



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022**

COURSE NAME	:	FUZZY SYSTEM DEVELOPMENT
COURSE CODE	:	BIT 33703
PROGRAMME CODE	:	BIT
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	<ol style="list-style-type: none">1. ANSWER ALL QUESTIONS.2. THIS FINAL EXAMINATION IS AN ONLINE ASSESSMENT AND CONDUCTED VIA CLOSED BOOK.3. STUDENTS ARE PROHIBITED TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES



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Q1 Explain the architecture of fuzzy system using a diagram.

(10 marks)

Q2 Suppose a fuzzy subset F is defined as:

$$\mu_F = \begin{cases} 0 & \text{for } 0 \leq y \leq 30 \\ (y - 30) / 30 & \text{for } 30 \leq y \leq 60 \\ (90 - y) / 30 & \text{for } 60 \leq y \leq 90 \\ 0 & \text{for } 90 \leq y \leq 120 \end{cases}$$

(a) Based on the above definition, calculate the value of μ_F when the values of y are 45, 80 and 110.

(6 marks)

(b) Draw the graph to represent the above function.

(4 marks)

Q3 Figure Q3 shows the membership functions of speed.

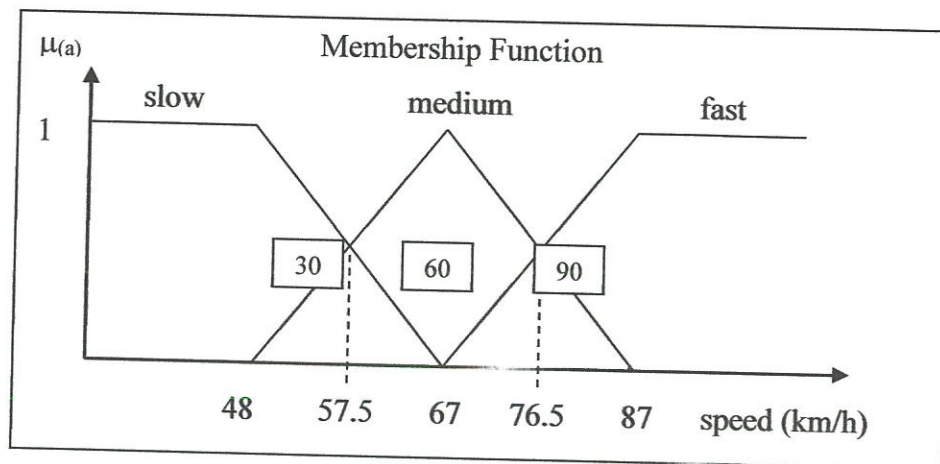


Figure Q3

(a) What is the Fuzzy Value if the speed is 55 km/h?

(6 Marks)

(b) What is the Fuzzy Value if the speed is 80 km/h?

(6 Marks)

- Q4** In a survey, students are compared based upon their score marks and activity participation. A universe of discourse of score marks is $X = \{0, 20, 40, 60, 80, 100\}$. The activity participation for the monitoring of a standard valuation provides typical membership functions to represent the achievement levels for each of the students; these are given below in standard discrete form:

$$\tilde{S}_1 = \left\{ \frac{0}{0} + \frac{0.5}{20} + \frac{0.65}{40} + \frac{0.85}{60} + \frac{1.0}{80} + \frac{1.0}{100} \right\}$$

$$\tilde{S}_2 = \left\{ \frac{0}{0} + \frac{0.45}{20} + \frac{0.6}{40} + \frac{0.8}{60} + \frac{0.95}{80} + \frac{1.0}{100} \right\}$$

Find the following membership functions using standard fuzzy operations:

(a) $\mu_{\tilde{S}_1} \cup \mu_{\tilde{S}_2}(x)$ (2 marks)

(b) $\mu_{\tilde{S}_1} \cap \mu_{\tilde{S}_2}(x)$ (2 marks)

(c) $\mu_{\tilde{S}_1}(x)$ (2 marks)

(d) $\mu_{\tilde{S}_1 \cup \tilde{S}_1}(x)$ (2 marks)

(e) $\mu_{\tilde{S}_1 \cap \tilde{S}_1}(x)$ (2 marks)

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Q5 Based on **Table 1**, answer **Q5(a) – Q5(d)**. Automatic Water Sprinkler System provides watering plants in a circular area around the sprinkler device. It is use the Fuzzy Logic method to identify the length of time watering the plant based on the temperature and humidity input.

Table 1: Automatic Water Sprinkle System

Variable	Categories	Range
Temperature	Very cold	10°C to 25°C
	Cold	20°C to 30°C
	Normal	25°C to 35°C
	Hot	30°C to 40°C
	Very hot	35°C to 50°C
Humidity	Very wet	Less than 30%
	Wet	10% to 50%
	Normal	30% to 70%
	Dry	50% to 90%
	Very dry	Greater than 70%
Watering Time	Too short	Less than 2 minutes
	Short	1 to 2 minutes
	Fairly short	2.5 to 5 minutes
	Medium	3.5 to 6.5 minutes
	Fairly long	5 to 7 minutes
	Long	7 to 9 minutes
	Too long	8 to 10 minutes

- (a) Design a fuzzy system which accommodates the given situation. (4 marks)
- (b) Describe the linguistic variable and the linguistic value. (8 marks)
- (c) Draw a membership function graph for each system input and output. (12 marks)
- (d) Construct a matrix of Fuzzy Associative Memory (FAM). (14 marks)

-END OF QUESTIONS -

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