Note: Do write the data structure and detailed procedure of each output. Please answer five questions out of six. Quaestions 1 to 4 are compusalory.

Q1- For each of the following graph search strategies, work out the order in which states are expanded, as well as the path returned by graph search. In all cases, assume that ties are resolve in such a way that states with earlier alphabetical order are expanded first. The start and goal states are S and G, respectively. Remember that in graph search, a state is expanded only once. The flowing figure (fig.1) illustrate the problem. **[5*5=25]**
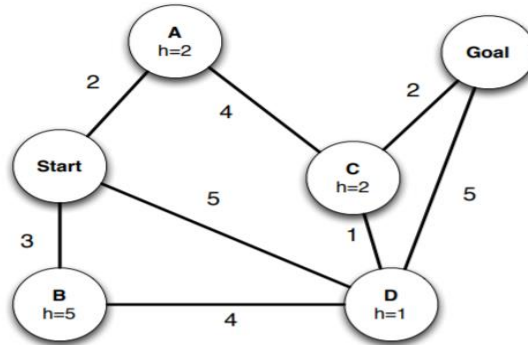

Fig.1

1. Depth-First Search.   2-Breadth First Search.   3- Uniform-Cost Search.
4. Greedy search with the heuristic h shown in the graph. 5- A* search with the same heuristic.

Q2- You want to predict if movies will be profitable based on their screenplays. You hire two critics A and B to read a script you have and rate it on a scale of 1 to 5 (1-low and 5 best). The critics are not perfect; here are the 5 data points including the critics' scores and the performance of the movie **[5+2*10=25]**

Movie Name	A	B	Profit?
Pellet Power	1	1	No
Ghosts!	3	2	Yes
Pac is Bac	4	5	No
Not a Pizza	3	4	Yes
Endless Maze	2	3	Yes

Table1: Training Data

(1)-First, you would like to examine the linear separability of the data. Plot the data on the 2D plane; label profitable movies with + and non-profitable movies with - and determine if the data are linearly separable.

(2)- Now you first decide to use a perceptron to classify your data. This problem will use the multi-class formulation even though there are only two classes. Suppose you directly use the scores given above as features, together with a bias feature. That is $f_0 = 1$, f_1 = score given by A and f_2 = score given by B. You want to train the perceptron on the training data in Table 1. The initial weights are given below:

Profitable	Weights	Weights after 1st update
Yes	[-1, 0, 0]	
No	[1, 0, 0]	

Table 2 : Weight Table

(i) Which is the first training instance at which you update your weights?

(ii) In the table 2 above, write the updated weights after the first update.

Q3- It's election season, and the chosen president may or may not be the Green Party candidate. Pundits believe that Green Party presidents are more likely to legalize Marijuana than candidates from other parties, but legalization could occur under any administration. Armed with the power of probability, the analysts model the situation with the Bayes Net below. Refer Fig.2 **[3*5=15]**
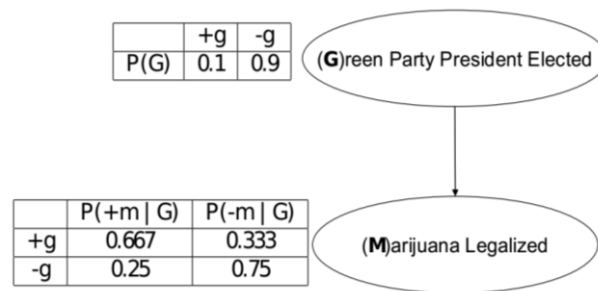
	+g	-g
P(G)	0.1	0.9

(**G**)reen Party President Elected

	P(+m | G)	P(-m | G)
+g	0.667	0.333
-g	0.25	0.75

(**M**)arijuana Legalized

Fig.2

(1)- Fill in the joint probability table over G and M in table3.

G	M	P(G,M)
+g	+m	
+g	-m	
-g	+m	
-g	-m	

Table-3

(2)- What is P (+m), the marginal probability that Marijuana is legalized?

(3)- News agencies air 24/7 coverage of the recent legalization of marijuana (+m), but you can't seem to find out who won the election. What is the conditional probability P (+g | +m) that a Green Party president was elected?

Q4: Consider the Bayes' net given below in fig.3. Remember that X ⊥⊥ Y reads as " X is independent of Y given nothing", and X⊥⊥Y|{Z, W} reads as "X is independent of Y Given Z and W. Which one is true?

1- **A ⊥⊥ B**   2- **A ⊥⊥ D|E**   3- **F⊥⊥ A|H**   4- **D⊥⊥ I| {E, G}**   5- **F⊥⊥ H|A**   **[2*5=10]**
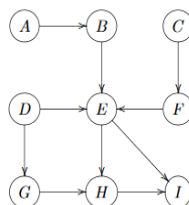

Fig.3

Q5- Considered the multilayer neural network (MLN) with 2 input, 1 hidden layer with 3 neurons and one output class. The chromosome could of order chain of weights. Each gene comprises of the weights arc that connect neurons from one to another layer. The fitness function is the reciprocal of sum of square of error of trained neural network with fixed epoch. Crossover can be performed by swapping the genes and mutation can be performed by randomly adding or subtraction small value between 0 and 1 from randomly selected gene. Refer Fig.4. Find the optimal weight set of MLN using genetic algorithm. **[25]**

W12	W23	W11	W13	W21	W23

Fig.4

Or

Q6- In this problem, three missionaries and three cannibals must cross a river using a boat which can carry at most two people, under the constraint that, for both banks, that the missionaries present on the bank cannot be outnumbered by cannibals. The boat cannot cross the river by itself with no people on board. Proposed the state space search graph and solve using depth first search order. **[25]**