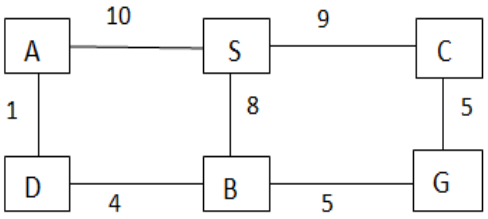
Artificial Intelligence

Written Assignment - 1

Q1. Multiple bombings have been sighted in different locations of the city. Each located at position *(xi, yi)*, having possible casualty counts of *ci*. Bomb at each location has a time *ti* to go off. The city has only a single bomb squad team. Time taken to diffuse a bomb is constant. The time taken by the team to reach from a place to another place is proportional to the distance between the two points.
Your task is to design a search algorithm with proper heuristics that may help in minimising the casualty count. Reason out why you have picked certain heuristic. Analyse the space and time complexity of your algorithm.

Q2. Find the minimum cost path from start state to goal state using IDA* algorithm. The heuristic values are given in the table below. Explain the steps in detail.



Heuristic Values:

Start -> S	0
A	0
B	4
C	3
D	0
Goal -> G	0

Q3. What is the probability of finding an optimal solution of 10, using one-point crossover with initial number of parent chromosomes as,

p1 – 17

p2 – 21

p3 – 4

p4 - 28

Justify your answer.

Q4. Give PEAS description for different agent types.

a. Medical Diagnosis System

b. Refinery Controller

c. Amazon Go

Q5. Let h*(x) be the shortest distance between a state x and a goal state. Let h(.) be a heuristic that over-estimates h*(x) by at most ϵ, i.e., for all states x, h(x)<= h*(x)+ϵ. Assume that h() still assigns 0 to all goal states. Prove that A* tree search using h finds a goal state t whose cost is at most more than the optimal goal. Formally, if s is the start state and t is the goal state returned by A*, then g(t)<= h*(s) +ϵ.

Q6. DRDO created a missile called Octopus. Octopus can fire 8 missiles in 8 different directions simultaneously up to range 10K kms. Now, DRDO wants to test this missile and have taken to destination **D**. Since this weapon is one of the best researches done by scientists, therefore, many enemies want to steal this weapon. Because of this, DRDO encrypted octopus missile launching commands and can be only decrypted through particular 2 keys. So, even if enemies stole it they are not able to use.

Now, Octopus has safely reached to its destination **D** and now its time to transfer keys from station $\mathbf{S}_i$ and $\mathbf{S}_j$ to **D**. Keys can be transferred with either gap of 1 station or gap of 4 stations. There are 50 such stations which are connected to each other in a linear fashion i.e. $\mathbf{S}_m$ is connected to $\mathbf{S}_{m+1}$ and D is at 50th station. Also, transfer of two keys should happen simultaneously from station i.e., While Key 1 is enroute, Key 2 need to enroute too.

Write a search algorithm to find the minimum number of transfers needed and its sequence required to reach destination **D** from $\mathbf{S}_i$ and $\mathbf{S}_j$ where **i** and **j** lie in the range **[1,49]**. Assume that keys are sent from both the stations simultaneously and need to reach the destination at the same time. If the solution is not possible then give output -1. Also Reason out, why the approach will give correct output.