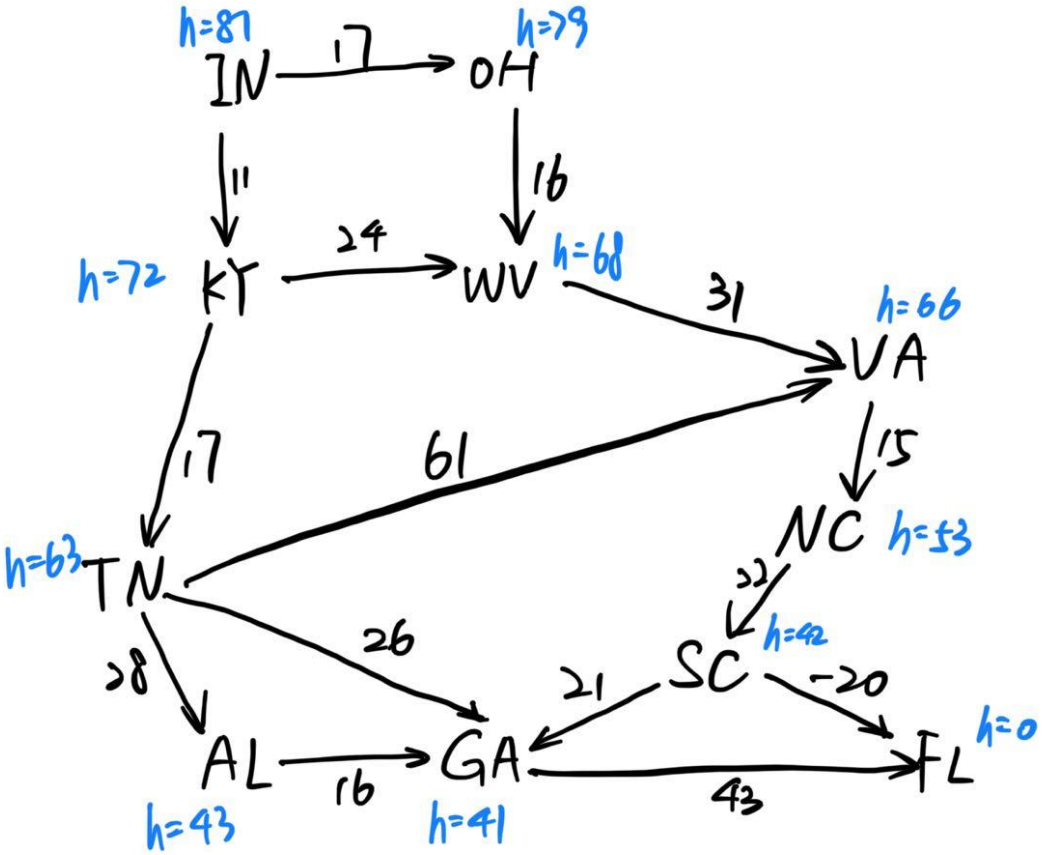
IN -> KY -> TN -> GA -> FL



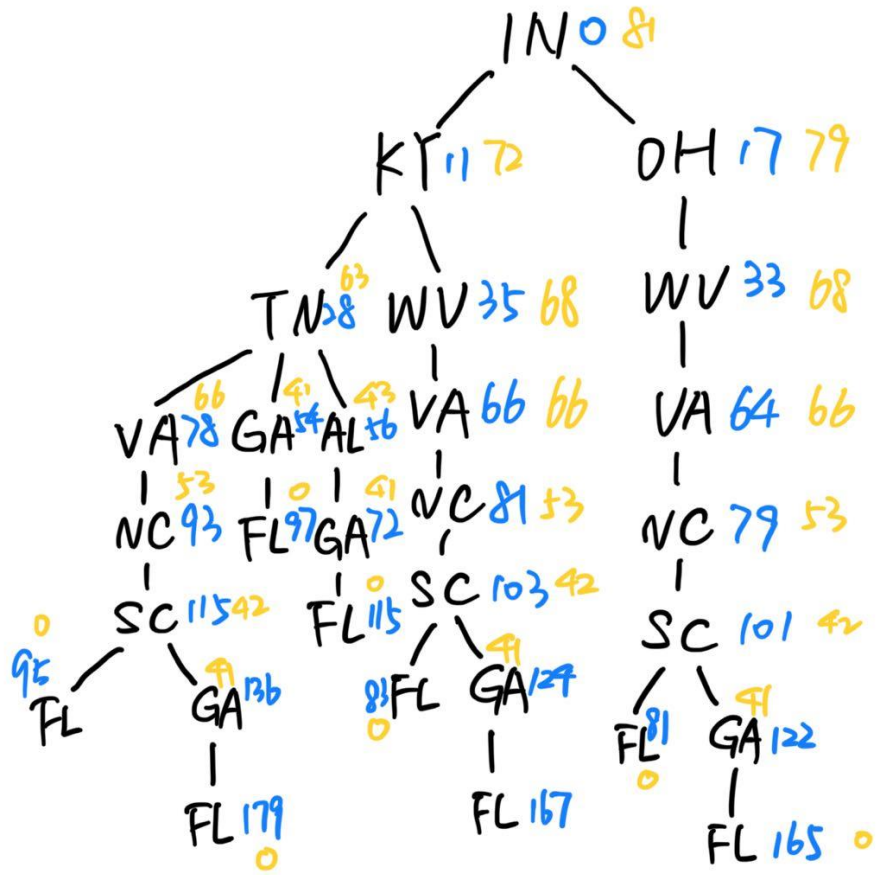
(v) (1). The order of the nodes expanded when executing A* Search:
IN -> KY -> TN -> GA -> OH -> FL
(2). The order of the node that Alice will visit is:

IN -> KY -> TN -> GA -> FL

1. (b) From the description, we could get a new graph:



The new version of the graph could be updated to:



(i) Breath First Search:
(1). The order of the nodes expanded when executing Breadth First Search: IN -> KY -> OH -> TN -> WV (35) -> WV(33) -> AL(56) -> GA (54) -> VA (78) -> VA (66) -> VA (64) -> FL (97)
(2). The order of the node that Alice will visit is: IN -> KY -> TN -> GA -> FL

(ii) Depth First Search: (1). The order of the nodes expanded when executing Depth First Search: IN -> KY -> TN -> AL -> GA ->FL
(2). The order of the node that Alice will visit is: IN -> KY -> TN -> AL -> GA ->FL

(iii) Uniform Cost Search: (1). The order of the nodes expanded when executing Uniform Cost Search: IN (0) -> KY (11) -> OH (17) -> TN (28) -> WV (33) -> WV (35) -> GA (54) -> AL (56) -> VA (64) -> VA (66) -> GA (72) ->VA (78) -> NC (79) -> NC (81) -> NC (93) -> FL (97)
(2). The order of the node that Alice will visit is: IN -> KY -> TN -> GA -> FL

(iv) (1). The order of the nodes expanded when executing Greedy Search: IN -> KY -> TN -> GA -> FL
(2). The order of the node that Alice will visit is: IN -> KY -> TN -> GA -> FL

(v) (1). The order of the nodes expanded when executing A* Search: IN -> KY -> TN -> GA -> OH -> FL

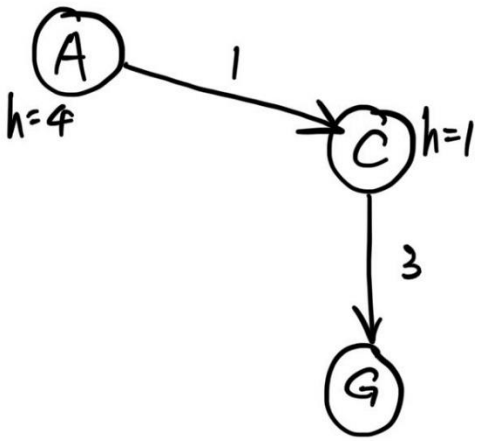
(2). The order of the node that Alice will visit is: IN -> KY -> TN -> GA -> FL

2. (a) Since we know that heuristic is consistent, h(A) <= cost(A to C) + h(C). Suppose the shortest path that we have is (x, w_1, w_2, w_3, w_4, … w_n, g). In the first part of the path, we have h(w_n) <= cost(w_n to g) + h(g). Because h(g) = 0, we could get h(w_n) <= cost(w_n to g). Therefore, we could get h(w_{n-1}) <= c(w_{n-1}, w_n) + h(w_n) <= c(w_{n-1}, w_n) + c(w_n).

   Similarly, we could get h(k) <= c(w_k, w_{k+1}) + … + c(w_{n-1}, w_n) + c(w_n, g). Moreover, (x, w_1, w_2, w_3, w_4, … w_n, g) is the shortest path. Therefore, p(w) = c(w_k, w_{k+1}) + … + c(w_{n-1}, w_n) + c(w_n, g).

   So, h(w_k) <= p(w_k)

   (b).



   In this graph, from A to G is admissible but not consistent. The heuristic function that A has is h = 4, which is equal to the actual cost of the path. However, it does not fulfill the requirement of consistent, which is less than 2 (cost from A to C + h(C)).