UNIT I PROBLEM SOLVING

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)

Part A

1. What is Artificial Intelligence?
2. What is an agent?
3. What are the different types of agents?
4. Define rational agent.
5. List down the characteristics of intelligent agent. What are various applications of AI? or What can AI do today?
6. Are reflex actions (such as flinching from a hot stove) rational? Are theyintelligent?
7. Is AI a science, or is it engineering? Or neither or both? Explain.
8. What are the various agent programs in intelligent systems?
9. Define the problem solving agent.
10. Define the terms goal formulation and problem formulation.
11. List the steps involved in simple problem solving agent.
12. What are the components of well-defined problems? (or)
    What are the four components to define a problem? Define them?
13. Differentiate toy problems and real world problems?
14. Give example for real world end toy problems.How will you measure the problem-solving performance?
15. What is the application of BFS?
16. State on which basis search algorithms are chosen?
17. Evaluate performance of problem-solving method based on depth-first searchalgorithm? List some of the uninformed search techniques.
18. What is the power of heuristic search? (or) Why does one go for heuristics search?
19. What are the advantages of heuristic function?

20. State the reason when hill climbing often gets stuck?

21. When a heuristic function h is said to be admissible? Give an admissible heuristic function for TSP?

22. What do you mean by local maxima with respect to search technique?

23. How can we avoid ridge and plateau in hill climbing?

24. Differentiate Blind Search and Heuristic Search.

25. What is CSP?

26. How can minimax also be extended for game of chance?

Part B

1. Enumerate Classical "Water jug Problem". Describe the state space for this problem and also give the solution.

2. How to define a problem as state space search? Discuss it with the help of an example

3. Solve the given problem. Describe the operators involved in it.

Consider a Water Jug Problem : You are given two jugs, a 4-gallon one anda 3-gallon one. Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallonsof water into the 4-gallon jug ? Explicit Assumptions: A jug can be filled from the pump, water can be poured out of a jug onto the ground, water canbe poured from one jug to another and that there are no other measuring devices available.

4. Define the following problems. What types of control strategy is used in the following problem.

i.The Tower of Hanoi

ii.Crypto-arithmetic

iii.The Missionaries and cannibals problems

iv.8-puzzle problem

5. Discuss uninformed search methods with examples.

6. Give an example of a problem for which breadth first search would workbetter than depth first search.
7. Explain the algorithm for steepest hill climbing
8. Explain the A* search and give the proof of optimality of A*
9. Explain AO* algorithm with a suitable example. State the limitations in the algorithm?
10. Explain the nature of heuristics with example. What is the effect of heuristics accuracy?
11. Explain the various types of hill climbing search techniques.
12. Discuss about constraint satisfaction problem with a algorithm for solving acrypt arithmetic Problem.
13. Solve the following Crypt arithmetic problem using constraints satisfaction search procedure.

```
  CROSS
+ROADS
------
DANGER
------
```

14. Explain alpha-beta pruning algorithm and the Minmax game playing algorithm with example?
15. Solve the given problem. Describe the operators involved in it.

    Consider a water jug problem: You are given two jugs, a 4-gallon one and a 3-gallon one. Neither have any measuring Markers on it. There is a pump that can be used to fill the jug with water. How can you get exactly 2 gallonsof water into the 4 gallon jug? Explicit Assumptions: A jug can be filled from the pump, water can be poured out of a jug onto the ground, water can be poured from one jug to another and that there are no other measuring devices available.

UNIT II PROBABILISTIC REASONING

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

Part A

1. Why does uncertainty arise?
2. Differentiate uncertainty with ignorance.
3. What is the need for probability theory in uncertainty?
4. What is the need for utility theory in uncertainty?
5. Define principle of maximum expected utility (MEU)?
6. Mention the needs of probabilistic reasoning in AI.
7. What does the full joint probability distribution specify?
8. State Bayes' Theorem in Artificial Intelligence.
9. Given that P(A)=0.3,P(A|B)=0.4 and P(B)=0.5, Compute P(B|A).
10. What is Bayesian Belief Network?

Part B

1. How to get the exact inference form Bayesian network?
2. Explain variable elimination algorithm for answering queries on Bayesian networks?
3. Define uncertain knowledge, prior probability and conditional probability. State the Bayes' theorem. How it is useful for decision making under uncertainty? Explain belief networks briefly?
4. Explain the method of handling approximate inference in Bayesian networks.
5. What is Bayes' rule? Explain how Bayes' rule can be applied to tackle uncertain Knowledge.
6. Discuss about Bayesian Theory and Bayesian network.
7. Explain how does Bayesian statistics provide reasoning under various kinds of uncertainty?

8. How to get the approximate inference from Bayesian network.
9. Construct a Bayesian Network and define the necessary CPTs for the given scenario. We have a bag of three biased coins a,b and c with probabilities of coming up heads of 20%, 60% and 80% respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins) and then the coin is flipped three times to generate the outcomes X1, X2 and X3.
    - **a.** Draw a Bayesian network corresponding to this setup and define the relevant CPTs.
    - **b.** Calculate which coin is most likely to have been drawn if the flips comeup HHT
10. Consider the following set of propositions

    Patient has spots

    Patient has measles

    Patient has high fever

    Patient has Rocky mountain spotted fever.

    Patient has previously been inoculated against measles.Patient
    was recently bitten by a tick

    Patient has an allergy.

    a) Create a network that defines the casual connections among these nodes.

    b) Make it a Bayesian network by constructing the necessary conditional probability matrix.

UNIT III SUPERVISED LEARNING

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests.

PART - A

1. What is Machine Learning?
2. Mention the difference between Data Mining and Machine learning?
3. What is 'Overfitting' in Machine learning?
4. Why overfitting happens?
5. How can you avoid overfitting?
6. What are the five popular algorithms of Machine Learning?
7. What are the different Algorithm techniques in Machine Learning?
8. What are the three stages to build the hypotheses or model in machinelearning?
9. What is the standard approach to supervised learning?
10. What is 'Training set' and 'Test set'?
11. What is the difference between artificial learning and machine learning?
12. What are the advantages of Naive Bayes?
13. What is the main key difference between supervised and unsupervisedmachine learning?
14. What is a Linear Regression?
15. What are the disadvantages of the linear regression model?
16. What is the difference between classification and regression?
17. What is the difference between stochastic gradient descent (SGD) and gradient descent (GD)?
18. What are the different types of least squares?
19. What is the difference between least squares regression and multiple regression?

20. What is the principle of least squares?

21. What are some advantages to using Bayesian linear regression?

22. What Is Bayesian Linear Regression?

23. What are the advantages of Bayesian Regression?

24. What are the disadvantages of Bayesian Regression?

25. What are types of classification models?

26. Why is random forest better than SVM?

27. Which is better linear regression or random forest?

28. Which is better linear or tree based models?

29. Is linear discriminant analysis classification or regression?

30. What is probabilistic discriminative model?

31. What is SVM?

32. What is Decision tree?

33. What is Random forest?

34. What is Decision Tree Classification?

35. What Is Pruning in Decision Trees, and How Is It Done?

36. Do you think 50 small decision trees are better than a large one? Why?

37. You've built a random forest model with 10000 trees. You got delighted after getting training error as 0.00. But, the validation error is 34.23. What is goingon? Haven't you trained your model perfectly?

38. When would you use random forests vs SVM and why?

Part – B

1. Assume a disease so rare that it is seen in only one person out of every million. Assume also that we have a test that is effective in that if a person hasthe disease, there is a 99 percent chance that the test result will be positive; however, the test is not perfect, and there is a one in a thousand chance that the test result will be positive on a healthy person. Assume that a new patient arrives and the test result is positive. What is the probability that the patient has the disease?
2. Explain Naïve Bayes Classifier with an Example.
3. Explain SVM Algorithm in Detail.
4. Explain Decision Tree Classification.
5. Explain the principle of the gradient descent algorithm. Accompany your explanation with a diagram. Explain the use of all the terms and constants that you introduce and comment on the range of values that they can take.
6. Explain the following

   a) Linear regression

   b) Logistic Regression

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

PART - A

1. What is bagging and boosting in ensemble learning?
2. What is stacking in ensemble learning?
3. Which are the three types of ensemble learning?
4. Why ensemble methods are used?
5. What is a voting classifier?
6. What type of classifiers are used in weighted voting method?
7. What is difference between K means and Gaussian mixture?
8. What are Gaussian mixture models How is expectation maximization used in it?
9. What is k-means unsupervised learning?
10. What is the difference between K-means and KNN?
11. What is expectation maximization algorithm used for?
12. What is the advantage of Gaussian process?
13. What are examples of unsupervised learning?
14. How do you implement expectation maximization algorithm?
15. What is the principle of maximum likelihood?

Part – B

1. Explain briefly about unsupervised learning structure?
2. Explain various learning techniques involved in unsupervised learning?
3. What is Gaussian process? And explain in detail of Gaussian parameterestimates with suitable examples.
4. Explain the concepts of clustering approaches. How it differ from classification.
5. List the applications of clustering and identify advantages and disadvantages of clustering algorithm.
6. Explain about EM algorithm.
7. List non-parametric techniques and Explain K-nearest neighbour estimation.

UNIT V NEURAL NETWORKS

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

PART - A

1. What is perceptron and its types?
2. Which activation function is used in multilayer perceptron?
3. What are the activation functions of MLP?
4. Does MLP have activation function?
5. What is the difference between a perceptron and a MLP?
6. What are the types of activation function?
7. What is MLP and how does it work?
8. Why do you require Multilayer Perceptron?
9. What are the advantages of Multilayer Perceptron?
10. What do you mean by activation function?
11. What are the limitations of perceptron?
12. How many layers are there in perceptron?
13. is stochastic gradient descent same as gradient descent?
14. How is stochastic gradient descent used as an optimization technique?
15. Does stochastic gradient descent lead to faster training?
16. What is stochastic gradient descent and why is it used in the training of neural networks?
17. What are the three main types gradient descent algorithm?
18. What are the disadvantages of stochastic gradient descent?
19. How do you solve the vanishing gradient problem within a deep neural network?
20. What is the problem with ReLU?
21. Why is ReLU used in deep learning?
22. Why is ReLU better than Softmax?

Part – B

1. Draw the architecture of a single layer perceptron (SLP) and explain itsoperation. Mention its advantages and disadvantages.
2. Draw the architecture of a Multilayer perceptron (MLP) and explain itsoperation. Mention its advantages and disadvantages.
3. Explain the stochastic optimization methods for weight determination.
4. Describe back propagation and features of back propagation.
5. Write the flowchart of error back-propagation training algorithm.
6. Develop a Back propagation algorithm for Multilayer Feed forward neural network consisting of one input layer, one hidden layer and output layer from first principles.
7. List the factors that affect the performance of multilayer feed-forward neural network.
8. Difference between a Shallow Net & Deep Learning Net.
9. How do you tune hyperparameters for better neural network performance?Explain in detail.