BRAC UNIVERSITY
Department of Computer Science and Engineering

Examination: Semester Final   Semester :Summer 2023
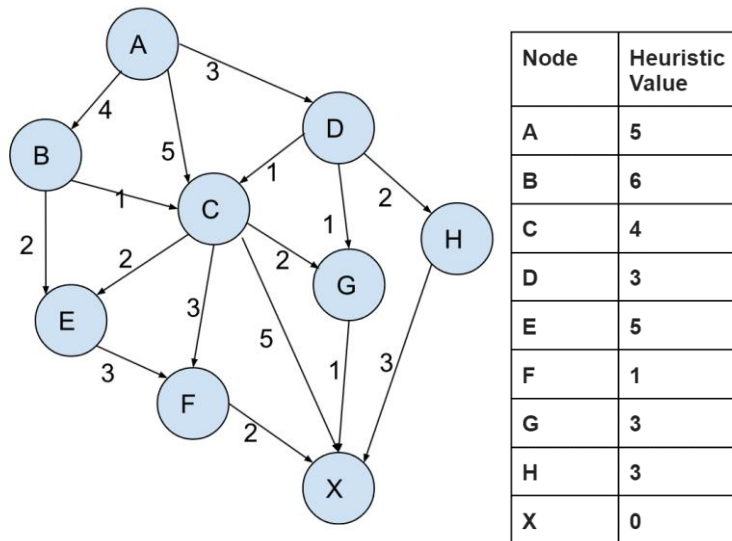Duration: 1 Hour 50 Minutes   Full Marks: 40

CSE 422: Artificial Intelligence (Set A)
Answer all the questions from 1-3. Answer any one of the questions from 4.
Figures in the right margin indicate marks.

Name:	ID:	Section:

1. CO1

Node	Heuristic Value
A	5
B	6
C	4
D	3
E	5
F	1
G	3
H	3
X	0

In the above graph, A is the source node and X is the destination node.

a. For which one of the nodes, the heuristic values are not admissible? **Why**?   3

b. **Apply** A* search on the graph. What is the path found from A to X? Is it the optimal path? If not, which   7
one is the optimal path?

2. CO4   a. **What** can be the smallest value of Entropy(Decision) ? When we get the smallest value ?   2
b. **Draw** "proportion of positive examples" vs "Entropy" curve in a binary classification problem.   2
c.   6

ID	Rain	Temperature	Remaining topic	Class cancelled ?
1	yes	hot	A few	yes
2	yes	hot	A lot	yes
3	yes	normal	A few	yes
4	no	cold	A few	no
5	no	cold	A lot	no
6	yes	cold	A few	yes
7	yes	cold	A lot	no

Find the root node of a decision tree on "Class cancelled ?" from the table above

3. CO3

X	Y	Z	Outcome
a	c	f	0
a	d	e	1
a	d	e	0
b	d	f	0
b	c	f	1
b	d	f	1

a. Applying Naive Bayes theorem, **find** the likelier outcome if the observed values of X, Y and Z are a, c and e. 5

b. Assume someone has given you a stock of jerseys of Chelsea Football Club bought from 2 different shops, A and B. Now out of all the jerseys, 30% are from Shop A, in which out of every 50 jerseys one of them is fake. Again, out of every 100 jerseys from shop B, one of them is fake. Now **calculate** the probability that a randomly chosen jersey from the stock will be fake. 2.5

c. 2.5

	Quiz = Pass	Quiz = Fail
AI = Fail	0.1	0.2
AI = Pass	0.6	0.1

	Mid = Pass	Mid = Fail
AI = Fail	0.2	0.2
AI = Pass	0.5	0.1

Suppose you have three events AI Grade, Quiz, and Mid. Here each event has two possible outcomes, either pass or fail. Additionally, given that AI Grade is observed, Quiz and Mid become independent of each other. Also, out of every 100 students, 70 students pass the AI course. Now, using the joint probability tables given below, **calculate** P(AI Grade = Fail , Quiz = Fail, Mid = Fail).

4. CO4

a. The initial hypothesis of a linear classifier for a two input OR gate is $0.25X1 - 0.50X2 - 1.25 = 0$. Find the updated equation after all the input examples are processed once. **Use** sigmoid function and a learning rate of 0.2 in your calculations. 6

b. Has learning rate have any influence on learning? How can you **modify** the learning rate during learning to affect the learning behavior? 2

c. **Find** the derivative of the sigmoid function at $X = 0$ 2

OR,

X	Y
2	11
4	23
6	28

Suppose, given a set of data samples in the table above, you are to fit the data points with a straight-line hypothesis $Y = mX + c$, where m is the slope and c is the y-intercept. The values of X and Y come from the data samples.

a. If the initial value of m is 9 and c is 2, **calculate** the error produced by the proposed hypothesis mean square error (MSE) or sum of square residual (SSR) function. 2

b. **Update** the m and c values with one iteration of gradient descent. If applicable, you can assume a learning rate of 0.001 8