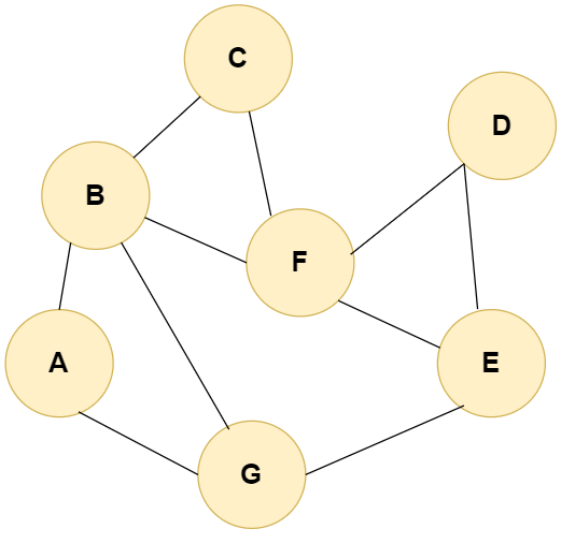
BRAC UNIVERSITY
Department of Computer Science and Engineering
CSE 422: Artificial Intelligence
Assignment -02

Question-01



a) Formulate the variable, domain, constraint, and the goal of the problem.
b) Based on the variable ordering procedure, mention the order of variables to be assigned with a digit. Provide an adequate explanation for your order.
c) Consider that node B already has digit 1 and all the other nodes are empty. If you are to provide a digit to node E next, which digit should you pick? Identify your choice based on value selection procedure.
d) If node F has digit 1, node G has digit 2 and the rest of the nodes are unassigned, does the constraint graph remain arc consistent? Why or why not? Explain.

Question-02

Covid	Diagnosed	Fever
Yes	Yes	Yes
Yes	Yes	No
Yes	No	Yes
Yes	No	No
No	Yes	Yes
No	Yes	No
No	No	Yes
No	No	No
Yes	Yes	Yes
Yes	Yes	No
Yes	No	Yes
Yes	No	No

a) From the given dataset generate a Joint Probability Distribution Table
b)From the Joint Probability Distribution table generated in (a), find the probability that a patient has covid but no fever given the patient is diagnosed with as covid positive
c)From the Joint Probability Distribution table generated in (a), find the probability that a patient has fever given the patient is diagnosed and is covid positive

Question-03

Wizarding Pet	Weight (Kg)	House Color	Magical Companion?
Hippogriff	9	Black	No
Kneazle	8	Orange	Yes
Hippogriff	15	White	No
Hippogriff	13	Orange	Yes
Owl	11	White	Yes
Owl	5	White	Yes
Hippogriff	9	Black	No
Kneazle	11	Orange	No
Kneazle	12	Black	Yes
Owl	6	White	Yes

In the wizarding world, magical creatures are considered heavy if they weigh more than 10kg. Now, answer the following questions:

a) Is Hippogriff conditionally independent of being heavy? Show full calculation.

b) Given a heavy-weighted orange Kneazle, is it more likely to be a magical companion or not? Apply the Naïve Bayes theorem to solve it. (No need to show the learning phase.)

Question-04

Dog_ID	Fur Color	Size	Tail_Length	Disease?
1	Black	Large	5.6	NO
28	White	Large	2.2	YES
3	Black	Small	3.8	YES
34	Black	Small	4.2	YES
26	Black	Large	1.2	NO
11	White	Small	2.3	NO
32	Black	Small	3.5	YES
13	White	Large	1.4	NO

a) Apply ID-3 and figure out among the 3 features which is best suited for being the root node of a decision tree.(Fur Color, Size, Tail_Length)
b) If an event X has n possible outcomes each with probabilities p1, p2,...., pn, then the entropy of X is defined as H(X) = -p1log2(p1) -p2log2(p2) ..... -pnlog2(pn) . If n = 8, what is the maximum possible value for H(X)? When does it happen?

Question-05:

In a linear regression model we relate the output y with input feature x using the formula $y=w_0+ w_1x$.

Now for each of the datatables given below, using Least Square Method estimate the value of w and w1. Then use the Gradient Descent algorithm to improve your estimation. Let the learning parameter be a constant.

Table 1.

X	Y
0	3
0.10101	3.20202
0.20202	3.40404
0.30303	3.606061
0.40404	3.808081
0.505051	4.010101
0.606061	4.212121
0.707071	4.414141
0.808081	4.616162
0.909091	4.818182