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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	SOCIO-ECONOMIC INFLUENCE OF SHARI'AH ON CONSUMERS' MOTIVES AND PERCEPTION IN ZAMFARA STATE, NIGERIA DR. HALIRU BALA	1
2.	EFFECTIVENESS OF COMPUTER ASSISTED INSTRUCTION IN RELATION TO THE LEARNING OUTCOMES OF THE ENGINEERING MANAGEMENT STUDENTS OF UNIVERSITY X MA. TEODORA E. GUTIERREZ	4
3.	IDENTIFYING TECHNOLOGICAL PARAMETERS EFFECTIVE ON COMPETITIVENESS OF SMALL AND MEDIUM-SIZED RESIN COMPANIES ACCORDING TO UNIDO MODEL: CASE STUDY OF IRAN KEATON POLYESTER MANUFACTURING COMPANY EHSAN GHASEMI, SEYED REZA HEJAZI, ABOLGHASEM ARABIOUN & REZA ALIBAKHSHI	6
4.	IMPACT OF ISLAMIC BUSINESS ETHICS ON FAMILY CONSUMPTION DECISION MAKING IN ZAMFARA STATE, NIGERIA DR. HALIRU BALA	12
5.	ETHICAL ISSUES AND CONSUMER PERCEPTION ABOUT BRANDED AND UNBRANDED MILK PRODUCTS: THE EMERGING SCENARIO DR. ASHOK AIMA & NARESH SHARMA	15
6.	SOFTWARE PROJECT MANAGEMENT - BEST PRACTICES DR. K. A. PARTHASARATHY	19
7.	RECALLING ANCIENT WISDOM FOR A SUSTAINABLE DEVELOPMENT DR. PADMA SHANKAR	23
8.	RADIO FREQUENCY IDENTIFICATION (RFID) TANAJI D. DABADE, DR. SHIVAJI U. GAWADE & ALEKHA CHANDRA PANDA	27
9.	SERVICE QUALITY MODELS IN HEALTHCARE - A REVIEW (1990-2010) K. VIDHYA, DR. C. SAMUDHRA RAJKUMAR & DR. K. TAMILIYOTHI	34
10.	A I R E P: A NOVEL SCALED MULTIDIMENSIONAL QUANTITATIVE RULES GENERATION APPROACH SAPNA JAIN, DR. M. AFSHAR ALAM & DR. RANJT BISWAS	45
11.	AN ANALYSIS OF ONLINE IDENTITY MANAGEMENT TECHNIQUES APARAJITA PANDEY & DR. JATINDERKUMAR R. SAINI	53
12.	PAPR REDUCTION OF OFDM BASED ON ADAPTIVE ACTIVE CONSTELLATION EXTENSION NEELAM DEWANGAN & MANGAL SINGH	56
13.	ANALYZING THE OUTPERFORMING SECTOR IN THE VOLATILE MARKET DR. SANDEEP MALU, DR. UTTAM RAO JAGTAP & RAHUL DEO	60
14.	AN ANALYTICAL STUDY OF JOB STRESS AMONG SOFTWARE PROFESSIONALS IN INDIA DR. SURENDRA KUMAR	65
15.	PROCESS FRAMEWORK FOR BUSINESS VALUE ENHANCEMENT BY IMPROVING OPERATIONAL EFFICIENCY RAMAKRISHNAN. N	71
16.	AN OVERVIEW OF SUPPLY CHAIN MANAGEMENT PRACTICES IN INDIAN AUTOMOBILE SECTOR R.VENKATESHWAR RAO	75
17.	AN EMPIRICAL STUDY OF BRAND PREFERENCE OF MOBILE PHONES AMONG COLLEGE AND UNIVERSITY STUDENTS DR. DINESH KUMAR	81
18.	ICT IN BANKING SECTOR: DISASTER AND RECOVERY OF INFORMATION GAGAN DEEP, SANJEEV KUMAR & ROHIT KUMAR	86
19.	CREDIT CARDS AND ITS IMPACT ON BUYING BEHAVIOUR: A STUDY WITH REFERENCE TO RURAL MARKET P.MANIVANNAN	89
20.	EMERGING APPLICATIONS AND SECURITY FOR VoIP: A STUDY HEMA JANDSALAR & DR. B. S. JANGRA	93
21.	SUCCESSION PLANNING IN INDIAN BANKING SYSTEM: A STUDY CONDUCTED AMONG BANK OFFICERS OF COIMBATORE DR. RUPA GUNASEELAN & S.DHANA BAGIYAM	96
22.	A CONCEPTUAL STRUCTURE FOR KNOWLEDGE MANAGEMENT MODEL IN HIERARCHICAL DISTRIBUTED ENVIRONMENT: CASE STUDY OF KNOWLEDGE SHARING AMONG DIFFERENT GOVERNMENT ORGANIZATION WORKING FOR PLANNING AND FACILITATING WATER RESOURCES IN UTTARAKHAND STATE JATIN PANDEY & DARSHANA PATHAK JOSHI	99
23.	A DNA-BASED ALGORITHM FOR MINIMUM SPANNING TREE PROBLEM USING TEMPERATURE GRADIENT TECHNIQUE B.S.E.ZORAIDA	102
24.	MARKET BASKET ANALYSIS: A DATA MINING TOOL FOR MAXIMIZING SALES & CUSTOMER SUPPORT KALPANA BABASO SALUNKHE, MURLIDHAR S. DHANAWADE & SACHIN PATIL	107
25.	FAULT DETECTION IN NETWORKS BASED ON DYNAMIC INTERVAL BASED ACTIVE PROBING BANUMATHI R	110
26.	ISSUES AND CHALLENGES IN ELECTRONIC WASTE DR. KUNTAL PATEL & NIRBHAY MEHTA	113
27.	STUDY ON CSR OF WIPRO, TATA & RIL SHWETA PATEL & ZARNA PATEL	116
28.	EMPOWERING RURAL WOMEN – ROLE OF MICROFINANCE DR. NANU LUNAVATH	119
29.	ROLE OF E-LEARNING IN EDUCATION: A STUDY OF UNIVERSITY OF JAMMU ANJU THAPA	126
30.	ADVERTISING: DO THEY HELP CONSUMERS IN MAKING SOUND PURCHASE DECISIONS? PINKI	130
	REQUEST FOR FEEDBACK	132

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RESULTS & DISCUSSION

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MARKET BASKET ANALYSIS: A DATA MINING TOOL FOR MAXIMIZING SALES & CUSTOMER SUPPORT**KALPANA BABASO SALUNKHE****ASST. PROFESSOR****SINHGAD INSTITUTE OF BUSINESS ADMINISTRATION & COMPUTER APPLICATION****LONAVALA****MURLIDHAR S. DHANAWADE****ASSOCIATE PROFESSOR****SINHGAD INSTITUTE OF BUSINESS ADMINISTRATION & COMPUTER APPLICATION****LONAVALA****SACHIN PATIL****ASST. PROFESSOR****DR. D.Y.PATIL INSTITUTE OF MANAGEMENT & RESEARCH****PIMPRI****ABSTRACT**

Data mining is becoming increasingly common in both the private and public sectors. Industries such as banking, insurance, medicine, and retailing commonly use data mining to reduce costs, enhance research and increase sales. Market Basket Analysis (MBA, -Association Analysis) is a mathematical modeling technique based upon the theory that if you buy a certain group of items, you are likely to buy another group of items. It is used to analyze the customer's purchasing behavior and helps in increasing the sales and maintain inventory by focusing on the point of sale transaction data. Market Basket Analysis is the discovery of relations or correlations among a set of items which are actually transactions made by customer's purchases. MBA also known as affinity analysis has emerged as the next step in the evolution of the retail merchandising and promotion. MBA allows leading retailers to quickly & easily look at the size, contents, & value of their customer's market basket to understand how products are purchased together. It helps the retailers to drill down into customer buying patterns over time to precisely target & understand specific, combination of products departments, brands, categories, & even time of day. Association rule which is the output of the MBA helps to specify the combination of the products; those should be sold in combination. The aim of the analysis is to determine the strength of all the association rules among a set of items. The strength of the association is measured by the support and confidence of the rule.

KEYWORDS

Association rule, Data mining, frequent patterns, Market Basket Analysis, threshold criteria.

INTRODUCTION

The major reason that the data mining has attracted a great deal of attention in the information industry in recent years is due to the wide availability of huge amounts of data and imminent need for turning such data into useful information and knowledge. The knowledge gained can be used for applications ranging from business management, production control, and market analysis, to engineering design and science exploration.

The discovery of interesting association relationships among huge amounts of business transaction records can help in many business decision making processes, catalog design, cross marketing and loss-leader analysis.

Data mining functionalities are used to specify the kind of patterns to be found in data mining tasks. In some cases, users may have no idea regarding what kind of patterns in their data may be interesting, and hence may like to search for several different kinds of patterns in parallel.

Frequent patterns, as the name suggests, are patterns that occurs frequently in data. There are many kinds of frequent patterns, including itemsets, subsequences, and substructures. A frequent itemset refers to set of items that frequently appear together in a transactional data set., such as milk and bread.

A frequently occurring subsequence, such as the pattern that the customer tends to purchase first PC & then memory card, is a sequential pattern. A substructure can refer to different structural forms, such as graph, trees or lattices, which can be combined with itemsets or subsequences. Mining such frequent patterns leads to discovery of interesting associations and correlations within data.

Frequent itemset mining leads to the discovery of associations and correlations among items in large transactional or relational data sets.

A typical example of association rule mining is market basket analysis. This process analyzes customer buying habits by finding associations between the different items that customers place in their 'shopping basket'. The discovery of such association can help retailers develop marketing strategies by gaining insight into which items are frequently purchased together by customers. For instance, if customers are buying milk, how likely are they also buy bread, they will specify what kind of bread they will prefer on the same trip to the supermarket? Such information can lead to increased sales by helping retailers do selective marketing and plan their shelf space. We will answer all these questions with the help of support & confidence- two measures of the association rule.

FIGURE 1: MARKET BASKET ANALYSIS**Market Basket Analysis**

Rule	Support	Confidence
$A \Rightarrow D$	2/5	2/3
$C \Rightarrow A$	2/5	2/4
$A \Rightarrow C$	2/5	2/3
$B \& C \Rightarrow D$	1/5	1/3

METHODOLOGY**A. SCOPE OF RESEARCH WORK**

Increasingly retailing is seeking a competitive edge through technology. Market basket analysis also known as affinity analysis has emerged as the next step in the evolution of retail merchandising and promotion.

Market basket analysis allows leading retailers to quickly & easily look at the size, contents and value of their customer's market basket to understand the patterns like how products are purchased together. Advanced implementations of market basket analysis leverage the instant results to encourage train of thoughts enabling retailers to drill down into customer buying patterns over time, combinations of products, departments, brands, categories, & even time of the day.

- 1) It checks some items usually bought in.
- 2) It helps to organize product in to different groups.
- 3) It gives information about products which almost always or almost never purchased together.
- 4) It gives information about how many items are there in a typical transaction. Once you get association rules, you can use this knowledge for many business ideas. Here are some of the business ideas:

- a) Cross selling: Offers the associated item when customer buys any items from your store.
- b) Product Placement: Items that are associated (such as bread and butter, computer & antivirus software) can be put near to each other. If the customers see them, it has higher probability that they will purchase them together.
- c) Affinity Promotion: Design the promotional events based on associated products.
- d) Customer behavior: Associating purchases with demographic, and socio economic data (such as age, gender & preference) may produce.

B. AIMS & OBJECTIVES

- 1) To study & analyze present customer purchasing & Organizations (retailers) role.
- 2) To study & suggest a suitable data mining tool which helps the organization
- 3) To make suggestions wherever necessary.
- 4) Empower the retailer planner.
- 5) Empower the merchant (buyer) to buy smarter
- 6) More profitable advertising & promotions.
- 7) Better loyalty card promotions with longitudinal analysis.
- 8) Attract more traffic into the store.
- 9) Increase the size & value of the market basket

C. METHODOLOGY

The following methodology adopted while developing the system.

1. The existing purchase and sale of the product is studied.
2. The purpose of different customer buying behavior is studied.
3. The information was collected from the related database and through discussion with manager.
4. After completely studying all aspect regarding customer, searched for statistical analytical process that will be suitable for the organization.

First I will use survey & interview technique to collect transactional data of the sales of products which are made by the customers. Then I will use Market Basket Analysis or Association Rule Mining which is one of the data mining tools. Market Basket Analysis may be performed on the retail data of customer transactions at the store. The results may be used to plan marketing or advertising strategies as well as catalog design. & to learn about the buying habits of your customers.

Steps for market based Analysis are as follows:

1. Generate all possible association rules.
 2. Compute the support and confidence of all possible association rules.
- Lets us call the items currently seen by the customer as X (independent variable) and other items associated to those current items as Y (dependent variable).

If you have 3 items, name A, B and C, we have 12 possible association rules as shown below:

Generating all possible association rules if you have three items named A, B, C, we have 12 association rules.

TABLE 1: POSSIBLE ASSOCIATION RULE

Association no	X	Y
1	[A]	[B]
2	[A]	[C]
3	[A]	[B,C]
4	[B]	[A]
5	[B]	[C]
6	[B]	[A,C]
7	[C]	[A]
8	[C]	[B]
9	[C]	[A,B]
10	[A,B]	[C]
11	[A,C]	[B]
12	[B,C]	[A]

For our demonstration example, we have 4 items that generate following possible association rules as shown below.

TABLE 2: TRANSACTIONAL DATA FOR MBA

Transaction ID	Items from the customers who bought more than 1 item
1	Sugar, Wheat, Pulses, Rice
2	Sugar, Pulses
3	Wheat, Pulses
4	Wheat, Pulses, Rice
5	Wheat, Pulses
6	Sugar, Wheat
7	Sugar, Rice, Pulses

For simplicity we call the items by its letter (A for Sugar, B for Wheat, C for Pulses, D for Rice). Lets us give name to compute support & confidence, we first set our transaction data into binary data as below:

TABLE 3: INPUT TRANSACTION RECORDS BINARIZED TRANSACTIONS

TID	Items from customers who bought more than 1 items		TID	A	B	C	D
1	Sugar, Wheat, Rice, Pulses		1	1	1	1	1
2	Sugar, Pulses		2	1	0	0	1
3	Wheat, Rice	⇒	3	0	1	0	1
4	Wheat, Rice, Pulses		4	0	1	1	1
5	Wheat, Pulses		5	0	1	0	1
6	Sugar, Wheat		6	1	1	0	0
7	Sugar, Rice, Pulses		7	1	0	1	1
			sum	4	5	3	6

TABLE 4: SUPPORT & CONFIDENCE

Transaction ID.	X	Y	N(X U Y)	N	%support	N(x)	Confidence	Accept as rule ?
1	A	B	2	7	29%	4	50%	NO
2	A	C	2	7	29%	4	50%	NO
3	A	D	3	7	43%	4	75%	Yes
4	B	D	4	7	57%	5	80%	Yes
5	C	AD	2	7	29%	3	67%	Yes

The support for the rule $A \Rightarrow B$ is the probability that the two item sets occur together. The support of the rule $A \Rightarrow B$ is estimated by the following:

$$\text{Support}(X \Rightarrow Y) = \frac{\text{transactions that contain every item in } A \text{ and } B}{\text{all transactions}}$$

The confidence of an association rule $A \Rightarrow B$ is the conditional probability of a transaction containing item set B given that it contains item set A . The confidence is estimated by the following:

$$\text{Confidence}(X \Rightarrow Y) = \frac{\text{transactions that contain every item in } A \text{ and } B}{\text{transactions that contain the items in } A}$$

For this above table i.e. Table 4 we can give threshold value to support & confidence for getting the association rule. As below:

Minimum support = 40 %

Minimum confidence = 60 %

CONCLUSION

1. There are certain buying habits of the customer.
2. There is association between the products which are purchased by the customer.
3. The procedure of purchasing the product by the customer depends on mainly on customer's requirement, product availability, and suitability. Product should be arranged suitably & attractively in the rack; so that they will be accessed easily. This probability of purchase of the product by the customer is checked & formulated.
4. It is observed that the product which are in the association rule, the probability of buying these products by the customer is very high.

SUGGESTIONS

On the basis of the results from the data mining tool the following suggestions are given:

1. It is suggested that organization should keep track of all transactions made by the customer.
2. The organization should install the data mining tool for the stored databases, which helps generating various association rule concerned with the products.
3. It helps organization in dating prior knowledge of associated items which customer is willing to buy from the store

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