Assignment- 2

Instructions:

☞ *Handwritten answer must be submitted either in A4 sized paper or loose sheets.*

☞ *Assignment must be submitted within specified deadline and with proper cover page by clearly mentioning subject name, assignment number , submitters information (name, roll-number and section)*

☞ *The answers should be written after understanding the concepts and blindly copying from others is strictly discouraged.*

Recommendations:

☞ *Students are highly recommended to follow text-books and internationally recognized reference books, research papers and authentic websites/blogs/tutorials.*

2. Solve the following problems:

2.1. Discuss about following knowledge representation techniques (with syntax/concept and examples)

    a) Frames

    b) Semantic Net

    c) Rule Based System (Production System)

    d) Scripts

    e) Conceptual Dependencies

2.2. Introduce Propositional logic and predicate logic with their strength and weaknesses.

2.3. Explain the concepts of unification and lifting in predicate logic with examples.

2.4. Convert following sentences into FOPL and prove that "Roney is naughty" using resolution algorithm.

> *All over smart persons are stupid*
> *Children of all stupid persons are naughty*
> *Roney is Children of Harry*
> *Harry is over smart*

2.5. Explain about forward chaining and backward chaining. Differentiate between them.

2.6. Explain about following with suitable examples:

    a) Inference using Full Joint Distribution

    b) Bayesian Networks and Reasoning in Belief Networks

2.7. How belief networks are constructed? Consider the probability of having cloudy is 50%. The probability that it will rain given the conditions it will be cloudy and if it is winter is

30%. The probability of being winter is 50%. The probability that it will be shiny is 70%. Now construct a belief network for this example.

2.8. Explain the concept of fuzzy logic. Describe about :
— Fuzzy Set
— Membership functions in Fuzzy Set
— Fuzzy Rule Base System

2.9. Explain the significance of Machine learning in AI.

2.10. Discuss in Detail about followings with key characteristics and challenges:
— Supervised Machine Learning
— Unsupervised Machine Learning
— Reinforcement Learning

2.11. Explain about Naive Bayes Classifier with suitable example.

2.12. Explain the concept of evolutionary algorithm and genetic algorithm. Discuss the working of selection, crossover and mutation operations in genetic algorithm with examples.

2.13. Explain how genetic algorithm works with proper flow diagram.

2.14. Explain the concept of neuron and neural network in AI. Discuss about mathematical model of ANN. Briefly describe the concept of activation functions with examples.

2.15. Explain about feed forward and feed backward neural networks.

2.16. Discuss about following machine learning algorithms
   a) Perceptron learning
   b) Hebbian Larning
   c) Back propagation Learning

2.17. Consider the following feed-forward ANN with input, weight and bias values as in given table. (x_i, w_{ij} and θ_i represents inputs, initial weights and initial biases respectively.) If activation function is sigmoid i.e. $f(x) = \frac{1}{1+e^{-x}}$ calculate the outputs at neurons 4, 5 and 6.
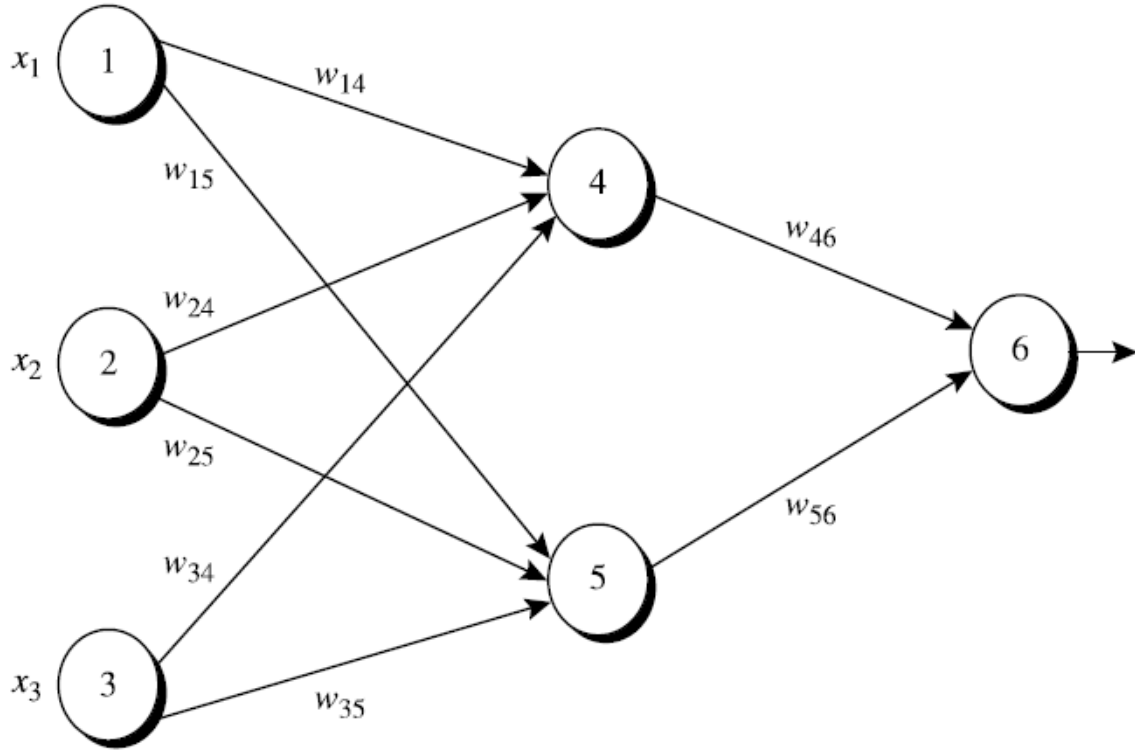
x_1	x_2	x_3	w_{14}	w_{15}	w_{24}	w_{25}	w_{34}	w_{35}	w_{46}	w_{56}	θ_4	θ_5	θ_6
1	0	1	0.2	−0.3	0.4	0.1	−0.5	0.2	−0.3	−0.2	−0.4	0.2	0.1

2.18. Consider above ANN and values in (Q.NO. 2.16) and trace a single iteration of backpropagation algorithm for updating weights and biases with training tuple X = (1,0,1) and output label 1.

[Assume learning rate is 0.9 and Error with output layer is computed as (T is labeled (targeted or exact) output and O is computed output)

$$Err_j = O_j(1 - O_j)(T_j - O_j),$$

and error at hidden layer is computed as :

$$Err_j = O_j(1 - O_j) \sum_k Err_k w_{jk},$$

The weights and biases are updated to reflect the propagated errors. Weights are updated by the following equations, where Δw_{ij} is the change in weight w_{ij}:

$$\Delta w_{ij} = (l) Err_j O_i.$$

$$w_{ij} = w_{ij} + \Delta w_{ij}.$$

Where l is the learning rate.

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Biases are updated by the following equations, where $\Delta\theta_j$ is the change in bias θ_j:

$$\Delta\theta_j = (l)\,Err_j.$$

$$\theta_j = \theta_j + \Delta\theta_j.$$
]

2.19. Define expert system. Explain structure of expert system with major components. Explain the phases in development of expert system.

2.20. Discuss about Natural language understanding and natural language generation. Explain about steps in NLP including Lexical Analysis(Segmentation, Morphological Analysis), Syntatic Analysis, Semantic Analysis, Pragmatic Analysis

2.21. Discuss about different application areas of NLP.

2.22. Discuss the concept of machine vision with major components of machine vision system. Discuss about applications of machine vision.

2.23. Describe Robotics as an application of AI with Robot hardware (sensor and effectors) and robotic perceptions.

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