

Revision ACCA6011

Question 1

1.1 Define a crisp set and a fuzzy set. Provide an example of each and explain how they differ in terms of membership?

1.2 Explain the concept of a triangular membership function in the context of fuzzy logic. Include a diagram to illustrate it and discuss its key characteristics.

1.3 Explain how fuzzy sets and membership functions can be used in a real-world application, such as a temperature control system.

1.4 Given a triangular membership function for the fuzzy set "warm" with parameters $a = 15^{\circ}\text{C}$, $b = 25^{\circ}\text{C}$ and $c = 35^{\circ}\text{C}$.

- Calculate the slope of the membership function for the increasing segment between **a** and **b** and define the membership function for this segment.
- Determine the membership value for a temperature of 20°C .

Question 2

2.1 Compare and contrast supervised and unsupervised learning, with an emphasis on their training process and data requirements ?.

2.2 You are tasked with developing a machine learning model for a set of real-world problems as in Table 1. In your answer booklet, complete the table by identifying the most suitable machine learning method (supervise or unsupervised or semi-supervised) and provide the reasoning for your selection.

Table 1: Learning problems

No	Learning problem	Suitable ML method (1 Mark)	Provide Justification (2 Mark)
2.2.1	A social media platform wants to remove inappropriate content automatically		
2.2.2	A healthcare provider wants to identify different patient segments based on their medical history.		

2.2.3	A language learning app wants to classify user feedback into positive, negative, or neutral sentiments.		
2.2.4	A news aggregator website wants to organize its articles into topics without having predefined categories.		

2.3 Explain the importance of splitting your data into training, evaluation, and testing sets in machine learning models. How do these splits contribute to the development and validation of the model?

2.4 Explain the impact of overfitting on machine learning model performance and name one technique to prevent overfitting.

Question 3

A major e-commerce company is working on creating an AI-driven recommendation system to enhance customer experience. The system aims to leverage browsing behaviour and purchase data to provide personalized product recommendations. K-Means is proposed for customer segmentation, while Genetic Algorithms will be used to optimize product bundles for marketing campaigns. Given the fast-paced advancements in AI and growing ethical concerns, the company is committed to ensuring its system adheres to responsible and ethical AI principles.

3.1 How can K-Means clustering be applied to segment customers based on their purchase history and browsing behaviour? Describe the steps involved in implementing K-Means clustering on customer data.

3.2 What steps can the company take to ensure transparency and accountability in its AI-driven recommendation system? Discuss the importance of explainability and user trust.

Question 4

4.1 Compare BFS and DFS in terms of:

- Search strategy

- Memory usage
- Optimality

4.2 How does Hill Climbing differ from BFS and DFS in terms of:

- Search space exploration
- Use of heuristics

4.3 Which search algorithm would you use for:

- Maze solving?
- Web crawling?
- Route planning?
- Scheduling or optimization problems?

4.4 Can Hill Climbing be used for problems with multiple goals? Explain.

4.5 What is a heuristic function? How is it used in Hill Climbing?