CBCS SCHEME

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15CS73

# Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
## Machine Learning

Time: 3 hrs. Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*



### Module-1

1 a. Define machine learning. Explain with specific examples. (06 Marks)
b. How you will design a learning system? Explain with examples. (06 Marks)
c. List and explain perspectives and issues in Machine Learning. (04 Marks)

**OR**

2 a. Define concept learning. Explain the task of concept learning. (06 Marks)
b. How the concept learning can be viewed as the task of searching? Explain. (04 Marks)
c. Explain with examples:
i) Find-S algorithm
ii) Candidate Elimination algorithm (06 Marks)

### Module-2

3 a. Define decision tree learning. List and explain appropriate problems for decision tree learning. (06 Marks)
b. Explain the basic decision tree learning algorithm. (05 Marks)
c. Describe Hypothesis space search in decision tree learning. (05 Marks)

**OR**

4 a. Define inductive bias. Explain inductive bias in decision tree learning. (06 Marks)
b. Give the differences between the hypothesis space search in ID3 and candidate elimination algorithm. (04 Marks)
c. List and explain issues in decision tree learning. (06 Marks)

### Module-3

5 a. Define Artificial neural networks. Explain biological learning systems. (05 Marks)
b. Explain representations of Neural network. (05 Marks)
c. Describe the characteristics of Back propagation algorithm. (06 Marks)

**OR**

6 a. Define Perceptron. Explain representational power of Perceptrons. (05 Marks)
b. Explain gradient descent algorithm. (06 Marks)
c. Describe derivation of the back propagation rule. (05 Marks)

### Module-4

7 a. List and explain features of Bayesian learning methods. (06 Marks)
b. Describe Brute-Force map learning algorithm. (05 Marks)
c. Explain maximum likelihood and least-squared error hypothesis. (05 Marks)

OR

8 a. Describe maximum likelihood hypotheses for predicting probabilities. (05 Marks)
b. Define Bayesian belief networks. Explain with an example. (06 Marks)
c. Explain EM algorithm. (05 Marks)

## Module-5

9 a. Define the following with examples: (08 Marks)
i) Sample error ii) True error iii) Mean iv) Variance.
b. Explain central limit Theorem. (04 Marks)
c. Explain K-Nearest neighbor algorithm. (04 Marks)

OR

10 a. Explain case-based reasoning. (06 Marks)
b. List and explain important differences of reinforcement algorithm with other function approximation tasks. (04 Marks)
c. Explain Q Learning Algorithm. (06 Marks)

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17CS73

# Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
## Machine Learning

Time: 3 hrs. Max. Marks: 100

**Note:** *Answer any FIVE full questions, choosing ONE full question from each module.*



### Module-1

1 a. Define machine learning. Mention five applications of machine learning. **(06 Marks)**

b. Explain concept learning task with an example. **(06 Marks)**

c. Apply candidate elimination algorithm and obtain the version space considering the training examples given Table Q1(c).

| Eyes | Nose | Head | Fcolor | Hair? | Smile?(TC) |
|---|---|---|---|---|---|
| Round | Triangle | Round | Purple | Yes | Yes |
| Square | Square | Square | Green | Yes | No |
| Square | Triangle | Round | Yellow | Yes | Yes |
| Round | Triangle | Round | Green | No | No |
| Square | Square | Round | Yellow | Yes | Yes |

Table Q1(c) **(08 Marks)**

**OR**

2 a. Explain the following with respect to designing a learning system :
i) Choosing the training experience
ii) Choosing the target function
iii) Choosing a representation for the target function. **(09 Marks)**

b. Write Find–S algorithm. Apply the Find–S for Table Q1(c) to find maximally specific hypothesis. **(06 Marks)**

c. Explain the concept of inductive bias. **(05 Marks)**

### Module-2

3 a. Explain the concept of decision tree learning. Discuss the necessary measures required to select the attributed for building a decision tree using ID3 algorithm. **(11 Marks)**

b. Explain the following with respect to decision tree learning :
i) Incorporating continuous valued attributes
ii) Alternative measures for selecting attributes
iii) Handling training examples with missing attribute values. **(09 Marks)**

**OR**

4 a. Construct decision tree using ID3 considering the following training examples :

| Weekend | Weather | Parental availability | Wealthy | Decision class |
|---|---|---|---|---|
| $H_1$ | Sunny | Yes | Rich | Cinema |
| $H_2$ | Sunny | No | Rich | Tennis |
| $H_3$ | Windy | Yes | Rich | Cinema |
| $H_4$ | Rainy | Yes | Poor | Cinema |
| $H_5$ | Rainy | No | Rich | Home |
| $H_6$ | Rainy | Yes | Poor | Cinema |
| $H_7$ | Windy | No | Poor | Cinema |
| $H_8$ | Windy | No | Rich | Shopping |
| $H_9$ | Windy | Yes | Rich | Cinema |
| $H_{10}$ | Sunny | No | Rich | Tennis |

Table Q4(b) **(12 Marks)**

b. Discuss the issues of avoiding overfitting the data, and handling attributes with differing costs. **(08 Marks)**

## Module-3

5 a. Discuss the application of neural network which is used to steer an autonomous vehicle. (06 Marks)

b. Write Gradient descent algorithm to train a linear unit along with the derivation. (08 Marks)

c. Discuss the issues of convergence, local minima and generalization, overfitting and stopping criterion. (06 Marks)

**OR**

6 a. List the appropriate problems for neural network learning. (05 Marks)

b. Define preceptron and discuss its training rule. (05 Marks)

c. Show the derivation of back propagation training rule for output unit weights. (10 Marks)

## Module-4

7 a. Explain Bayes theorem and mention the features of Bayesian learning. (07 Marks)

b. Prove that a maximum likelihood hypotheses cab be used to predict probabilities. (08 Marks)

c. Explain Naïve Bayes classifier. (05 Marks)

**OR**

8 a. Describe MAP learning algorithm. (08 Marks)

b. Classify the test data and {Red, SUV, Domestic} using Naine Bayes classifier for the dataset shown in Table Q8(b).

| Color | Type | Origin | Stolen |
|---|---|---|---|
| Red | Sports | Domestic | Yes |
| Red | Sports | Domestic | No |
| Red | Sports | Domestic | Yes |
| Yellow | Sports | Domestic | No |
| Yellow | Sports | Imported | Yes |
| Yellow | SUV | Imported | No |
| Yellow | SUV | Imported | Yes |
| Yellow | SUV | Domestic | No |
| Red | SUV | Imported | No |
| Red | Sports | Imported | Yes |

Table Q8(b) (06 Marks)

c. Write and explain EM algorithm. (06 Marks)

## Module-5

9 a. Define :
i) Sample error
ii) True error
iii) Confidence intervals. (06 Marks)

b. Explain K-nearest neighbor learning algorithm. (08 Marks)

c. Write a note no Q – learning. (06 Marks)

**OR**

10 a. Define mean value, variance, standard deviation and estimation bias of a random variable. (04 Marks)

b. Explain locally weighted linear regression and radial basis functions. (10 Marks)

c. What is reinforcement learning? How it differs from other function approximation tasks? (06 Marks)

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# Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
# Machine Learning

Time: 3 hrs. Max. Marks: 80

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***

## Module-1

1 a. What do you mean by well-posed learning problem? Explain with example. **(04 Marks)**

b. Explain the various stages involved in designing a learning system in brief. **(08 Marks)**

c. Write Find_S algorithm and discuss the issues with the algorithm. **(04 Marks)**

**OR**

2 a. List the issues in machine learning. **(04 Marks)**

b. Consider the given below training example which finds malignant tumors from MRI scans.

| Example | Shape | Size | Color | Surface | Thickness | Target concept |
|---|---|---|---|---|---|---|
| 1 | Circular | Large | Light | Smooth | Thick | Malignant |
| 2 | Circular | Large | Light | Irregular | Thick | Malignant |
| 3 | Oval | Large | Dark | Smooth | Thin | Benign |
| 4 | Oval | Large | Light | Irregular | Thick | Malignant |
| 5 | Circular | Small | Light | Smooth | Thick | Benign |

Show the specific and general boundaries of the version space after applying candidate elimination algorithm. (Note: Malignant is +ve, Benign is –ve). **(08 Marks)**

c. Explain the concept of inductive bias in brief. **(04 Marks)**

## Module-2

3 a. Discuss the two approaches to prevent over fitting the data. **(08 Marks)**

b. Consider the following set of training examples:

| Instance | Classification | $a_1$ | $a_2$ |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 |
| 3 | 0 | 1 | 0 |
| 4 | 1 | 0 | 0 |
| 5 | 0 | 0 | 1 |
| 6 | 0 | 0 | 1 |

(i) What is the entropy of this collection of training examples with respect to the target function classification?

(ii) What is the information gain of $a_2$ relative to these training examples? **(08 Marks)**

**OR**

4 a. Define decision tree. Construct the decision tree to represent the following Boolean functions:

i) $A \wedge \neg B$ ii) $A \vee [B \wedge C]$ iii) A XOR B **(06 Marks)**

b. Write the ID3 algorithm. **(06 Marks)**

c. What do you mean by gain and entropy? How it is used to build the decision tree. **(04 Marks)**

## Module-3

5 a. Define perceptron. Explain the concept of single perceptron with neat diagram. (06 Marks)

b. Explain the back propagation algorithm. Why is it not likely to be trapped in local minima? (10 Marks)

**OR**

6 a. List the appropriate problems for neural network learning. (04 Marks)

b. Discuss the perceptron training rule and delta rule that solves the learning problem of perceptron. (08 Marks)

c. Write a remark on representation of feed forward networks. (04 Marks)

## Module-4

7 a. Explain Naïve Bayes classifier. (08 Marks)

b. Explain brute force MAP learning algorithm. (08 Marks)

**OR**

8 a. Discuss Minimum Description Length principle in brief. (08 Marks)

b. Explain Bayesian belief networks and conditional independence with example. (08 Marks)

## Module-5

9 a. Define: (i) Simple Error (ii) True Error (04 Marks)

b. Explain K-nearest neighbor learning algorithm. (08 Marks)

c. What is reinforcement learning? (04 Marks)

**OR**

10 a. Define expected value, variance, standard deviation and estimate bias of a random variable. (04 Marks)

b. Explain locally weighted linear regression. (08 Marks)

c. Write a note on Q-learning. (04 Marks)

# Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
## Machine Learning

Time: 3 hrs. Max. Marks: 80

**Note:** *Answer FIVE full questions, choosing ONE full question from each module.*

### Module-1

1 a. Specify the learning task for 'A checkers learning problem'. **(03 Marks)**

b. Discuss the following with respect to the above,

(i) Choosing the training experience. **(09 Marks)**

(ii) Choosing the target function and **(04 Marks)**

(iii) Choosing a function approximation algorithm.

c. Comment on the issues in machine learning.

**OR**

2 a. Write candidate elimination algorithm. Apply the algorithm to obtain the final version space for the training example. **(10 Marks)**

| Sl. No. | Sky | Air temp | Humidity | Wind | Water | Forecast | Enjoy sport |
|---|---|---|---|---|---|---|---|
| 1 | Sunny | Warm | Normal | Strong | Warm | Same | Yes |
| 2 | Sunny | Warm | High | Strong | Warm | Same | Yes |
| 3 | Rainy | Cold | High | Strong | Warm | Change | No |
| 4 | Sunny | Warm | High | Strong | Cool | Change | Yes |

b. Discuss about an unbiased Learner. **(06 Marks)**

### Module-2

3 a. What is a decision tree & discuss the use of decision tree for classification purpose with an example. **(08 Marks)**

b. Write and explain decision tree for the following transactions: **(08 Marks)**

| Tid | Refund | Martial status | Taxable Income | Cheat |
|---|---|---|---|---|
| 1 | Yes | Single | 125 K | No |
| 2 | No | Married | 100 K | No |
| 3 | No | Single | 70 K | No |
| 4 | Yes | Married | 120 K | No |
| 5 | No | Divorced | 95 K | Yes |
| 6 | No | Married | 60 K | No |
| 7 | Yes | Divorced | 220 K | No |
| 8 | No | Single | 85 K | Yes |
| 9 | No | Married | 75 K | No |
| 10 | No | Single | 90 K | Yes |

**OR**

4 a. For the transactions shown in the table compute the following :

(i) Entropy of the collection of transaction records of the table with respect to classification.

(ii) What are the information gain of $a_1$ and $a_2$ relative to the transactions of the table? **(08 Marks)**

| Instance | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| $a_1$ | T | T | T | F | F | F | F | T | F |
| $a_2$ | T | T | F | F | T | T | F | F | T |
| Target class | + | + | – | + | – | – | – | + | – |

b. Discuss the decision learning algorithm. **(04 Marks)**

c. List the issues of decision tree learning. **(04 Marks)**

## Module-3

5 a. Draw the perceptron network with the notation. Derive an equation of gradient descent rule to minimize the error. **(08 Marks)**

b. Explain the importance of the terms : (i) Hidden layer (ii) Generalization (iii) Overfitting (iv) Stopping criterion **(08 Marks)**

**OR**

6 a. Discuss the application of Neural network which is used for learning to steer an autonomous vehicle. **(06 Marks)**

b. Write an algorithm for back propagation algorithm which uses stochastic gradient descent method. Comment on the effect of adding momentum to the network. **(10 Marks)**

## Module-4

7 a. What is Bayes theorem and maximum posterior hypothesis? **(04 Marks)**

b. Derive an equation for MAP hypothesis using Bayes theorem. **(04 Marks)**

c. Consider a football game between two rival teams: Team 0 and Team 1. Suppose Team 0 wins 95% of the time and Team 1 wins the remaining matches. Among the games won by team 0, only 30% of them come from playing on teams 1's football field. On the otherhand, 75% of the victories for team 1 are obtained while playing at home. If team 1 is to host the next match between the two teams, which team will most likely emerge as the winner? **(08 Marks)**

**OR**

8 a. Describe Brute-force MAP learning algorithm. **(04 Marks)**

b. Discuss the Naïve Bayees classifier. **(04 Marks)**

c. The following table gives data set about stolen vehicles. Using Naïve bayes classifier classify the new data (Red, SUV, Domestic) **(08 Marks)**

Table

| Color | Type | Origin | Stolen |
|---|---|---|---|
| Red | Sports | Domestic | Yes |
| Red | Sports | Domestic | No |
| Red | Sports | Domestic | Yes |
| Yellow | Sports | Domestic | No |
| Yellow | Sports | Imported | Yes |
| Yellow | SUV | Imported | No |
| Yellow | SUV | Imported | Yes |
| Yellow | SUV | Domestic | No |
| Red | SUV | Imported | No |
| Red | Sports | Imported | Yes |

## Module-5

9 a. Write short notes on the following:
(i) Estimating Hypothesis accuracy.
(ii) Binomial distribution. **(08 Marks)**

b. Discuss the method of comparing two algorithms. Justify with paired to tests method. **(08 Marks)**

**OR**

10 a. Discuss the K-nearest neighbor language. **(04 Marks)**

b. Discuss locally weighted Regression. **(04 Marks)**

c. Discuss the learning tasks and Q learning in the context of reinforcement learning. **(08 Marks)**

# Seventh Semester B.E. Degree Examination, June/July 2019
## Machine Learning

Time: 3 hrs. Max. Marks: 80

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***

### Module-1

1 a. Define machine learning. Describe the steps in designing learning system. **(08 Marks)**

b. Write Find-S algorithm and explain with example. **(04 Marks)**

c. Explain List-Then-Eliminate algorithm. **(04 Marks)**

**OR**

2 a. List out any 5 applications of machine learning. **(05 Marks)**

b. What do you mean by hypothesis space, instance space and version space? **(03 Marks)**

c. Find the maximally general hypothesis and maximally specific hypothesis for the training examples given in the table using candidate elimination algorithm. **(08 Marks)**

| Day | Sky | Air Temp | Humidity | Wind | Water | Forecast | Enjoy Sport |
|---|---|---|---|---|---|---|---|
| 1 | Sunny | Warm | Normal | Strong | Warm | Same | Yes |
| 2 | Sunny | Warm | High | Strong | Warm | Same | Yes |
| 3 | Rainy | Cold | High | Strong | Warm | Change | No |
| 4 | Sunny | Warm | High | Strong | Cool | Change | Yes |

### Module-2

3 Construct decision tree for the following data using ID3 algorithm.

| Day | A1 | A2 | A3 | Classification |
|---|---|---|---|---|
| 1 | True | Hot | High | No |
| 2 | True | Hot | High | No |
| 3 | False | Hot | High | Yes |
| 4 | False | Cool | Normal | Yes |
| 5 | False | Cool | Normal | Yes |
| 6 | True | Cool | High | No |
| 7 | True | Hot | High | No |
| 8 | True | Hot | Normal | Yes |
| 9 | False | Cool | Normal | Yes |
| 10 | False | Cool | High | No |

**(16 Marks)**

**OR**

4 a. Explain the concept of decision tree learning. Discuss the necessary measure required to select the attributes for building a decision tree using ID3 algorithm. **(08 Marks)**

b. Discuss the issues of avoiding over fitting the data, handling continuous data and missing values in decision trees. **(08 Marks)**

### Module-3

5 a. Explain artificial neural network based on perception concept with diagram. **(06 Marks)**

b. What is gradient descent and delta rule? Why stochastic approximation to gradient descent is needed? **(04 Marks)**

c. Describe the multilayer neural network. Explain why back propagation algorithm is required. **(06 Marks)**

OR

6 a. Derive the back propagation rule considering the output layer and training rule for output unit weights. **(08 Marks)**

b. What is squashing function 3 why is it needed? **(04 Marks)**

c. List out and explain in briefly representation power of feed forward networks. **(04 Marks)**

## Module-4

7 a. Explain maximum a posteriori (MAP) hypothesis using Bayes theorem. **(06 Marks)**

b. Estimate conditional probabilities of each attributes {colour, legs, height, smelly} for the species classes: {M, H} using the data given in the table. Using these probabilities estimate the probability values for the new instance – (Colour = Green, Legs = 2, Height = Tall and Smelly = No) **(10 Marks)**

| No | Colour | Legs | Height | Smelly | Species |
|---|---|---|---|---|---|
| 1 | White | 3 | Short | Yes | M |
| 2 | Green | 2 | Tall | No | M |
| 3 | Green | 3 | Short | Yes | M |
| 4 | White | 3 | Short | Yes | M |
| 5 | Green | 2 | Short | No | H |
| 6 | White | 2 | Tall | No | H |
| 7 | White | 2 | Tall | No | H |
| 8 | White | 2 | Short | Yes | H |

OR

8 a. Explain Naive Bayes classifier and Bayseian belief networks. **(10 Marks)**

b. Prove that how maximum likelihood (Bayesian learning) can be used in any learning algorithms that are used to minimize the squared error between actual output hypothesis and predicted output hypothesis. **(06 Marks)**

## Module-5

9 a. Explain locally weighted linear regression. **(08 Marks)**

b. What do you mean by reinforcement learning? How reinforcement learning problem differs from other function approximation tasks. **(05 Marks)**

c. Write down Q-learning algorithm. **(03 Marks)**

OR

10 a. What is instance based learning? Explain K-Nearest neighbour algorithm. **(08 Marks)**

b. Explain sample error, true error, confidence intervals and Q-learning function. **(08 Marks)**