NOORUL ISLAM COLLEGE OF ENGINEERING, KUMARACOIL

Department of Electronics and Communication Engineering

Second Semester ME (Communication Systems)

CO1631 – Soft Computing

Question and Answers

Part A

Unit I Artificial Neural Networks.

1. What do you mean by artificial neural networks?

An artificial neural network is an information processing system that has certain performance characteristics in common with biological neural networks.

2. What is neural network architecture?

A neural network is characterized by its pattern of connections between the neurons called its architecture.

3. What is meant by training of artificial neural networks?

The method of determining the weights on the connections called training.

4. What is meant by weights?

The weights represent information being used by the net to solve problem.

5. Write the logistic sigmoid function?

$f(x) = 1/(1+\exp(-x))$.

6. What is the important characteristics that artificial neural network share with biological neural system?

Fault tolerance.

7. Name some application of artificial neural networks.

Signal processing, Control, pattern recognition, Medicine, Speech production, Speech recognition and Business etc..

8. What is the classification of training?

Supervised and unsupervised.

9. What is supervised training?

Training is accomplished by presenting a sequence of training vectors or patterns, each with an associated target output vector. The weights are adjusted according to the learning algorithm. This process is known as supervised training.

10. What is associative memory?

A neural net that is trained to associate a set of input vectors with a corresponding set of output vectors is called associative memory.

11. What is auto associative memory?

If the desired output vector is same as the input vector, the net is an auto associative memory.

12. What is hetro-associative memory?

If the desired output vector is different from the input vector, the net is an hetro-associative memory.

13. What is unsupervised training?

A sequence of input vector is provided, but no target vectors are specified. The net modifies the weights so that the most similar input vectors are assigned to the same output unit.

14. Define identity function.

$f(x) = x$ for all x.

15. Define binary step function with threshold θ.

    $f(x) = 1$ if $x >= \theta$

    $f(x) = 0$ if $x < \theta$

16. What are the three layers of perceptron?

    Sensory units, associator units, and a response unit.

17. Define delta rule.

    The delta rule changes the weights of the neural connections so as to minimize the difference between the net input to the output unit and the target value.

18. Draw the structure of ADALINE net.

    Structure

19. Draw the structure of MADALINE net.

    Structure

20. Draw the structure of back propagation net.

    Structure.

Unit II Unsupervised Networks

21. What is unsupervised training?

    A sequence of input vector is provided, but no target vectors are specified. The net modifies the weights so that the most similar input vectors are assigned to the same output unit.

22. Which net is related to "winner take all"?

    Competitive learning network.

23. What is meant by winner take all?

    Only the neuron with the largest activation is allowed to remain on.

24. Draw the architecture of MAXNET.

    Draw the architecture.

25. What is the equation for updating the activation?

    $A_j(new)=f[a_j(old) - \Sigma \Sigma a_k(old)]$

26. Draw the architecture of Mexican cat.

    Draw the architecture.

27. What is the activation unit x_i at time t of Mexican cat?

    $X_i(t) = f[S_i(t) + \Sigma w_k x_{i+k}(t-1)]$

28. What is hamming net?

    A hamming net is a maximum likelihood classifier net that can be used to determine which of the exemplar vector is most similar to an input vector.

29. Define hamming distance between two vectors.

    It is the number of components in which vector differ.

30. Draw the architecture of hamming bet.

    Draw the architecture.

31. What is the other name of Kohonen Self-organising maps?

    Topology preserving maps.

32. What is the concept of hebbian learning?

    Hebb proposed that learning occurs by modification of the synapse strengths(weights) in a manner such that if two interconnected neurons are both on at the same time, then the weights between these neurons should be increased.

33. Draw the architecture of Adaptive Resonance Theory.

Draw the architecture.

34. What is the other name of Auto associative net?

Content addressable nature.

35. What is **stability-plasticity dilemma**?

A learning agent should be plastic, or adaptive in reacting to changing environments meanwhile it should be stable to preserve knowledge acquired previously.

36. What is **leaky learning**?

To update the weights of both the winning and losing units, but use a significantly smaller learning rate for the losers; this is commonly referred to au leaky learning.

37. Name some application of competitive learning network.

Data compression in communication and image processing, graph partitioning and word perception models.

38. Name some application of Kohonen self-organizing network .

neural phonetic type writer, to learn ballistic arm movements.

39. What is general content addressable memory?

Any physical system whose dynamics in phase space is dominated by a substantial number of locally stable states to which it is attracted can therefore be regarded as general content-addressable memory.

40. What is **basin of attraction**?

The present input pattern vector cannot escape from a region.

Unit III Fuzzy Systems

41 .In which situation fuzzy logic is most suitable.

i) Very complex models where understanding is strictly limited or infact quite judgmental.

ii) process where human reasoning, human perception, or human decision making are inextricably involved.

42. What is called the principle of incompatibility?

Conventional techniques for system analysis are intrinsically unsuited for dealing with humanistic systems, whose behavior is strongly influenced by human judgment, perception and emotion. This is the manifestation of what might be called the principle of incompatibility.

43. Write an example for linguistic variable and values.

In the sentence “age is young”, age is the linguistic variable and young is the linguistic value.

44. Define the concentration of linguistic values.

Let A be the linguistic value, then the operation of concentration is defined as $CON(A) = A^2$

45. Define the dilation of linguistic values.

Let A be the linguistic value, then the operation of dilation is defined as $DIL(A) = A^{0.5}$

46. Define contrast intensification.

$INT(A) = 2A^2$, for $0 \le \mu_A(x) \le 0.5$

$\neg\, 2(\neg\, A)^2$, for $0.5 \le \mu_A(x) \le 1$

47. Write the Material implication of A entails B

$R = A \rightarrow B = \neg\, A \cup B$

48. Write the Proportional calculus of A entails B

$R = A \rightarrow B = \neg A \cup (A \cap B)$

49. Write the Extended Proportional calculus of A entails B

$R = A \rightarrow B = (\neg A \cap \neg B) \cup B$

50. Write the Generalization of modus ponen of A entails B

$\mu_R(x,y) = \sup\{c | \mu_A(x) * c \leq \mu_B(y) \text{ and } 0 \leq c \leq 1\}$.

51. What is classical set?

A set with crisp boundary.

52. What is fuzzy set?

A set without crisp boundary.

53. What is member ship function?

If X is a collection of objects denoted generically by x, then a fuzzy set A in X is defined as a set of ordered pairs

$A = \{(x, \mu_A(x)) \mid x \in X\}$ where $\mu_A(x)$ is called the membership function for the fuzzy set A.

54. Define Support.

The support of the fuzzy set A is the set of all points x in X such that $\mu_A(x) > 0$.

$\text{Support}(n) = \{x \mid \mu_A(x) > 0\}$

55. Define Core.

A core of a fuzzy set A is the set of all points x in X such that $\mu_A(x) = 1$.

$\text{Core}(A) = \{x \mid \mu_A(x) = 1\}$

56. Define normality.

A fuzzy set A is normal if its core is non empty. In otherwords, we can always find a point $x \in X$ such that $\mu_A(x) = 1$.

57. Define Cross over point.

A cross over point of a fuzzy set A is a point $x \in X$ at which $\mu_A(x) = 0.5$

$\text{Crossover}(A) = \{x \mid \mu_A(x) = 0.5\}$

58. Define fuzzy sington.

A fuzzy set whose support is a single point in X with $\mu_A(x) = 1$ is called a fuzzy singleton.

59. Define Convexity.

A fuzzy set A is Convex if and only if any $x1, x2 \in X$ and any $\lambda \in [0,1]$

$\mu_A(\lambda x_1 + (1 - \lambda)x_2) \geq \min \{ \mu_A(x_1), \mu_A(x_2)\}$

60. Define fuzzy members.

A fuzzy member A is a fuzzy set in the real line ® that satisfies the conditions for normality and convexity.

Unit IV Neuro-fuzzy modeling

61. What is the name of parameters in the layer1 of ANFIS?

Premise parameter

62. What is the output of layer3 of ANFIS?

Normilised firing strength.

63. What is the name of parameters in the layer4 of ANFIS?

Consequent parameters.

64. What is the acronym for CANFIS?

Coactive neuro-fuzzy inference systems.

65. What is meant by **dilemma between interpretability and precision**?

The learning process often follows the diagonal route of improving mapping precision and deteriorating interpretability at the same time. This is referred as dilemma between interpretability and precision.

66. What is the use of data clustering algorithm?

Clustering algorithm are used extensively not only to organize and categorize data, but are also useful for data compression and model construction.

67. What are the applications of K-means clustering?

Image and speech data compression, data preprocessing for system modeling using radial basis function networks and task decomposition in heterogeneous neural network architectures.

68. What are the applications of fuzzy C-means clustering?

Medical image segmentation and qualitative modeling.

69. What is mountain clustering method?

Approximate estimation of cluster centers on the basis of a density measure called mountain function.

70. What is subtractive clustering?

Here the data points are considered as the candidates for cluster center.

71. What is balanced –sampling criterion?

Cut the dimension in which the training data associated with the region are most spread out and cut it as the median value of those samples in that dimention.

72. What is direct evaluation?

To feed the structure into the parameter identification phase and use the final performance to choose the best cut.

73. Define a binary fuzzy boxtree.

It is rooted tree in which each internal node has two children.

74. What is knowledge acquisition?

Acquisition of human operator's knowledge about how to control a system and generates a set of fuzzy if-then rules as the backbone for a fuzzy controller that behaves like the original human operator.

75. What is linguistic information?

An experienced human operator can usually summarize his or her reasoning process in arriving at final control actions or decisions as a set of fuzzy if-then rules with imprecise but correct membership functions.

76. What is numerical information?

When a human operator is working, it is possible to record the sensor data observed by the human and the human's corresponding actions as a set of desired input output data pairs.

77. What is stage adaptive network?

The adaptive network containing the FC block and the plant block are referred as stage adaptive network.

78. What is fuzzy inference systems?

It is a popular computing frame work based on the concepts of fuzzy set theory, fuzzy if-then rule, and fuzzy reasoning.

79. What are the three conceptual components of the basic structure of a fuzzy inference system?

Rule base, data base and reasoning mechanism.

80. What are the other names of fuzzy inference system?

Fuzzy-rule based system, fuzzy expert system, fuzzy model, fuzzy associative memory, fuzzy logic controller and fuzzy system.

Unit V Genetic Algorithm

81. What is genetic algorithm?

Genetic algorithms are search algorithms based on the mechanics of natural selection and natural genetics.

82. What is the theme of research on genetic algorithms?

The central theme of research on genetic algorithms has been robustness, the balance between efficiency and efficacy necessary for survival in many different environments.

83. Name some of the existing search methods.

Calculus based methods, enumerative schemes, random search algorithms.

84. What are the operators involved in a simple genetic algorithm?

Reproduction, cross over, mutation.

85. What is reproduction?

Reproduction is a process in which individual strings are copied according to their objective function.

86. What is the use of SCHEMATA?

The schemata provides a tools to answer the questions such as how one string can be similar to its fellow strings and in what ways is a string a representative of other string classes with similarities at certain string positions.

87. What is schema?

A schema is a similarity template describing a subset of strings with similarities at certain string positions.

88. What is cross over?

Cross over is a recombination operator.

89. What are the types of cross over?

Single site cross over, two point cross over, multipoint cross over and uniform cross over.

90. What are the types of multi point cross over?

Even number of cross sites and odd number of cross sites.

91. What is cross over rate?

Cross over rate is usually denoted as Pc the probability of cross over.

92. What is inversion?

The string from the population is selected and the bits between two random sites are inverted.

93. What are the types of inversion?

Linear+end-inversion , continuous inversion and mass inversion.

94. What is deletion and duplication?

Any two or three bits at random in order are selected and the previous bits are duplicated.

95. What is segregation?

The bits of the parents are segregated and then crossed over to produce offspring.

96. What is cross over and inversion?

It is the combination of both cross over and inversion.

97. What is mutation operator?

Mutation of a bit involves flipping it, changing 0 to1 and vice versa with a small mutation probability.

98. What is mutation rate?

Mutation rate is the probability of mutation which is used to calculate number of bits to be muted.

99. What is the concept of simulated annealing?

Simulated annealing mimics the cooling phenomenon of molten metals to constitute search procedure.

100. What is segregation?

The bits of the parents are segregated and then crossed over to produce offspring.

Part B

Unit I Artificial Neural Networks.

1. Explain the ADALINE network with an example.
    - Architecture
    - Algorithm
    - Example
2. Explain the MADALINE network with an example.
    - Architecture
    - Algorithm
    - Example
3. Explain the Back propagation network with an example
    - Architecture
    - Algorithm
    - Example
4. Explain the Radial basis network with an example
    - Architecture
    - Algorithm
    - Example
5. Explain the Perceptron with an example
    - Architecture
    - Algorithm
    - Example

Unit II Unsupervised Networks

6. Explain the Competitive learning network with an example
    - Architecture
    - Algorithm
    - Example
7. Explain the Kohonen self organising network with an example
    - Architecture
    - Algorithm
    - Example

8. Explain the Learning vector quantization vector network with an example
    - Architecture
    - Algorithm
    - Example
9. Explain the Binary Hopfield network with an example
    - Architecture
    - Algorithm
    - Example
10. Explain the Adaptive resonance theory network with an example
    - Architecture
    - Algorithm
    - Example

Unit III Fuzzy Systems

11. Explain the Sugeno model with an example
    - Architecture
    - Algorithm
    - Example
12. Explain the Tsukamoto model with an example
    - Architecture
    - Algorithm
    - Example
13. Explain the Fuzzy control methods with an example
    - Architecture
    - Algorithm
    - Example
14. Explain the Mamdani model with an example
    - Architecture
    - Algorithm
    - Example
15. Explain the Multi objective decision making with an example
    - Architecture
    - Algorithm
    - Example

Unit IV Neuro-fuzzy modeling

16. Explain the K-means clustering with an example
    - Architecture
    - Algorithm
    - Example
17. Explain the Fuzzy C-mean clustering with an example
    - Architecture
    - Algorithm
    - Example
18. Explain the Adaptive neuro fuzzy based inference system with an example

- Architecture
- Algorithm
- Example

19. Explain the Mountain clustering with an example
    - Architecture
    - Algorithm
    - Example
20. Explain the Subtractive clustering with an example
    - Architecture
    - Algorithm
    - Example

Unit V Genetic Algorithm

21. Explain the cross over with an example
    - Architecture
    - Algorithm
    - Example
22. Explain the reproduction with an example
    - Architecture
    - Algorithm
    - Example
23. Explain the Generational cycle rank with an example
    - Architecture
    - Algorithm
    - Example
24. Explain the Simulated annealing with an example
    - Architecture
    - Algorithm
    - Example
25. Explain the Down hill simplex search with an example
    - Architecture
    - Algorithm
    - Example