



Name: Roll No.:

Branch: Signature of Invigilator:

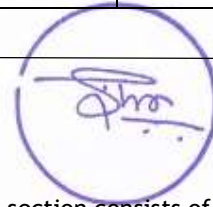
Semester: VIth

Date: 04/05/2022 (MORNING)

Subject with Code: IT340 MACHINE LEARNING

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE



1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. Candidates should write their roll no. in each page of the booklet.
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to submit the question paper cum answer sheets before leaving the examination hall.

Birla Institute of Technology, Mesra, Ranchi
End Semester Examination SP22
Subject: IT340 Machine Learning (Program Elective)

Program: B.Tech.
Branch: CS/ IT
Time: 2 Hrs.

Semester: VI
Session: SP/2022
Full Marks: 50

Instructions:

1. The question paper contains MCQs of 30 marks and subjective questions of 20 marks.
2. In some questions multiple options may be the correct answer.
3. The missing data if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.

Multiple Choice Questions [Q1 to Q20 carry 1 mark each and Q21 to Q25 carry 2 marks each]

Section A

Q1. If \vec{a} is a vector and is equal to $\begin{pmatrix} 1 \\ 4 \end{pmatrix}$. The unit vector in the direction of \vec{a} is:

- (a) $\begin{pmatrix} 0.24 \\ 0.97 \end{pmatrix}$ (b) $\begin{pmatrix} 0.04 \\ 0.17 \end{pmatrix}$ (c) $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ (d) $\begin{pmatrix} 0.24 \\ 0.07 \end{pmatrix}$

Q2. If the correlation between the two attributes A1 and A2 is 0.6. The expectation of the squared deviation of the attribute A2 from its mean is 25 and its covariance between A1 and A2 is 27. Then the variance of A1 is:

- (a) 9 (b) 81 (c) 5 (d) 2.5

Q3. A d-dimensional cartesian coordinate space is specified using d unit vectors, are called:

- (a) Orthogonal unit vector (b) Unit vector
(c) Standard basis vector (d) None of them

Q4. Two features A1 and A2 are independent of each other. The correlation coefficient between them is:

- (a) -1 (b) 0 (c) 1 (d) Not defined

Q5. Which of the following is not a classification problem?

- (a) Predicting the temperature (in Celsius) of a room from other features like pressure, humidity etc.
(b) Predicting if a cricket player is a batsman or a bowler given his playing records.
(c) Predicting the price of house based on the data consisting prices of other house and its features such as area, number of rooms, location etc.
(d) Detecting spam messages.

Q6. Which of the following strategies can be implemented to minimize the overfitting problem in decision tree?

- (a) By attaching each of the leaf nodes with a specific class.
- (b) Try to put minimum numbers of samples in each leaf nodes.
- (c) Using pruning method.
- (d) Enforcing maximum depth of the tree.

Q7. In Ensemble methods higher weights are given to the classifier with high _____

- (a) Precision
- (b) Recall
- (c) Accuracy
- (d) Votes

Q8. In which of the following machine learning approaches a set of parameters can be updated iteratively to minimize the error function?

- (a) Decision Tree
- (b) Clustering
- (c) Attribute Reduction
- (d) Gradient Descent

Q9. In a data set with 14 observations (each having 5 features and one class label attribute), 6 belong to positive class and 8 belong to negative class. The entropy of the data set is:

- (a) 0.99
- (b) 0.85
- (c) 0.89
- (d) 0.79

Q10. In linear regression method the under fitting shows:

- (a) Good performance on training data set but poor performance on validation or test data set.
- (b) Poor performance on training data set and poor performance on test data set.
- (c) Moderate performance on training data set poor performance on test or validation data set.
- (d) Poor performance on training data set and good performance on test data set.

Q11. Which activation function is used in single layer perceptron neural network model?

- (a) Sigmoid function
- (b) tanh function
- (c) Step or hard limit function
- (d) Cosine function

Q12. Consider a neural network model with input vector [0.4 0.2 0.3] and weight vector [0.1 -0.1 0.2] and bias of 0.4. The net input to the output neuron is:

- (a) 0.0
- (b) 0.26
- (c) 0.10
- (d) 0.48

Q13. Consider a neuron whose net input is 0.5. Binary sigmoidal activation function is used to activate the neuron. The output of the neuron is:

- (a) 0.606
- (b) 0.378
- (c) 0.622
- (d) 1.606

Q14. Choose the correct options as similarity metrics:

- (a) Mahalanobis distance metric
- (b) Cosine similarity metric
- (c) Manhattan Measurement
- (d) All of them

Q15. The goodness criteria for clustering is:

- (a) if number of clusters k is small
- (b) if number of clusters k is large
- (c) if intra-cluster metric is low and inter-cluster metric is high
- (d) if intra-cluster metric is high and inter-cluster metric is low

Q16. PAM is better than K-Means clustering because:

- (a) PAM converge faster than K-Means
- (b) PAM can generate any arbitrary shaped clusters
- (c) PAM is less sensitive to outliers
- (d) Both (a) and (c)
- (e) Both (b) and (c)

Q17. Performance of Agenes is better than K-Means in large data sets.

- (a) Absolutely true
- (b) Cannot agree
- (c) Sometimes true
- (d) For large numbers of attributes.

Q18. A data set consists of 110 objects. To cluster the objects based on similarity measures, Divisive clustering algorithm is used. The method starts with

- (a) A single cluster
- (b) A set of k clusters
- (c) A set of 55 clusters
- (d) 110 individual clusters

Q19. Ensemble of classifiers

- (a) May be more accurate than any of the individual model.
- (b) Always faster than individual model.
- (c) Both (a) and (b)
- (d) None of them

Q20. Consider you want to develop a machine learning model for predicting the number of positive and negative reviews of some movies. Your analysis is based on the attributes like number of views, duration of movie etc. Which metric would you like to choose in this case?

(a) Distance metric

(b) Accuracy

(c) Precision

(d) Mean square error

Q21. Let us consider a COVID-19 data sample with two class labels such as CoV-Positive and CoV-Negative. There are two hundred samples in the data set. A decision tree-based approach has been used to classify the data samples. The accuracy of the model is 85%. Find out the number of misclassified samples.

(a) 15

(b) 30

(c) 170

(d) 155

Q22. Consider the following information:

(i) There is a 60% chance it will rain today

(ii) There is a 50% chance it will rain tomorrow

(iii) There is 30% chance that it does not rain either day.

The probability that it will rain today and tomorrow is:

(a) 0.4

(b) 0.3

(c) 1

(d) Cannot say

Q23. Which of the following options is true for partitioning the following data by using the concept of smoothing by bin means?

8, 16, 9, 15, 21, 21, 24, 30, 26, 27, 30, 34

(a) Bin1: [12, 12, 12, 12] Bin2: [23, 26, 23, 23] Bin3: [30, 30, 30]

(b) Bin1: [12, 12, 12, 12] Bin2: [23, 23, 23, 23] Bin3: [30, 30, 30, 30]

(c) Bin1: [12, 12, 12, 12] Bin2: [26, 26, 26, 26] Bin3: [30, 30, 30, 30]

(d) Bin1: [12, 12, 12, 12] Bin2: [24, 24, 24, 24] Bin3: [29.25, 29.25, 29.25, 29.25]

Q24. Consider two vectors \vec{a} and \vec{b} . \vec{a} is $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and \vec{b} is $\begin{pmatrix} 1 \\ 4 \end{pmatrix}$. What is the value of unit vector in the direction of \vec{b} ?

(a) $\sqrt{5}$

(b) $\frac{1}{\sqrt{17}}$

(c) $\begin{pmatrix} \frac{17}{\sqrt{17}} \\ \frac{4}{\sqrt{17}} \end{pmatrix}$

(d) $\begin{pmatrix} \frac{1}{\sqrt{17}} \\ \frac{4}{\sqrt{17}} \end{pmatrix}$

Q25. Consider two objects O1 and O2 are participating in the clustering process. O1(0, 3, 0, 0, 2, 0, 0, 2, 0, 5) and O2(1, 2, 0, 0, 1, 1, 0, 1, 0, 3). What is the value of the cosine similarity between the objects O1 and O2?

(a) (-1, 1, 0, 0, 1, -1, 0, 1, 0, 2)

(b) 6.481

(c) 0.94

(d) 3

Subjective Questions [Answer any four questions. Each question carries 5 marks]

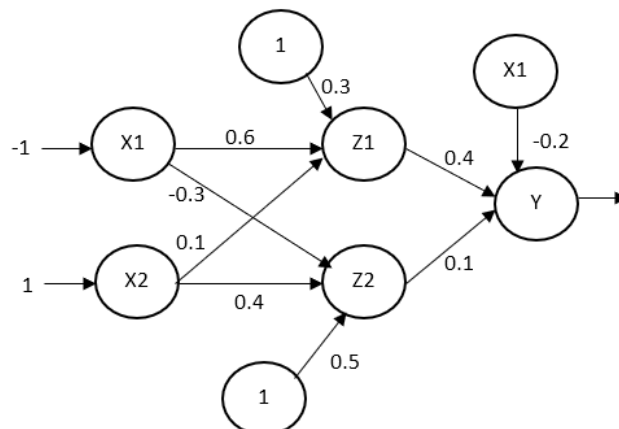
Section B

Q1. How do we represent the cost function in terms of hypothesis in univariate Linear Regression? Describe mathematical intuition of cost function with suitable example.

Q2. Use the following data set to find out the Information Gain for the attribute ‘*Car*’ i.e. [InfoGain(*Car*)] and gain ratio for the attribute ‘*Age*’ i.e. [GainRatio(*Age*)]. What judgement would you make about the three (Information gain, Gain ratio & Gini index) splitting attribute evaluation measures? [‘*Risk*’ represents the class label for each tuple *H(High)* & *L(Low)*, *Age* (*M: Middle aged, Y: Young, S: Senior*)].

ID	Age	Car	Risk
1	M	Sports	L
2	Y	Vintage	H
3	M	Sports	L
4	S	SUV	H
5	Y	Sports	H
6	M	SUV	H

Q3. Consider a Back Propagation Neural Network model shown in the figure given below. The network is presented with the input pattern [-1, 1] and the target output is +1. The initial weights between input layer to hidden layer are [v_{11} v_{21} v_{01}] = [0.6 0.1 0.3] and [v_{12} v_{22} v_{02}] = [-0.3 0.4 0.5]. The weight vector between the hidden layer and output layer is [w_1 w_2 w_0] = [0.4 0.1 -0.2]. The learning rate $\alpha = 0.25$ is considered. Bipolar sigmoidal activation function is used which is $f(x) = \frac{1 - e^{-x}}{1 + e^{-x}}$. Calculate the error correction term δ_1 and change in weights [Δw_1 Δw_2 Δw_0] in between the output layer and the hidden layer. Calculate the values for a single iteration.



Q4. Mention at least three limitations of K-Means clustering algorithms. The following data points are given as: 2, 4, 10, 12, 3, 20, 30, 11, 25. Assume $k = 3$ and randomly chosen initial means are $m_1 = 2$, $m_2 = 4$ and $m_3 = 6$. Show the clusters obtained after one iteration and new means for the next iteration.

Q5. Justify the necessity of Bagging method for classification process? Explain Bootstrap aggregation method with suitable diagram.



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