UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER I
SESI 2009/2010

NAMA MATA PELAJARAN	:	PEMBANGUNAN SISTEM FUZZY
KOD MATA PELAJARAN	:	BIT 3373
KURSUS	:	3 BIT
TARIKH PEPERIKSAAN	:	NOVEMBER 2009
JANGKA MASA	:	2 JAM 30 MINIT
ARAHAN	:	JAWAB **SEMUA** SOALAN.

KERTAS SOALAN INI MENGANDUNGI SEBELAS (11) MUKA SURAT

Instruction: Answer **ALL** questions.

Q1 Why conventional logic is sometimes called two-valued?

(2 marks)

Q2 Define the different between linguistic variable and linguistic term/value.

(4 marks)

Q3 What are the contents of Fuzzy Knowledge Base?

(2 marks)

Q4 What is the purpose of aggregation?

(2 marks)

Q5 State **TWO (2)** basic Fuzzy Logic operators and its mathematical expressions.

(6 marks)

Q6 Briefly describe each step in designing fuzzy expert system as listed below.

(i) Fuzzification
(ii) Inference
(iii) Aggregation
(iv) Defuzzification

(12 marks)

Q7 Elaborate **FOUR (4)** steps in tuning a fuzzy system.

(8 marks)

Q8 Using common knowledge, experience, judgment, and perception, **construct and sketch** appropriate membership function for the following set:

(a) Food price in UTHM campus

(4 marks)

(b) Staff services at post office counter

(4 marks)

Q9 **Figure Q9** shows a membership function for engine speed.

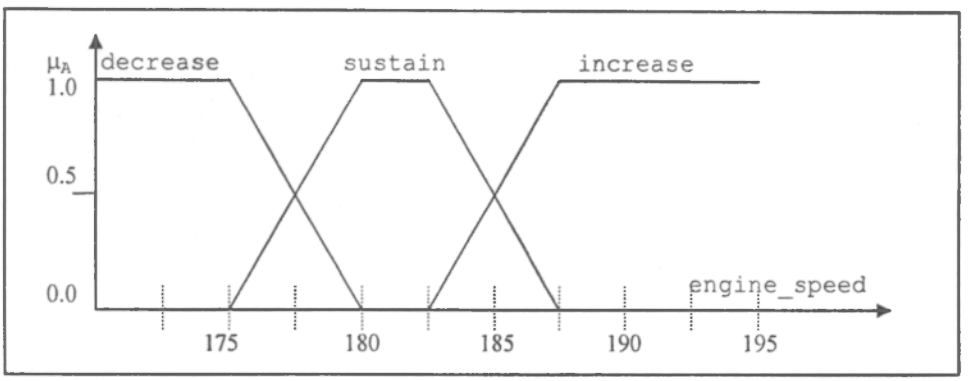


Figure Q9

What is the degree membership value for all fuzzy sets in **Figure Q9** if the input x is 178. Show the calculation.

(10 marks)

Q10 **Figure Q10** shows a membership function for linguistic variable temperature.

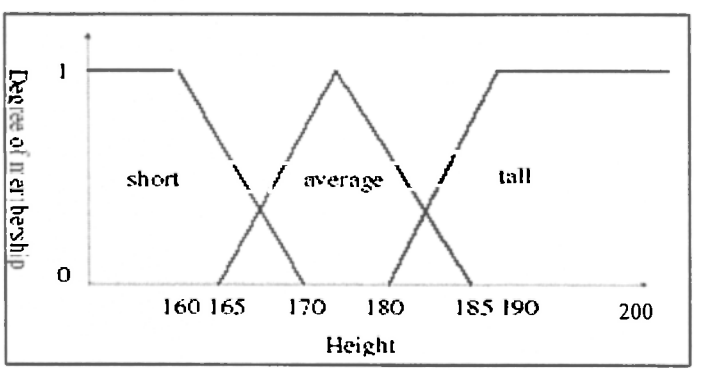


Figure Q10

How does a membership function for fuzzy set **NOT short** look like?

(3 marks)

Q11 **Table Q11** shows a Fuzzy Associative Memory (FAM) for a video game monster. HP and FP indicate 'Hit Points' and 'Fire Power' respectively.

Table Q11

HP/FP	Very low HP	Low HP	Medium HP	High HP	Very high HP
Very weak FP	Retreat	Retreat	Defend	Defend	Attack
Weak FP	Retreat	Defend	Defend	Attack	Attack
Medium FP	Retreat	Defend	Attack	Attack	Full attack
High FP	Retreat	Defend	Attack	Attack	Full attack
Very high FP	Defend	Attack	Attack	Full attack	Full attack

(a) Based on **Table Q11**, construct **ONE (1)** rule using union operation and **ONE (1)** rule using intersect operation.

(4 marks)

(b) Determine the input variables used in **Table Q11**.

(1 mark)

(c) Determine the fuzzy values for the output variable used in **Table Q11**.

(1 mark)

Q12 **Figure Q12** shows a membership function for an output variable.

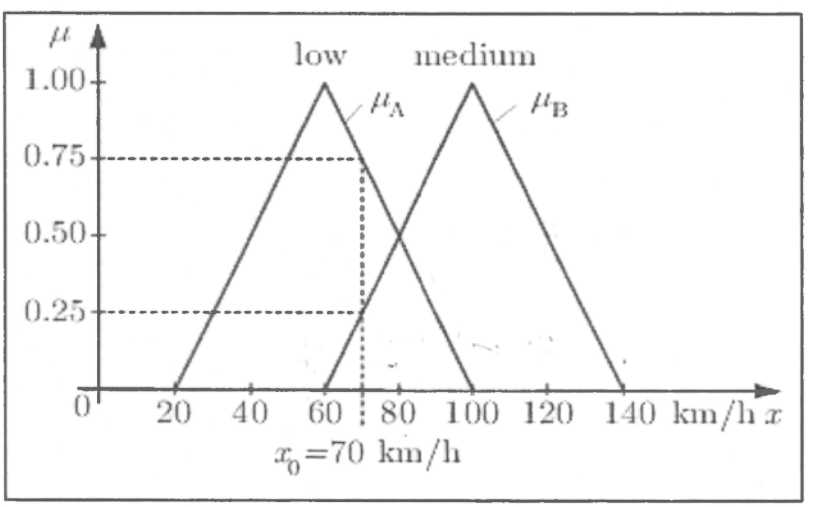


Figure Q12

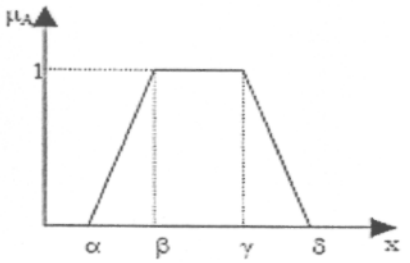
(a) Calculate the crisp output using **TWO (2)** defuzzification methods; Center of Gravity and Weighted Average. Assume that the fuzzy value for `low` is `0.50` and `medium` is `0.25`. Use the membership function graph in **Figure Q12** to support your calculation.

(6 marks)

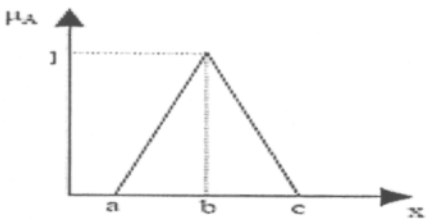
(b) Give a suitable linguistic variable for **Figure Q12**.

(1 mark)

Appendix



$$\Pi(x;\alpha,\beta,\gamma,\delta) = \begin{cases} 0 & \text{for } x < \alpha \\ (x-\alpha)/(\beta-\alpha) & \text{for } \alpha \le x \le \beta \\ 1 & \text{for } \beta \le x \le \gamma \\ (\delta-x)/(\delta-\gamma) & \text{for } \gamma \le x \le \delta \\ 0 & \text{for } x > \delta \end{cases}$$



$$\Delta(x;a,b,c) = \begin{cases} 0 & \text{for } x < a \\ (x-a)/(b-a) & \text{for } a \le x \le b \\ (c-x)/(c-b) & \text{for } b \le x \le c \\ 0 & \text{for } x > c \end{cases}$$

Arahan: Jawab **SEMUA** soalan.

S1 Kenapakah logik konvensional juga dikenali sebagai '*two-valued*'?

(2 markah)

S2 Terangkan perbezaaan antara pembolehubah linguistik dan nilai linguistik.

(4 markah)

S3 Apakah kandungan yang terdapat di dalam '*Fuzzy Knowledge Base*'?

(2 markah)

S4 Apakah fungsi penggabungan?

(2 markah)

S5 Nyatakan **DUA (2)** operator asas Logik Kabur dan pernyataan matematiknya.

(6 markah)

S6 Terangkan secara ringkas setiap langkah dalam merekabentuk sistem pakar kabur yang disenaraikan di bawah.

(i) Pengaburan
(ii) Penaakulan
(iii) Penggabungan
(iv) Penyahkaburan

(12 markah)

S7 Huraikan **EMPAT (4)** langkah untuk memperbaiki suatu sistem kabur.

(8 markah)

S8 Dengan menggunakan pengetahuan umum, pengalaman, penilaian, dan persepsi, bina dan lakarkan fungsi keahlian yang bersesuaian bagi set berikut:

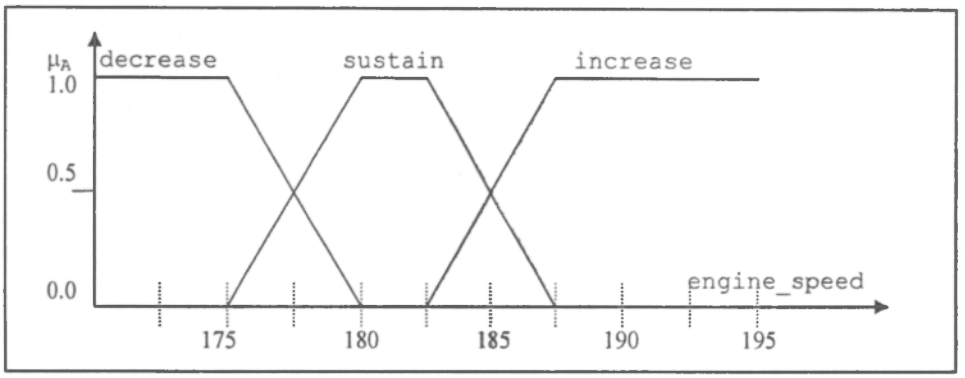
(a) Harga makanan di kampus UTHM

(4 markah)

(b) Perkhidmatan staf di kaunter pejabat pos

(4 markah)

S9 **Rajah S9** menunjukkan fungsi keahlian bagi '*engine speed*'.

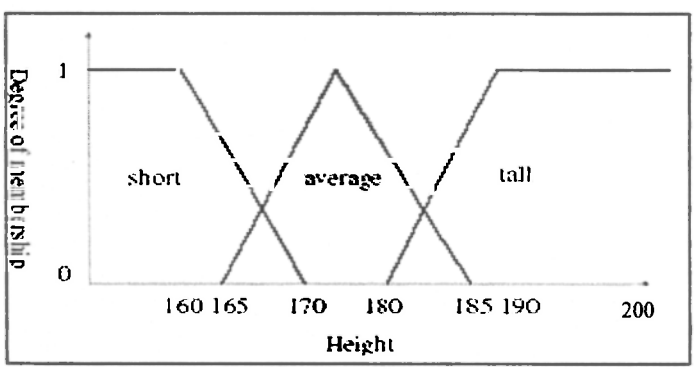


Rajah S9

Apakah nilai darjah keahlian bagi kesemua set kabur di dalam **Rajah S9** sekiranya input x ialah 178. Sila tunjukkan pengiraan anda.

(10 markah)

S10 **Rajah S10** menunjukkan fungsi keahlian bagi pembolehubah linguistik '*temperature*'.



Rajah S10

Bagaimanakah lakaran fungsi keahlian bagi set kabur **NOT short**.

(3 markah)

S11 **Jadual S11** menunjukkan '*Fuzzy Associative Memory (FAM)*' bagi permainan video '*monster*'. HP mewakili '*Hit Points*', manakala FP mewakili '*Fire Power*'.

Jadual S11

HP/FP	Very low HP	Low HP	Medium HP	High HP	Very high HP
Very weak FP	Retreat	Retreat	Defend	Defend	Attack
Weak FP	Retreat	Defend	Defend	Attack	Attack
Medium FP	Retreat	Defend	Attack	Attack	Full attack
High FP	Retreat	Defend	Attack	Attack	Full attack
Very high FP	Defend	Attack	Attack	Full attack	Full attack

(a) Berdasarkan **Jadual S11**, bina **SATU (1)** peraturan menggunakan operasi kesatuan dan **SATU (1)** peraturan menggunakan operasi tindanan.

(4 markah)

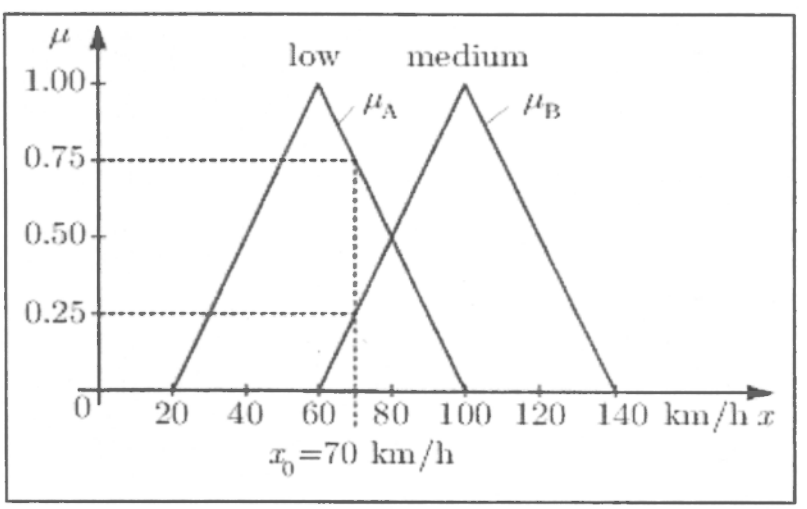
(b) Kenalpasti pembolehubah input yang terdapat di dalam **Jadual S11**.

(1 markah)

(c) Kenalpasti nilai kabur bagi pembolehubah output yang terdapat di dalam **Jadual S11.**

(1 markah)

S12 **Rajah S12** menunjukkan fungsi keahlian bagi suatu pembolehubah output.



Rajah S12

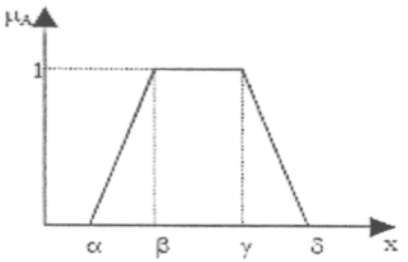
(a) Dapatkan nilai output krisp menggunakan **DUA (2)** kaedah penyahkaburan; *Center of Gravity* dan *Weighted Average*. Andaikan nilai kabur bagi `low` ialah `0.50`, dan `medium` ialah `0.25`. Gunakan graf fungsi keahlian pada **Rajah S12** bagi membantu pengiraan anda.

(6 markah)

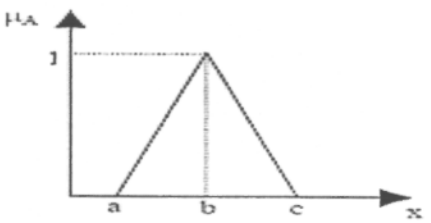
(b) Namakan/cadangkan pembolehubah linguistik yang bersesuian bagi **Rajah S12**.

(1 markah)

Apendiks



$$\Pi(x;\alpha,\beta,\gamma,\delta) = \begin{cases} 0 & \text{for } x < \alpha \\ (x-\alpha)/(\beta-\alpha) & \text{for } \alpha \le x \le \beta \\ 1 & \text{for } \beta \le x \le \gamma \\ (\delta-x)/(\delta-\gamma) & \text{for } \gamma \le x \le o \\ 0 & \text{for } x > \delta \end{cases}$$



$$\Gamma(x;a,b,c) = \begin{cases} 0 & \text{for } x < a \\ (x-a)/(b-a) & \text{for } a \le x \le b \\ (c-x)/(c-b) & \text{for } b \le x < c \\ 0 & \text{for } x > c \end{cases}$$