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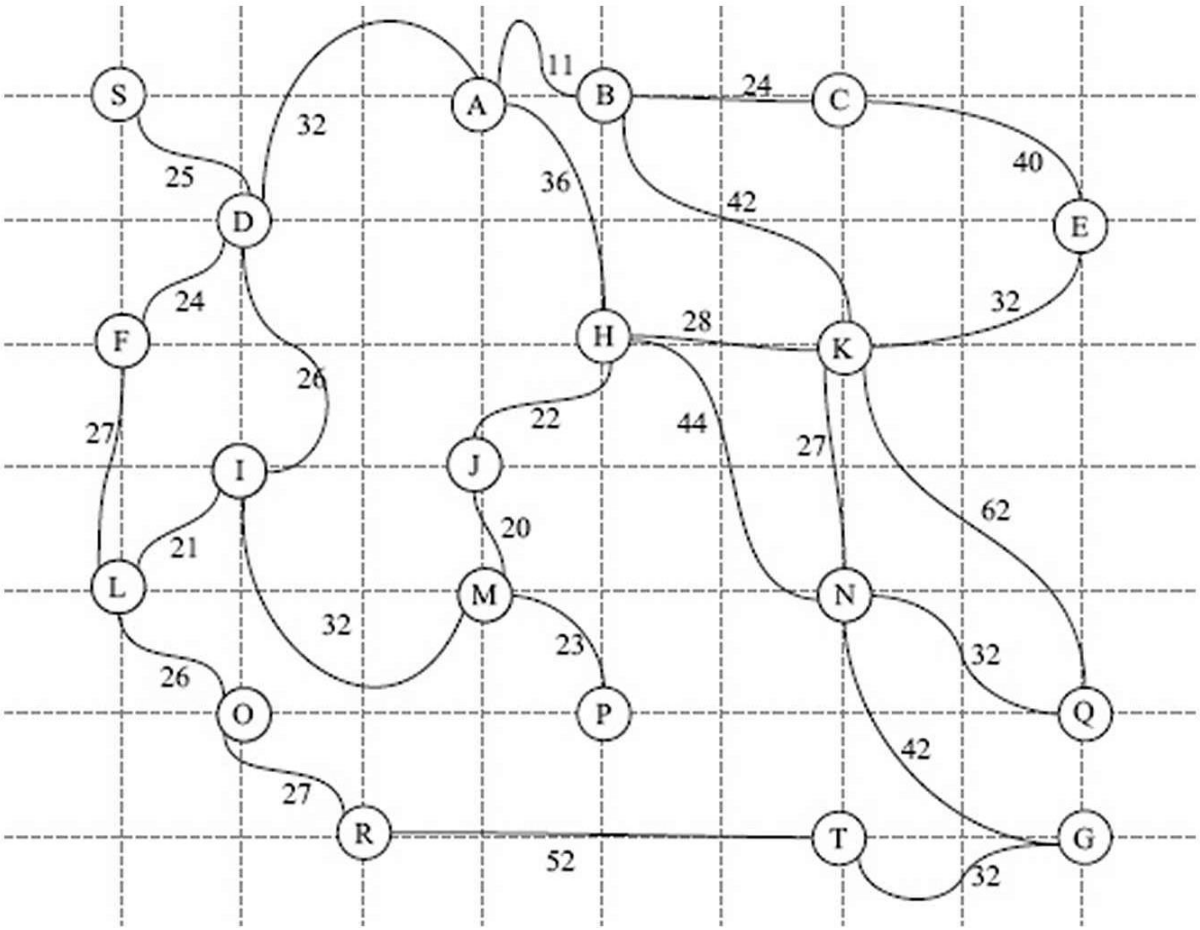
ASS:2

TY CSE AY-2022-23 Sem-I

Artificial Intelligence and Machine Learning Lab

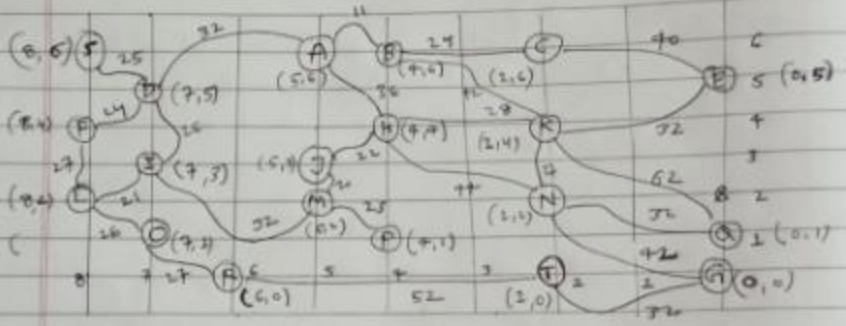
Assignment No 2

Q1. Consider the below graph, Find the optimal path from start node S to goal node G using A* algorithm



The length(cost) of each edge is marked on the graph. Use the Manhattan distance as a heuristic function. Assume that each square side on the grid is 10KM.

Q.1 Consider below graph, find optimal path from S to G using A* Algo.

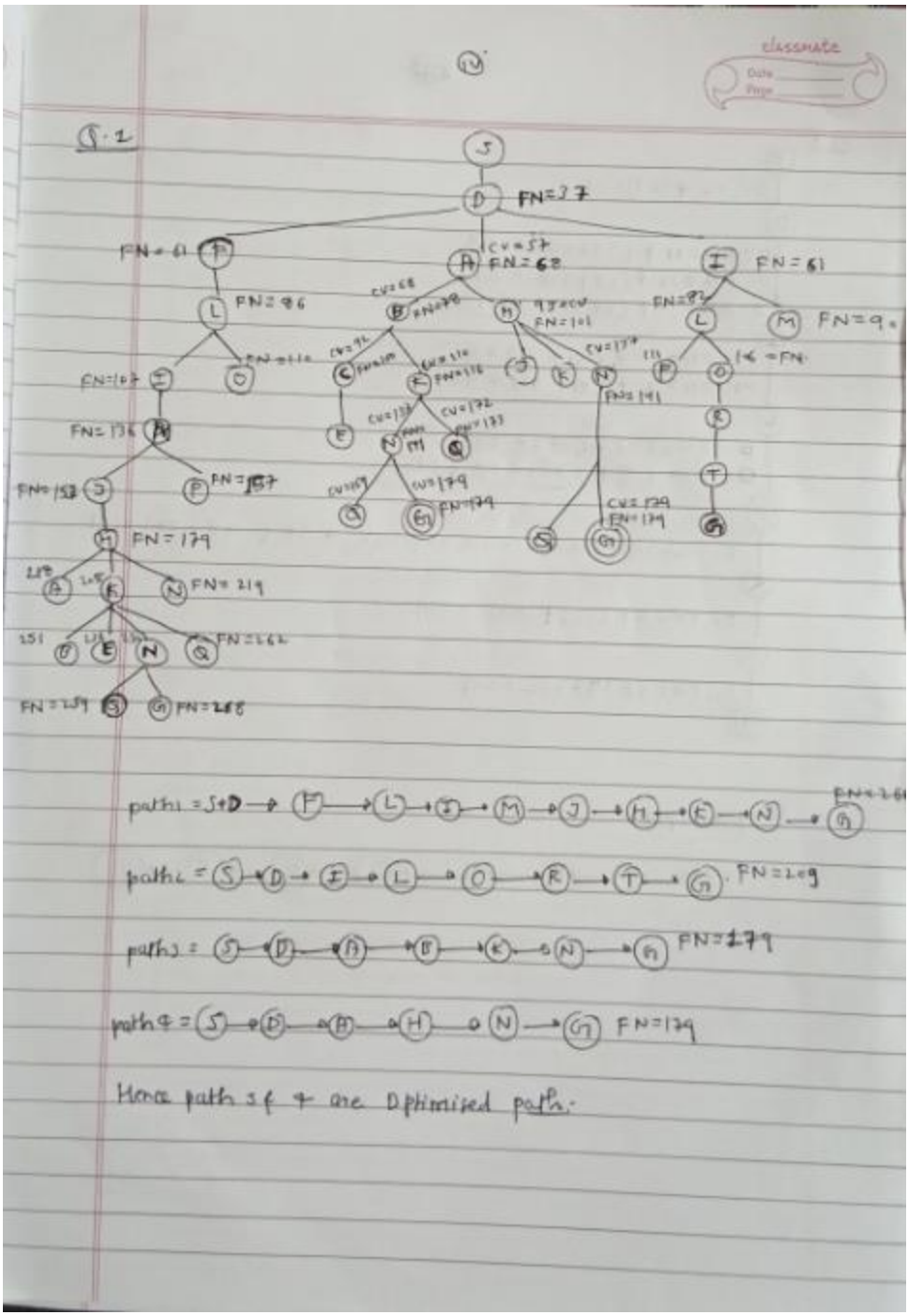


The length (cost) of each node is marked on graph. We the manHattan dist. as heuristic fun°. Assume that each square side on the grid is 10 Km.

→ finding heuristic value for every node by manHattan distance

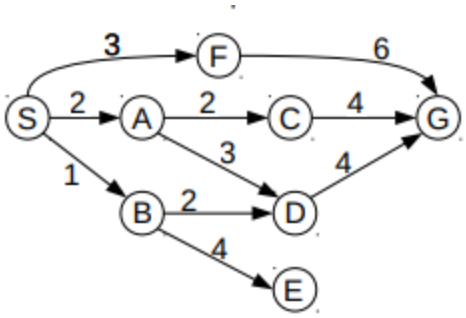
EV(S): $|8-0|+|6-0|=14$
EV(P): $|8-0|+|4-0|=12$
EV(L): $|8-0|+|2-0|=10$
EV(D): $|7-0|+|5-0|=12$
EV(I): $|7-0|+|3-0|=10$
EV(O): $|7-0|+|1-0|=8$
EV(R): $|6-0|+|0-0|=6$
EV(A): $|5-0|+|6-0|=11$
EV(J): $|5-0|+|3-0|=8$
EV(M): $|5-0|+|2-0|=7$
EV(B): $|4-0|+|6-0|=10$

EV(H) = 8
EV(P) = 5
EV(C) = 8
EV(K) = 6
EV(N) = 4
EV(T) = 2
EV(E) = 5
EV(Q) = 1
EV(G) = 0



Q2.

1. Consider below a directed graph given and corresponding heuristic function values given in the table.

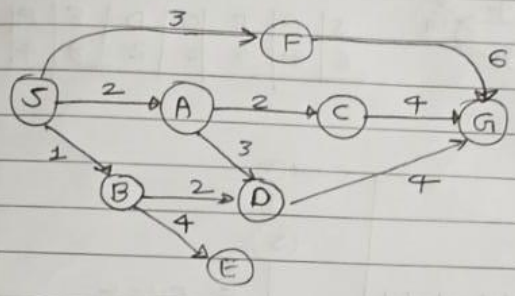


heuristic function (goal state: G)

S	A	B	C	D	E	F	G
6	4	5	2	2	8	4	0

a. Implement A* algorithm and Best first search algorithm to identify an optimal path from Starting state S to goal state G.
b. What will be the time and space complexity?

Q.2 ☆ Consider below a directed graph given and corresponding heuristic function values given in the table.



heuristic fun^c (goal : G)

S	A	B	C	D	E	F	G
6	4	5	2	2	8	4	0

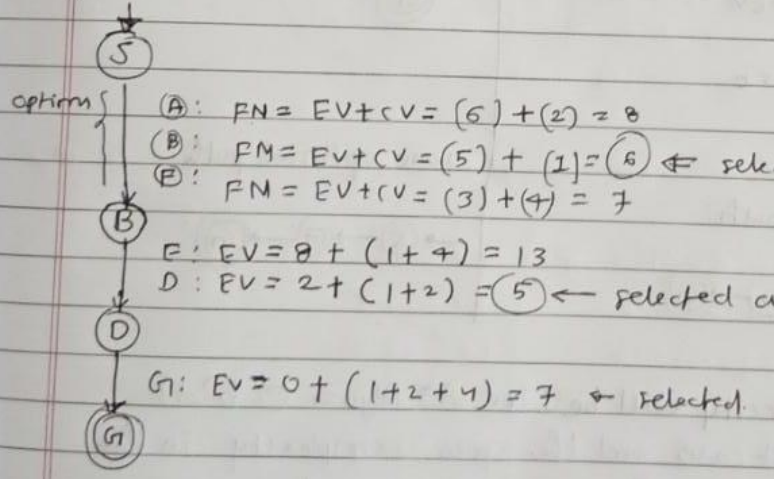
(a)

(1) optimal path using A* Algo from (S) to (G) state.

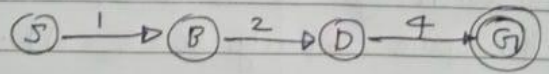
Let Fitness number = FN

Evalution Number (value) = EV & FN = EV + CV

Cost value = CV ↳ heuristic fun^c

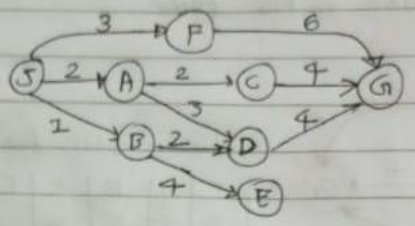


∴ optimal path using A* Algo :



(II)

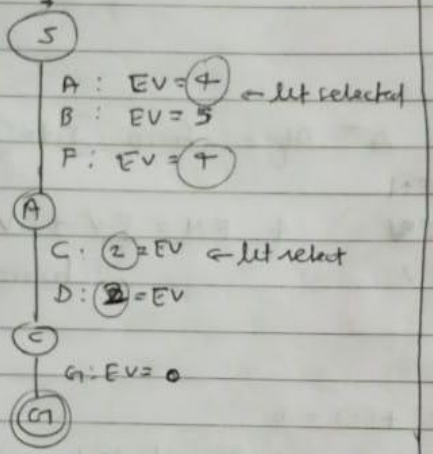
Q2 a. (II) finding optimal path using Best First Search



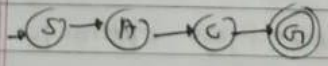
Evaluation value (goal G)

S	A	B	C	D	E	F	G
6	4	5	2	2	8	4	0

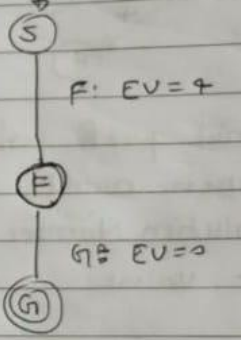
Case (I)



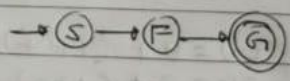
Here optimal path:



Case (II)



Here optimal path



(2) Time complexity will be (1) for A* Algo = $O(b^d)$ in the worst case and the space complexity in the worst case is O(N), when it is skewed.

(2) for Best-First search Algo: $T_C = O(h*d)$ in the worst case and the space complexity $S_C = O(N)$.

→ TC of BFS is also represented = $O(N \log N)$

where N = Number of Node

Q3.

Consider the following logic puzzle: In five houses, each with a different color, live five persons of different nationalities, each of whom prefers a different brand of candy, a different drink, and a different pet. Given the following facts, the questions to answer are "Where does the zebra live, and in which house do they drink water?"

The Englishman lives in the red house.
The Spaniard owns the dog.
The Norwegian lives in the first house on the left.
The green house is immediately to the right of the ivory house.
The man who eats Hershey bars lives in the house next to the man with the fox.
Kit Kats are eaten in the yellow house.
The Norwegian lives next to the blue house.
The Smarties eater owns snails.
The Snickers eater drinks orange juice.
The Ukrainian drinks tea.
The Japanese eats Milky Ways.
Kit Kats are eaten in a house next to the house where the horse is kept.
Coffee is drunk in the green house.
Milk is drunk in the middle house.

Discuss different representations of this problem as a CSP. Why would one prefer one representation over another?

Ans

Q.3. The given constraint satisfaction problem can be represented as:→

House	Yellow	Blue		Ivory	Green
Nationality	Norwegian				
Drink			Milk		
Candy	kitkats				
Pet					

↓ with the given data

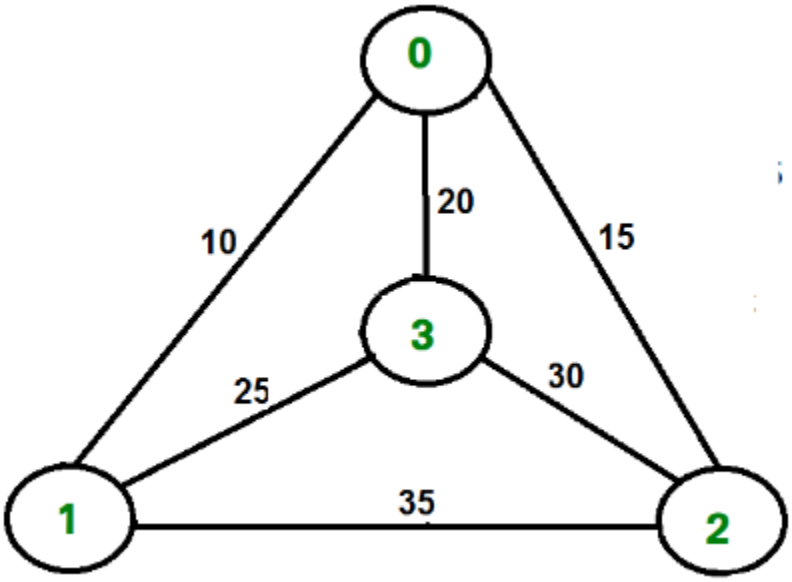
House	Yellow	Blue	Red	Ivory	Green
Nationality	Norwegian	Ukranian	English	Spaniard	Japanese
Drink	Water	Tea	Milk	Orange Juice	Coffee
Candy	kitkats	Hershey bar ~~Smarties~~	Smarties	Snickers	Milky way
Pet	Fox	Horse ~~Snails~~	Snails	Dog	Zebra

So Answer should be:→

The Zebra lives in the Green house.
They Drink water in Yellow House.

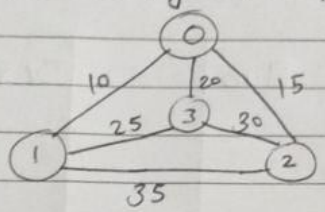
Q4.

Given a set of cities and distance between every pair of cities, the problem is to find the shortest possible tour that visits every city exactly once and returns to the starting point.



Identify the optimal path and implement this TS problem using branch and bound concept.

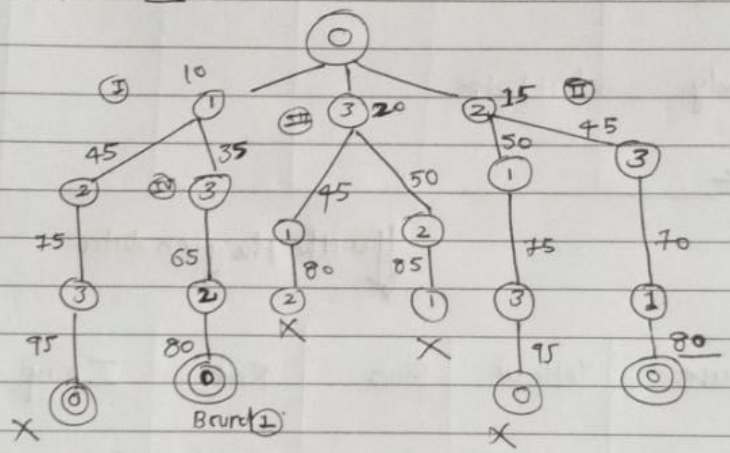
Q4. Given a set of cities and distance bet every pair of cities, the problem is to find the shortest possible tour that visit every cities exactly once & return to starting point.



→ finding optimal path using branch & Bound

Ans

Let start with → 0

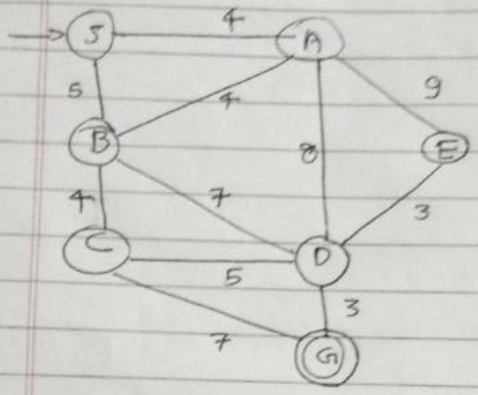


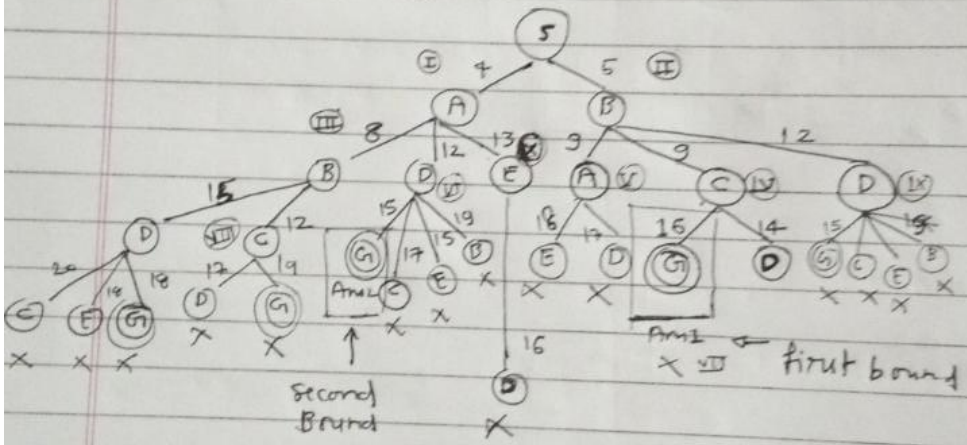
∴ optimal path: ① : 0 → 1 → 3 → 2 → 0

path: ② : 0 → 2 → 3 → 1 → 0

Q5.
Using branch and bound identify optimal path of below graph from starting state S to goal state G.

Q.5 Using branch & bound identify optimal path of below graph from starting state S to goal state G.





→ Here first bound is 16, which will be replaced by second bound 15 which is less thus more optimized path it is.

→ Therefore optimal path : S → A → D → G.

i.e S → A → D → G.