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CMRIT – CMR INSTITUTE OF TECHNOLOGY, BENGALURU. ACCREDITED WITH A+ GRADE BY NAAC

Internal Assessment Test 2 – June 2022

Sub:	DATA MINING AND DATA WAREHOUSING					Sub Code:	18CS641	Branch:	ISE
Date:	09/06/2022	Duration:	90 min's	Max Marks:	50	Sem/Sec:	VI / A, B & C		OBE

Answer any FIVE FULL Questions

		MARKS	CO	RBT
1 (a)	Describe the challenges that motivated the development of Data mining.	[05]	CO2	L2
(b)	Differentiate between ROLAP vs MOLAP vs HOLAP.	[05]	CO2	L1
2	Explain any 5 data pre-processing methods with examples.	[10]	CO2	L2
3	For the following vectors, x and y, calculate the indicated similarity or distance measures. a. x = (0, 1, 0, 1), y = (1, 0, 1, 0) cosine, correlation, Euclidean, Jaccard b. x = (0, −1, 0, 1), y = (1, 0, −1, 0) cosine, correlation, Euclidean c. x = (1, 1, 0, 1, 0, 1), y = (1, 1, 1, 0, 0, 1) cosine, correlation, Jaccard	[10]	CO2	L3
4 (a)	Discuss whether or not each of the following activities is a data mining task. a. Dividing the customers of a company according to their gender. b. Dividing the customers of a company according to their profitability. c. Computing the total sales of a company. d. Sorting a student database based on student identification numbers. e. Predicting the outcomes of tossing a (fair) pair of dice. f. Predicting the future stock price of a company using historical records.	[06]	CO2	L2
(b)	Classify the following attributes as binary, discrete, or continuous. Also classify them as qualitative (nominal or ordinal) or quantitative (interval or ratio). a. Brightness as measured by people's judgments. b. Angles as measured in degrees between 0 and 360. c. Bronze, Silver, and Gold medals as awarded at the Olympics. d. Height above sea level.	[04]	CO2	L2
5	Explain Frequent Item Set Generation with example.	[10]	CO3	L2
6	Apply Apriori Algorithm for the following dataset and Write the algorithm for the same.	[10]	CO3	L3

Transaction Id	Items Purchased
1	A,B,D,E
2	B,C,D
3	A,D,F
4	A,B,C,D,F
5	A,B
6	C,E,F

Faculty Signature CCI Signature HOD Signature

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Scheme of Evaluation

Sub:	DATA MINING AND DATA WAREHOUSING					Sub Code:	18CS641	Branch:	ISE
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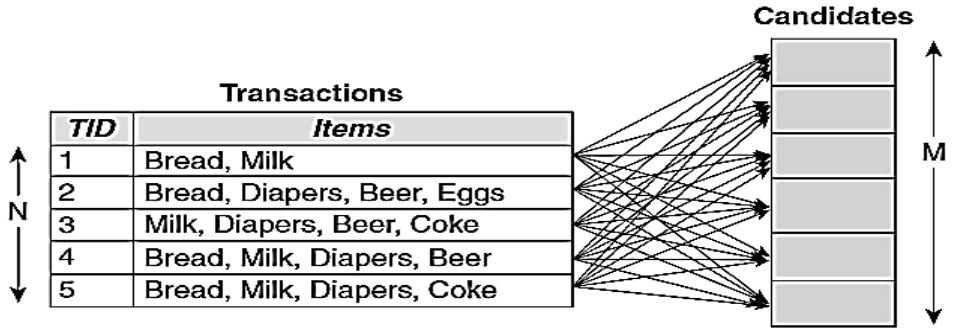
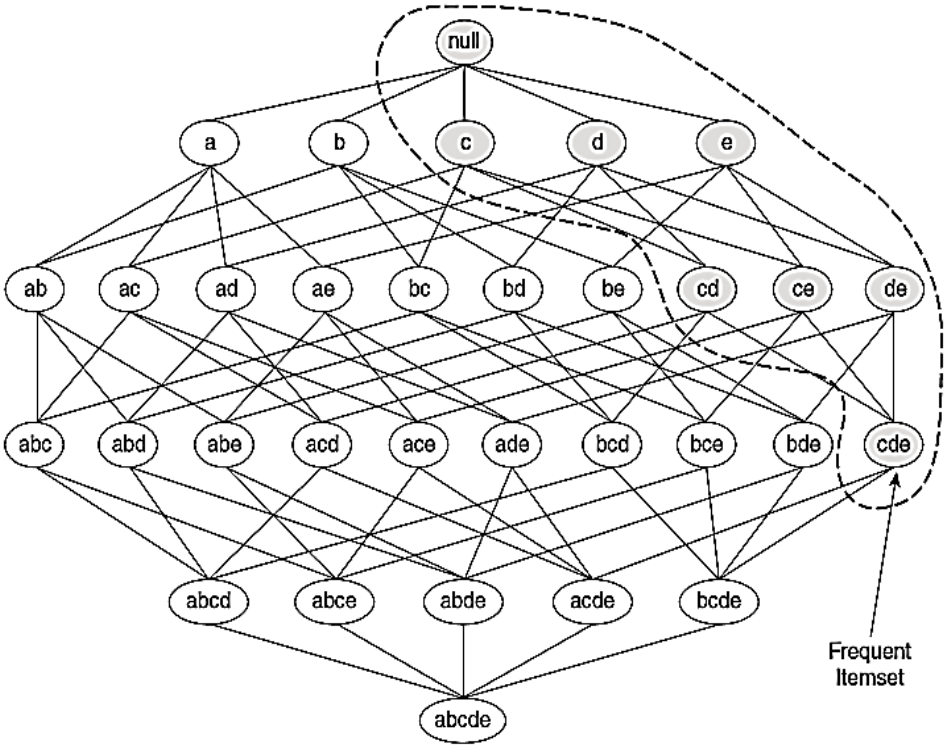
Answer any FIVE FULL Questions

		MARKS	CO	RBT
1 (a)	**Describe the challenges that motivated the development of Data mining.** **Scheme:** List and Explanation of each challenge carries **1 Mark each.** **Solution:** Scalability, High Dimensionality, Heterogeneous and Complex Data, Data Ownership and Distribution, Non-traditional Analysis.	[05]	CO2	L2
(b)	**Differentiate between ROLAP vs MOLAP vs HOLAP.**	[05]	CO2	L1

Comparison	MOLAP	ROLAP	HOLAP
Meaning	Multi-Dimensional Online Analytical Processing	Relational Online Analytical Processing	Hybrid Online Analytical Processing
Data Storage	It stores data in a multi-dimensional database.	It stores data in a relational database.	It stores data in a relational database
Technique	It utilizes the Sparse Matrix technique.	It employs Structured Query Language (SQL).	It uses a combination of SQL and Sparse Matrix technique.
Volume of data	It can process a limited volume of data.	It processes enormous data.	It can process huge volumes of data.
Designed view	The multi-dimensional view is static.	The multi-dimensional view is dynamic.	The multi-dimensional view is dynamic.
Data arrangement	It arranges data in data cubes.	It arranges data in rows and columns (tables).	There is a multi-dimensional arrangement of data

2	**Explain any 5 data pre-processing methods with examples.** **Scheme:** Explanation of any 5 data pre-processing carries **2 Marks** each. **Solution:** • Aggregation • Sampling • Dimensionality Reduction • Feature subset selection • Feature creation • Discretization and Binarization • Attribute Transformation **Aggregation** ⊓ Combining two or more attributes (or objects) into a single attribute (or object) Purpose: o Data reduction o Reduce the number of attributes or objects o Change of scale o Aggregated data tends to have less variability o More "stable" data **Sampling** ⊓ Sampling is the main technique employed for data selection. ⊓ Selecting a subset of the data objects to be analyzed ⊓ It is often used for both the preliminary investigation of the data and the final data analysis. ⊓ Statisticians sample because obtaining the entire set of data of interest is too expensive or time consuming. **Dimensionality Reduction:** • A key benefit is that many data mining algorithms work better if the dimensionality the number of attributes in the data-is lower. • This is partly because dimensionality reduction can eliminate irrelevant features and reduce noise **Purpose:** o Avoid curse of dimensionality o Reduce amount of time and memory required by data mining algorithms o Allow data to be more easily visualized o May help to eliminate irrelevant features or reduce noise **Feature Subset Selection:** • Another way to reduce dimensionality of data • Use only a subset of the features • Redundant and irrelevant features can reduce classification accuracy and the quality of the clusters that are found. Redundant features – Duplicate much or all of the information contained in one or more other attributes – Example: purchase price of a product and the amount of sales tax paid almost same Irrelevant features – Contain no information that is useful for the data mining task at hand – Example: students' ID is often irrelevant to the task of predicting students' GPA **Feature Creation** ⊓ Create new attributes that can capture the important information in a data set much more efficiently than the original attributes Three general methodologies: ⊓ Feature Extraction- Example: extracting edges from images domain-specific- ⊓ Mapping Data to New Space Example: Fourier and wavelet analysis	[10]	CO2	L2

3	**For the following vectors, x and y, calculate the indicated similarity or distance measures.** **Scheme:** Computation of Cosine, Correlation,Euclidean,Jaccard carries **4,3,4 Marks** Each. **Solution:** a. x = (0, 1, 0, 1), y = (1, 0, 1, 0) cosine, correlation, Euclidean, Jaccard **cos(x, y) = 0, corr(x, y) = −1, Euclidean(x, y) = 2, Jaccard(x, y)=0** b. x = (0, −1, 0, 1), y = (1, 0, −1, 0) cosine, correlation, Euclidean **cos(x, y) = 0, corr(x, y)=0, Euclidean(x, y)=2** c. x = (1, 1, 0, 1, 0, 1), y = (1, 1, 1, 0, 0, 1) cosine, correlation, Jaccard **cos(x, y) = 0.75, corr(x, y) = 0.25, Jaccard(x, y) = 0.6**	[10]	CO2	L3
4 (a)	**Discuss whether or not each of the following activities is a data mining task.** **Scheme:** Defining each statement is a data mining Task or not with conclusion carries **1 Mark** each. **Solution:** a. Dividing the customers of a company according to their gender. **No. This is a simple database query.** b. Dividing the customers of a company according to their profitability. **No. This is an accounting calculation, followed by the application of a threshold. However, predicting the profitability of a new customer would be data mining.** c. Computing the total sales of a company. **No. Again, this is simple accounting.** d. Sorting a student database based on student identification numbers. **No. Again, this is a simple database query.** e. Predicting the outcomes of tossing a (fair) pair of dice. **No. Since the die is fair, this is a probability calculation.** f. Predicting the future stock price of a company using historical records. **Yes. We would attempt to create a model that can predict the continuous value of the stock price.**	[06]	CO2	L2
(b)	**Classify the following attributes as binary, discrete, or continuous. Also classify them as qualitative (nominal or ordinal) or quantitative (interval or ratio).** **Scheme:** Defining each statement as a type of attributes with conclusion carries **1 Mark** each. **Solution:** a. Brightness as measured by people's judgments. **Discrete, qualitative, ordinal** b. Angles as measured in degrees between 0^0 and 360^0. **Continuous, quantitative, ratio** c. Bronze, Silver, and Gold medals as awarded at the Olympics. **Discrete, qualitative, ordinal** d. Height above sea level. **Continuous, quantitative, interval/ratio (depends on whether sea level is regarded as an arbitrary origin)**	[04]	CO2	L2

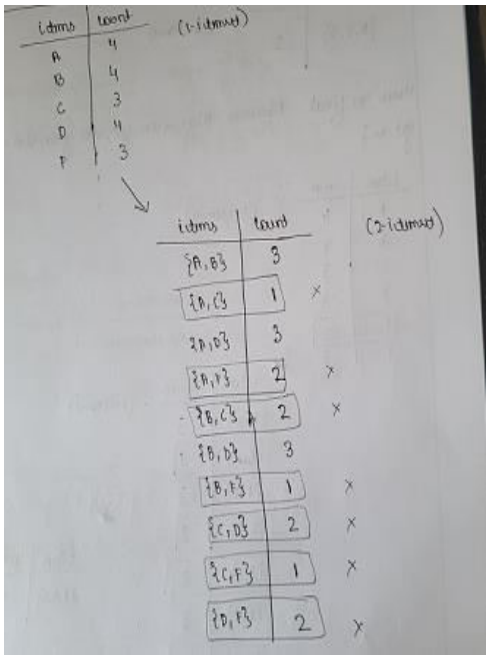
5	**Explain Frequent Item Set Generation with example.** **Scheme:** Explanation of Frequent Itemset with Brute-Force approach and No.of candidates with examples carries **5 Marks** each. **Solution:** ➢ Generate all itemsets whose support ≥ minsup **Brute-force approach:** ➢ Each itemset in the lattice is a candidate frequent itemset ➢ Determine the support count of each candidate by scanning the database.  **Figure 5.2.** Counting the support of candidate itemsets. **Reduce the number of candidates (M)** The Apriori principle, is an effective way to eliminate some of the candidate itemsets without counting their support values.  **Figure 5.3.** An illustration of the *Apriori* principle. If $\{c, d, e\}$ is frequent, then all subsets of this itemset are frequent.	[10]	CO3	L2
6	Apply Apriori Algorithm for the following dataset and Write the algorithm for the	[10]	CO3	L3

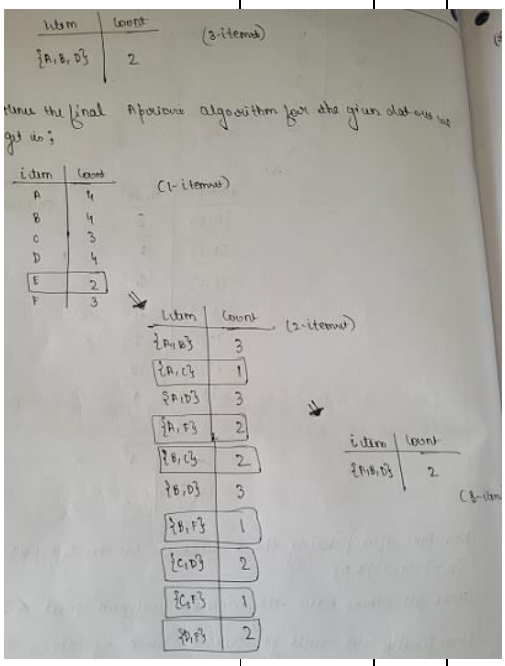
same.

Transaction Id	Items Purchased
1	A,B,D,E
2	B,C,D
3	A,D,F
4	A,B,C,D,F
5	A,B
6	C,E,F

Scheme : Applying Apriori algorithm for the given dataset (6 Marks) and algorithm (4 Marks).

Solution:





Algorithm 6.1 Frequent itemset generation of the *Apriori* algorithm.

1: $k = 1$.
2: $F_k = \{ i \mid i \in I \wedge \sigma(\{i\}) \geq N \times minsup\}$. {Find all frequent 1-itemsets}
3: **repeat**
4: $k = k + 1$.
5: $C_k = \text{apriori-gen}(F_{k-1})$. {Generate candidate itemsets}
6: **for** each transaction $t \in T$ **do**
7: $C_t = \text{subset}(C_k, t)$. {Identify all candidates that belong to t}
8: **for** each candidate itemset $c \in C_t$ **do**
9: $\sigma(c) = \sigma(c) + 1$. {Increment support count}
10: **end for**
11: **end for**
12: $F_k = \{ c \mid c \in C_k \wedge \sigma(c) \geq N \times minsup\}$. {Extract the frequent k-itemsets}
13: **until** $F_k = \emptyset$
14: Result $= \bigcup F_k$.

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