Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(BME)/SEM-3/MBMI-301A/2012-13

2012

ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* of the following. 5 × 14 = 70

1. a) What is supervised learning in Neural Network ? 5

   b) What are the shortcomings of Back Propagation Algorithm ? How it can be overcome by Kohenen self-organizing Neural Network ? 2 + 7

2. a) Given the fuzzy rules for an armature controlled D.C. motor :

   Rule 1 : If armature voltage (aV) is HIGH
   then speed is HIGH

   Rule 2 : If speed is HIGH
   then back emf (b-emf) is HIGH

   Rule 3 : If back emf (b-emf) is HIGH
   the speed is LOW

   For the given motor problem, the following membership distributions are given :

$\mu_{HIGH}(aV) = \left\{ \frac{0{\cdot}2}{2} V , \frac{0{\cdot}6}{4} V , \frac{0{\cdot}7}{10} V , \frac{0{\cdot}9}{12} V \right\}$

$\mu_{HIGH}(\text{speed}) = \left\{ \frac{0{\cdot}3}{40} \text{ r.p.m.}, \frac{0{\cdot}6}{60} \text{ r.p.m.}, \frac{0{\cdot}9}{90} \text{ r.p.m.}, \frac{0{\cdot}2}{100} \text{ r.p.m.} \right\}$

$\mu_{HIGH}(\text{b-emf}) = \left\{ \frac{0{\cdot}2}{0{\cdot}5} \text{ V}, \frac{0{\cdot}4}{1} \text{ V}, \frac{0{\cdot}6}{1{\cdot}5} \text{ V}, \frac{0{\cdot}9}{2} \text{ V} \right\}$

$\mu_{LOW}(\text{speed}) = \left\{ \frac{0{\cdot}9}{40} \text{ r.p.m.}, \frac{0{\cdot}8}{60} \text{ r.p.m.}, \frac{0{\cdot}4}{90} \text{ r.p.m.}, \frac{0{\cdot}2}{100} \text{ r.p.m.} \right\}$

Evaluate implication relational matrices R1 (aV, speed), R2 (Speed, b-emf), and R3 (b-emf, speed). 3 + 3 + 3

b) Given the membership distribution of armature voltage to be MORE-OR-LESS-HIGH. What would be the distribution of speed to be MORE-OR-LESS-HIGH by using rules 1 and 2 ? 5

3. a) What is fuzzy singleton ? 4

b) What is defuzzifier ? State the significance of centre of area defuzzifier and centre average defuzzifier. 3 + 7

4. a) Give a schematic of evaluation of $\mu_B(y)$ from $\mu_A(x)$, where x denotes age ; y denotes speed ; *Ai* is fuzzy subset like young, old, very old ; *Bi* is fuzzy set like slow runner, medium-fast runner, fast runner. 8

b) Develop a continuous membership function for a fuzzy set A = “about 30 years”, B = “about 25 years” from a universal set of possible ages for people. 6

5. What is fuzzy base controller ? Tabulate all the properties of fuzzy set. What are the significance of turing test ? 5 + 6 + 3

6. Describe breadth-first search with an example. How is it different from uniform cost search ? Define fuzzy quantizer. 8 + 3 + 3

7. a) Define back tracking search with a search tree representation. 5

   b) How depth limited search is different from depth first search ? 5

   c) What are the common non-linear functions used for synaptic inhibition ? 4

8. a) Metion all the rule-based methods for uncertain reasoning. 5

   b) Draw a schematic of artificial neural network. Explain how this network balances the threshold of output signal, keeping input features at constant amplitude. 5

   c) Consider 2 universes : $U = \{ 1, 2, 3 \}$ and $V = \{ 2, 3, 4 \}$. Construct $\mu_{EQUAL} (u, v)$ for $U \in v$ and $v \in V$ and hence determine $R (u, v)$ in matrix form. 4