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Roll No. | | | | | | | | | | |

S. No. of Question Paper : 2780

Unique Paper Code : 32347611 IC

Name of the Paper : Data Mining

Name of the Course : B.Sc. (H) Computer Science : DSE-4

Semester : VI

Duration : 3 Hours Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *All* questions from Section A.

Attempt any *four* questions from Section B.

Section A

1. (*a*) Find the Euclidean distance between data points X(0, −1, 0, 1) and Y(1, 0, 1, 0). 2

(*b*) If recall and precision are 0.5 and 0.6 respectively, compute the value of F_1 measure. 2

(*c*) In a given dataset, it is found that an itemset {*ab*} is infrequent. Will itemset {*abc*} be infrequent or frequent ? Explain why. 2

P.T.O.

(*d*) What are the three strategies for handling missing values in a dataset ? 3

(*e*) Differentiate between precision and bias on the basis of the quality of the measurement process. 3

(*f*) What is meant by variable transformation ? What are its advantages ? 3

(*g*) If support of an association rule X –> Y is 80% and confidence is 75%, can we derive support and confidence of the rule Y –> X ? If yes, list down the values. If no, state the reason. 3

(*h*) List down *two* advantages and *two* disadvantages of leave-one-out approach used in cross-validation for evaluating the performance of the classifier ? 4

(*i*) Differentiate between agglomerative and divisive methods of hierarchical clustering with the help of a diagram. 4

(*j*) What are asymmetric attributes ? Give an example of each : 4

(*i*) asymmetric binary attribute,

(*ii*) asymmetric discrete attribute,

(*iii*) asymmetric continuous attribute.

(*k*) **The confusion matrix** for a 2-class problem is given **below :** 5

		Predicted Class	
		Class=1	Class=0
Actual Class	Class=1	400	100
	Class=0	200	300

Calculate the Accuracy, Sensitivity, Specificity, True Positive Rate, and False Positive rate.

Section B

2. (*a*) What are the differences between noise and outliers ? Are noise objects always outliers ? Are outliers always noise objects ? 2+1+1

(*b*) Let A and B be two sets of integers. A distance measure '*d*' is defined as follows : 4

$d(A - B)$ = size $(A - B)$ + size $(B - A)$ where '–' denotes set difference. Size denotes the number of elements in the set.

Prove that the distance measure '*d*' is a metric.

(*c*) What is unsupervised learning ? Explain with the help of an example application. 2

3. (*a*) Consider the following dataset for a 2-class problem : 7

A	B	Class Label
T	F	+
T	T	+
T	T	+
T	F	–
T	T	+
F	F	–
F	F	–
F	F	–
T	T	–
T	F	–

(*i*) Calculate the gain in the Gini Index when splitting on A and B.

(*ii*) Which attribute would the decision tree induction algorithm choose ?

(*iii*) Draw the decision tree after splitting showing the number of instances of each class.

(iv) How many instances are misclassified by the resulting decision tree ?

(b) Why is K-nearest neighbor classifier a lazy learner ? 3

4. (a) What is an exhaustive rule-sets in Rule based classification ? If the rule-set is not exhaustive, what problem arises ? How is it resolved ? 4

(b) What is progressive sampling ? What are its advantages ? 3

(c) State Bayes' theorem. What assumption is used by the Naive Bayes classifier ? 3

5. (a) Consider the following set of frequent 3-itemsets :

{1, 2, 3}, {1, 2, 4}, {1, 2, 5}{1, 3, 4}, {1, 3, 5}, {2, 3, 4}, {2, 3, 5}, {3, 4, 5}.

Assume that there are only five items in the dataset.

(i) List all candidate 4-itemsets obtained by a candidate generation procedure using the $F_{k-1} \times F_1$ merging strategy.

(ii) List all candidate 4-itemsets obtained by a candidate generation procedure in Apriori. 6

(b) Let X denotes the categorical attribute having values {awful, poor, OK, good}. What is the representation of each value when X is converted to binary form using :

(i) 2 bits

(ii) 4 bits ? 4

6. Consider the following transactional dataset : 8

Transaction ID	Items Bought
0001	{a, d, e}
0002	{a, b, c, e}
0003	{a, b, d, e}
0004	{a, c, d, e}
0005	{b, c, e}
0006	{b, d, e}
0007	{c, d}
0008	{a, b, c}
0009	{a, d, e}
0010	{a, b, e}

(*i*) Find out the support of itemsets {*e*}, {*b*, *d*}, {*a*, *d*} and {*b*, *d*, *e*}. Are these itemsets frequent if minimum support threshold is 30% ?

(*ii*) Find all the rules generated from the 3-itemset {*b*, *d*, *e*}. List down the strong rules among these rules if minimum confidence threshold is 60%.

(*b*) What is the difference between nominal attributes and ordinal attributes ? Give an example of each. 2

7. (*a*) Explain the following terms with reference to the DBSCAN clustering algorithm :

(*i*) Core point

(*ii*) Noise point

(*iii*) Border point 6

(*b*) Given the following data points : 2, 4, 10, 12, 3, 20, 30, 11, 25. Assume K = 3 and initial means 2, 4, 6. Show the clusters obtained using K-means algorithm after two iterations and show the new means for the next iteration. 4