Section A (40 Marks)

1. Aisha is a Poultry Farmer who is struggling with management of the farm. As a student of Artificial Intelligence advise Aisha on how she can use Artificial Intelligence to improve on the management of her poultry farm. Hint Use atleast three scenarios when providing the advise [**6 marks**]

2. KCCA is in the process of developing a Traffic Surveillance Monitoring Robot

   (a) State any two performance measure for the robot [**2 marks**]

   (b) Is the environment for the Robot static or dynamic? Explain your answer. [**2 marks**]

   (c) List any two percepts for the Robot? [**2 marks**]

   (d) state the sensor(s) needed for collecting the percepts mentioned in (2c)? [**2 marks**]

3. (a) When performing graph search, two lists are used. Mention these two lists stating clearly the purpose of each list as the search progresses [**4 marks**]

   (b) Explain why Iterative Deepening algorithm is preferred over Depth First search and Breadth First search in the development of search application based on uninformed search [**4 marks**]

   (c) For A^* graph search to be optimal, the heuristic used must be admissible and consistent. With an illustration explain why the heuristics must meet these two requirements. [**6 marks**]

4. (a) When would you consider using Simulated Annealing algorithm instead of A* search algorithm? [**2 marks**]

   (b) Joy has been experimenting with the 16-queen number puzzle game to find out the average expected number of moves needed to play the game efficiently when no side moves are allowed. From her experiments, she has found out that the probability of succeeding is **0.04**, the average number of moves per trial are 200 when succeeding and 150 when getting stuck. Basing on this information find the average expected number of moves for the game. [**3 marks**]

5. Explain why auctioning for a textbook at a school fundraising is termed as game playing in artificial intelligence? [**3 marks**]

6. (a) Explain why the K-nearest neighbor classifier called a majority vote? [**2 marks**]

   (b) Why is it recommended that k should be odd? [**2 marks**]

Section B. Attempt any 3 questions (20 Marks each).

Question 1

(a) Explain the general operation of the following local search algorithms.[**15 marks**]

(i) Hill climbing

(ii) Genetic algorithm

(iii) Beam search algorithm

(b) With an illustration, discuss the minimum conflict heuristic as applied to local search. [**5 marks**]

Question 2

(a) Explain what you understand by the term zero-sum game in relation to adversarial search [**3 marks**]

(b) Explain the minimax algorithm for a zero-sum game. What assumption are applied during its formulation? How would you modify it to work for games which are none zero-sum or having multiple players? [**9 marks**]

(c) With an illustration, explain how you would modify a game tree for a game with chance outcomes? [$3\frac{1}{2}$ **marks**]

(d) Consider the game tree in figure 1. Complete the game tree by filling in values for A, B, C, D, E, F, G, H and I. [$4\ \frac{1}{2}$ **marks**]

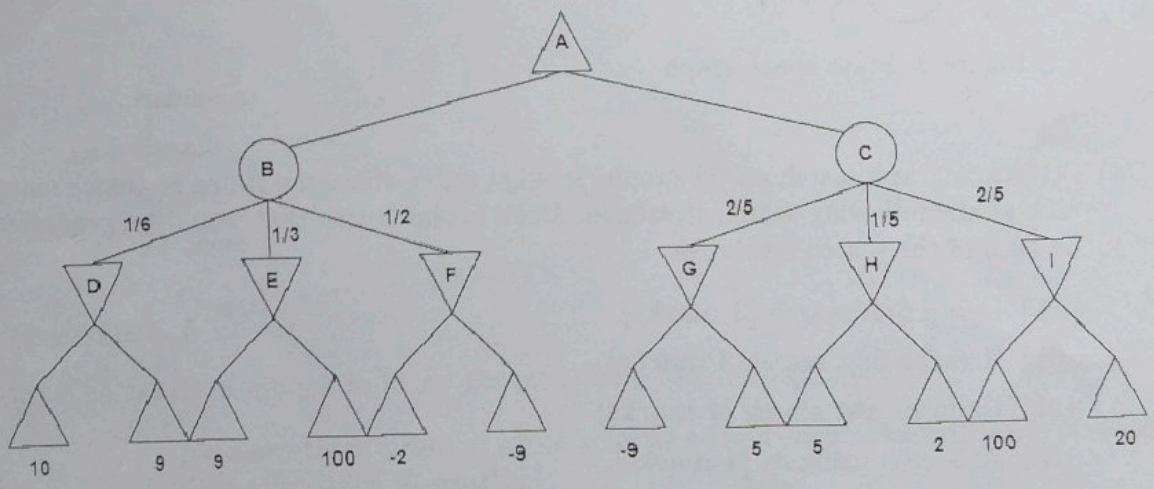
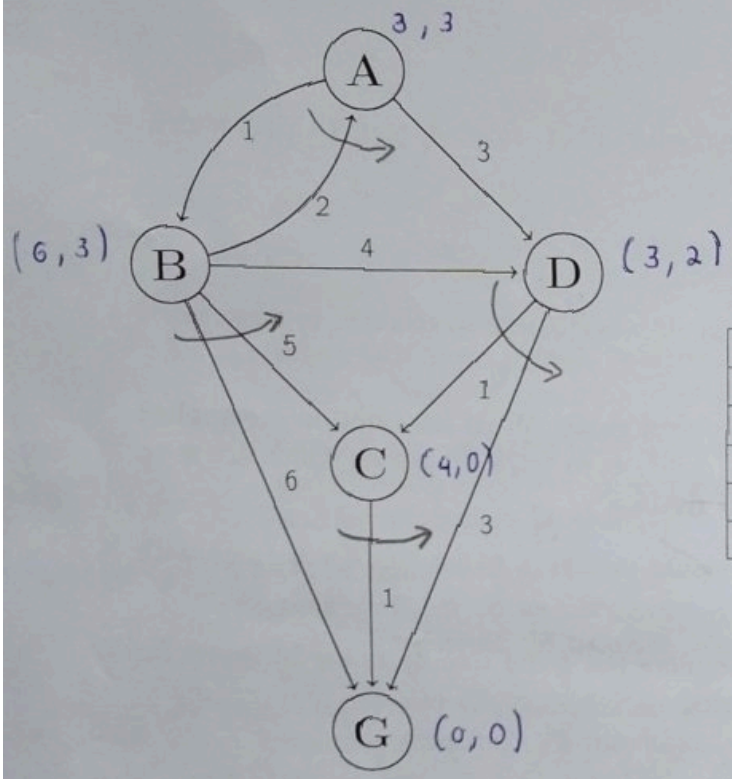


Figure 1: Game tree

Question 3

Consider the state space graph shown in Figure 2 (A is the initial state and G is the final state,numbers on the links are link costs). We can search it with a variety of different algorithms, resulting in different search trees. The table besides the graph provides heuristic information h_1, h_2 for each of the states. Assuming that children of a node are visited in alphabetical order whenever there is a tie.



Node	h_1	h_2
A	3	3
B	6	3
C	4	0
D	3	02
G	0	0

Figure 2: State space graph

(a) Perform a graph search on the graph. In what order would the states be search using each of the following search strategies. Draw a search tree that would be generated by each of the search strategies.

(i.) Depth first search [**3 marks**]

(ii.) Breadth first search[**3 marks**]

(iii.) Uniform cost search [**4 marks**]

(iv.) A^* search using h_1 [**4 marks**]

(v.) A^* search using h_2 [**4 marks**]

(b) Explain what is meant by the term heuristic dominance? For the above heuristics h_1 and h_2 which one is dominant over the other [**2 marks**]

Question 4

During the 2022 Healthcare International AI conference presentation, Shaka convinced attendees that supervised learning techniques performed better than unsupervised learning techniques for his disease classification problem. He further justified his argument by showing the precision, recall, accuracy and F1-score of the best supervised Learning model although he failed to select the best model evaluation metric for his classification problem.

(a) Explain any three supervised learning techniques used by Shaka's classification problem. **[6 marks]**

Classification
Regression
Navie bayes

(b) Describe any three unsupervised learning techniques that might not have performed well for Shaka's classification problem. **[6 marks]**

Association
clustering

(c) Study Shaka's confusion matrix in Table 1 then calculate and explain the following. **[2 marks each]**

Table 1: Confusion Matrix

		Predicted label	
Actual label		600	50
		TN	FP FN
		150	200
		FP	TP

(i.) Precision $\frac{TP}{TP+FP}$

(ii.) Recall $\frac{TP}{TP+FN}$

(iii.) Accuracy $\rightarrow \frac{TP}{(TP+FP+FN+TN)}$

(iv.) F1-Score $\rightarrow \frac{2 \times P \times R}{(P+R)}$

Question 5

(a) You are developing a Robbery Detection and Monitoring Agent.

(i.) Explain any three means in which your Agent will acquire knowledge to perform its task effectively. [**6 marks**] .

(ii.) Explain any three key knowledge information the agent needs to acquire as it performs its task. [**6 marks**]

(b) New knowledge can be acquired from already available knowledge either through entailment or proofs.

Figure 3: Wild life

(a)

(b)

(i.) Consider the images in Figure 3; Which of the two images is an entailment of the other. Give an explanation for your answer. [**4 marks**]

(ii.) What is a proof? With the use of examples explain any two methods used to handle poofs in knowledge representation. [**4 marks**]

End