



**RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES**

B. Sc (General) Degree

Third Year – Semester I Examination – February/March 2013

COM 3303 – ARTIFICIAL INTELLIGENCE

Answer ALL questions .

Time allowed: three hours.

Calculators are provided.

1.

a) Using Truth Tables prove that “Nadika doesn’t like Chamara” based on Knowledge Base given below (P, Q, R).

P: Nadika likes Chamara if and only if Chamara has a car.

Q: Chamara will have car if and only if he passes the exam.

R: Chamara doesn’t pass the exam.

[30 marks]

b) Explain why it is difficult to use proposition logic to prove that Sanjeewa likes ice cream based on following sentences (L,M):

L: All students like ice cream.

M: Sanjeewa is a student.

[20 marks]

c) Mention unit resolution rule.

[10 marks]

d) Discuss three Inference Algorithms that can use for Proposition Logic.

[20 marks]

e) Explain how you would apply resolution rule for First Order Logic using a suitable example.

[20 marks]

2.

a) Explain difference between informed search and uninformed search using suitable examples.

[15 marks]

b) Mention two informed search algorithms.

[10 marks]

c) Compare and contrast Breath First Search (BFS) and Depth First Search (DFS).

[15 marks]

d) Point out two uninformed search algorithms.

[10 marks]

e) Briefly explain A* search algorithm.

[10 marks]

f) State two Admissible Heuristic Functions that can use to solve 8 puzzle problem with A* search.

[10 marks]

g) Apply A* search with Admissible Heuristic Function to solve given 8 puzzle in initial state (**Figure1**).Goal state is given in **Figure 2**. List all the steps in detail.

3	1	2
4		5
6	7	8

Initial state
Figure 1

	1	2
3	4	5
6	7	8

Goal state
Figure 2

[30 marks]

3.

a) Explain with suitable examples the importance of followings regarding Artificial Neural Networks (ANN).

- (i) Bias weight and value
- (ii) Hidden layers
- (iii) Non linear activation function
- (iv) Multilayer ANN

[40 marks]

b) Student A and B trained two ANNs with same structure , training data set, training algorithm and parameters . But these two ANNs produce different results for same inputs. Identify possible reason(s) for this situation.

[10 marks]

c) Explain how you would use ANN to develop to recognize handwritten characters for ten different characters. Explain the followings:

- i) Digitization of character images
- ii) Inputs and outputs of ANN
- iii) Method that you would identify character from the output of ANN

[40 marks]

d) What is meant by overfitting of an ANN? Explain how you would overcome overfitting.

[10 marks]

g) Apply A* search with Admissible Heuristic Function to solve given 8 puzzle in initial state (**Figure1**).Goal state is given in **Figure 2**. List all the steps in detail.

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4		5
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Initial state
Figure 1

	1	2
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Goal state
Figure 2

[30 marks]

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[40 marks]

d) What is meant by overfitting of an ANN? Explain how you would overcome overfitting.

[10 marks]

4.

a) Explain two different methods to implement AND and OR operators in fuzzy logic.

[16 marks]

b) Using suitable examples explain T-Norms and S-Norms.

[22 marks]

“Modern Toy” company wants to design a toy bicycle which can maintain its balance automatically. Company engineers plan to use fuzzy inference methods for this purpose. They decided to control movement of handlebar in order to maintain the balance of the bicycle. Angle between plan of bicycle with the vertical and speed of the bicycle determines angle of the handlebar. Membership functions for relevant linguistic variables are given in below **Figure 3**, **Figure 4**, and **Figure 5**. Fuzzy inference rules for controlling the handlebar are given in the **Table 1**. Output of fuzzy inference systems gives the angle of handle bar need to keep at the moment with respect to normal position of handlebar. Two selected rules are given below as examples from the Table1. All 25 fuzzy inference rules are used Min operator as fuzzy **AND** operator.

- If speed of bicycle is **Very High** and angle with vertical is **Small** then angle of handlebar is **Small**.
- If speed of bicycle is **Very Low** and angle with vertical is **Small** then angle of handlebar is **Moderate**.

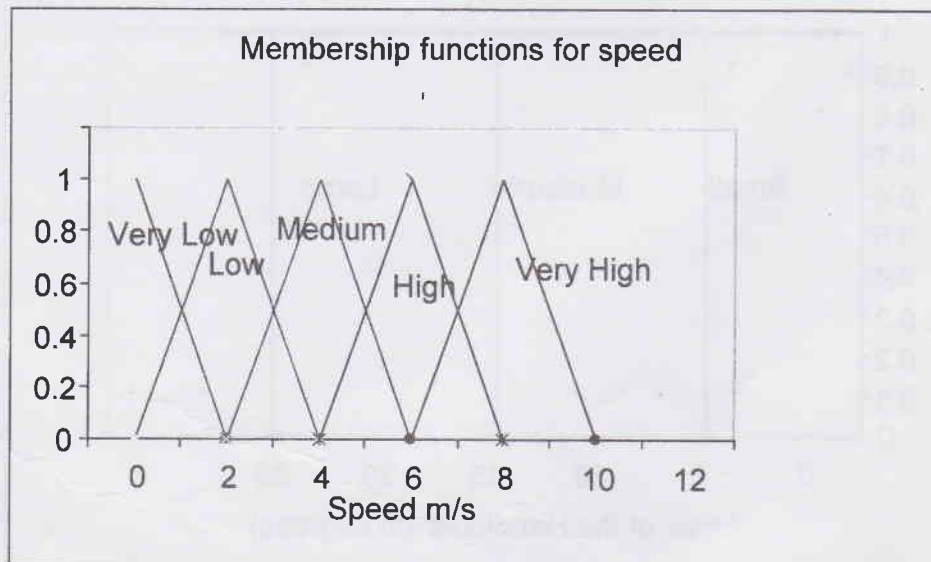


Figure 3

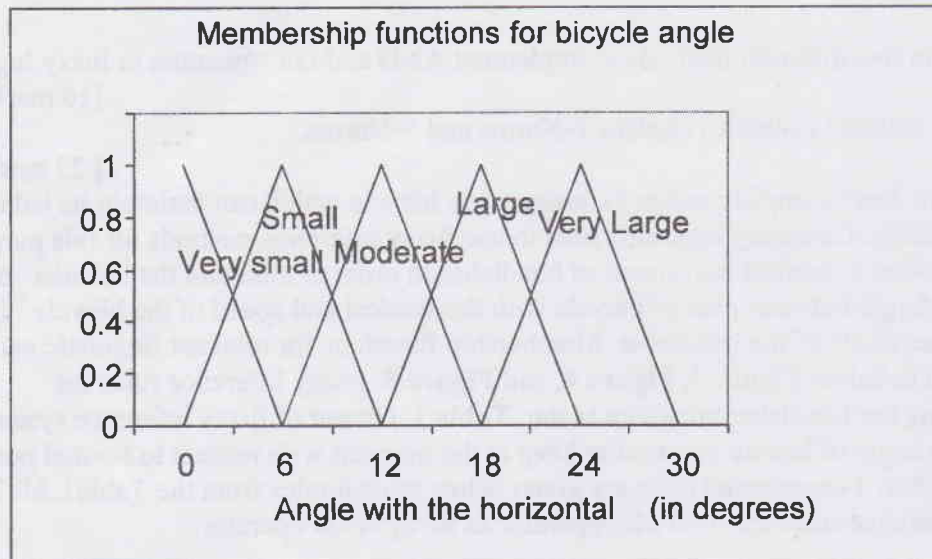


Figure 4

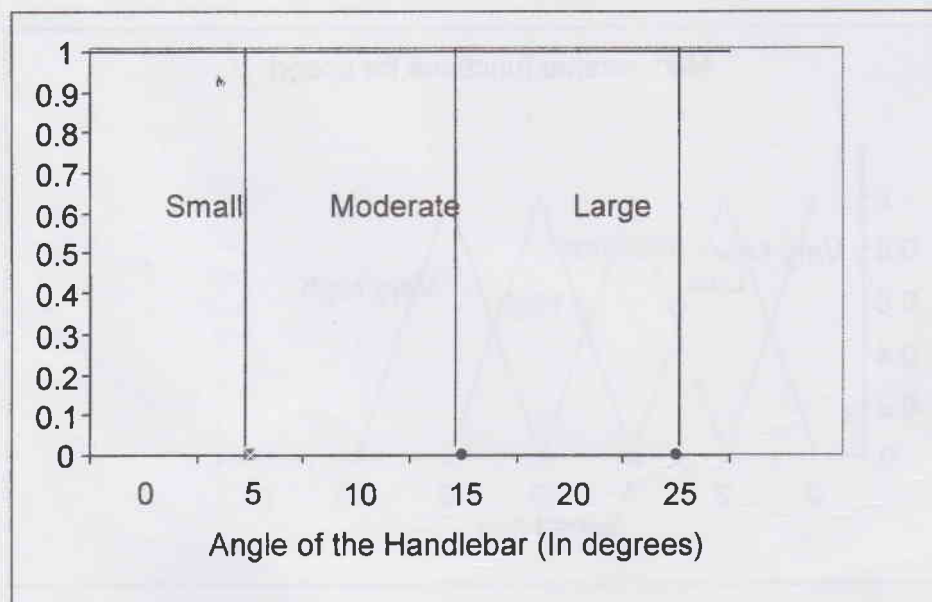


Figure 3

Fuzzy Inference Rules.

Speed of bicycle		Angle with vertical				
		Very small	Small	Moderate	Large	Very large
	Very low	Moderate	Moderate	Moderate	Large	Large
	low	Moderate	Moderate	Moderate	Large	Large
	Medium	Small	Small	Moderate	Large	Large
	High	Small	Small	Small	Moderate	Moderate
	Very high	Small	Small	Small	Moderate	Moderate

Table 5

c) Identify all the fuzzy rules applied when speed is 4.5m/s and angle with horizontal is 16.5° .

[32 marks]

d) Apply suitable **defuzzification** method to calculate the final output.

[30 marks]

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