Comparative Study of Different Algorithms for Automatic Generation of Question Paper

Ms P V. Bobade[1], S S.Dandge[2], Dr M A.Pund[3]

Student[1], Assistant Professor[2], Associate Professor[3]

Department of CSE

PRMIT&R, Amravati, India

Corresponding Author's email id: *bobade.poonam@gmail.com*

Abstract

Automated question paper generating system is an automated process of generating question paper with the help of computer with various constraints conditions according to the requirement. It is a system which has been designed to overcome the traditional paper based method of generating question paper. This system is more secured, efficient and time consuming. This automated method of generating question papers has been designed using various algorithms and methodologies. The algorithms used for working of the system are randomization algorithm, shuffling algorithm, ant colony algorithm, genetic algorithm and methodologies used are backtracking, soft computing technique, xml based search etc. The various methods and algorithms which are available have certain advantages as well as few shortcomings. This paper makes a comparative study of the various algorithms available and which can be used for automatic generation of question paper.

Keywords: *Ant colony, Shuffling algorithm, Backtracking, Genetic Algorithm*

I. INTRODUCTION

Examination process is an activity to measure the performance of a student. Thus generation of an effective question paper is a task of great importance. Traditional methodology of generating a test paper was manual in which professors needed to invest a lot of time an effort in framing a question

paper. Framing an effective question paper needs to consider various parameters such as difficulty level marks, numerical as well as theoretical contents of the paper and weightage of questions according to the marks. Evolutionary changes in computer technology has led to a change from manual to an automated system. Various algorithms and techniques can be used for effective generation of question paper. There are various algorithms which are used for efficient generation of question paper. Few of the know algorithms and methodologies for automatic generation of question paper are random test method, backtracking test method, genetic algorithm method randomization algorithm, shuffling algorithm, ant colony algorithm, genetic algorithm. Each of the available methodologies and algorithms have certain advantages and disadvantages. This paper describes the comparative study of the various algorithms and methodologies used for automated question paper generating system

II. STUDY OF ALGORITHM

There are a variety of test paper generation algorithms in the existing examination system such as random test method, backtracking test method and genetic

algorithm method. Random test method has many advantages, such as test paper generation strategy intuitive and simple programming. However, it has not pre-process of constraint conditions, which leads to lack of rationality in the paper and make it difficult to control the difficulty coefficient of the test paper.

Backtracking test method has high success rate of paper composition. But if there are larger numbers of paper, paper making would take a relatively long time, which reduces the working efficiency.

A. Genetic Algorithm
Genetic algorithm method is of high efficiency, shorter time and high success rate. Traditional genetic algorithm (GA) uses binary code. If the number of questions in a test database is large, then the binary string is too long to control genetic operations.

Therefore, most ATPGS uses decimal code, which is able to avoid this problem. Generally in the decimal coding, crossover points and mutation points are generated in the whole coding. It makes the number of question types changed.

B. Shuffling Algorithm

Shuffling algorithm provides a technique of randomization which helps in generating question paper without repetition or duplication there are four categories of randomization which are generating a random permutation of a sequence, selecting a random sample of a population, generating random numbers and transforming a data stream using a scrambler in telecommunications. Shuffling algorithms is a ways to implement for randomization of generated question. This algorithms check for duplication and repetition of the randomize question. Shuffling algorithm only focuses on selecting the paper randomly without repetition and duplication and does not include the difficulty and level of the question. The types of question which has been selected using the mechanism also do not vary. A low quality of exam paper with less opportunities to success is generated with high costs.

3. Fuzzy Logic Algorithm

Classical logic only permits conclusions which are either true or false. Fuzzy logic technique has been used to handle the concept of partial truth, where the truth value may range between completely true and completely false. One such method of applying fuzzy logic is Top-N queries. Top-N query is used for limiting the number of rows returned from ordered sets of data. They are extremely useful when the top or bottom 'N' number of rows has to be returned from a set of data. In the proposed system, Top-N query helps to select random questions from the question set.

Question once selected is stored in a different database and every time new questions are entered, it selects the questions apart from the ones contained by that particular database holding questions that are previously entered. Thus every time random question paper is generated.

4. Apriori Algorithm

Apriori algorithm is itemset mining. It can fetch data using subsets of subsets from large transactional databases. Apriori makes use of "bottom up" approach, where frequent subsets are extended one item at a time. The algorithm terminates when no further successful extensions are found. Apriori algorithm makes use of breadth-first search and a Hash tree structure to count candidate item sets efficiently.

5. Utility Based Agent

Utility based agents are autonomous, proactive and reactive in behaviour in attaining its goal along with required efficiency. The utility function based agent's helps in measuring the efficiency of way of attaining its goals. More specifically utility based agents provide extra benefit of measure of efficiency in addition to usual benefits of goal based agents.

The efficiency criteria can be any parameter i.e. minimization of time in covering distance by any agent. Utility based agents provide means to attain goals with efficiency measures. In some applications this efficiency measure is computation of total expected utility of goal.

6. Ant Colony Algorithm

Ant colony is a simulated and evolved heuristic algorithm. This algorithm adopts positive feedback parallel mechanism. Automatic generation of test paper using ant colony algorithm improves the success rate of question paper generation. Ant colony algorithm is a kind of colony intelligence searching method, and is equipped with positive feedback paralleling mechanism, with strong searching capability, enabling it to be appropriate for the solution of automatic test paper generation, especially binary ant colony algorithm, which enables ant to only select between 0 and 1 in each moment due to its special random binary system chain structure. 0 and 1 actually correspond with "yes "and "no" of the question in examination database.

7. Software Based Agent

This system takes a text file as an input from the user. This text file is processed by document processing agent which extracts the words from the ranked list of words extracted from the text which has been given as an input by the user. The system first processes the input by the Tree Tagger tool, which produces the output in the form of one word per line, along with the tag and the lemma of that particular token.

The second step is that the processed output is ranked based upon the frequency of occurrence of each word. Finally stemming process is done to get the proper keyword, this is accomplished by filtering all the suffix and prefix out of the given word. The entire process is carried out by the agent, which eliminates the work of the human in the processing module. [6]

III.   LITERATURE SURVEY

The mechanism of automatic generation of question paper is based on various methodologies. The various techniques, algorithms and methodologies have been presented and   by authors in their papers. Few of them are

A. "Automatic Question Generation Using Software Agents for Technical Institutions" the authors Shivank Pandey, K.C. Rajeswari have proposed a methodology of generating question paper with the help of software agents. They have made use of document processing agent which does the processing on input text file. The output is generated by a tree tagger. The occurrence of each word is counted and displayed in numerical form along with the word. [1]

B. "Advanced Question Paper Generator Using Fuzzy Logic" Pratik Gadge,Ravikant Vishwakarma, Divya Gandhi

The authors have proposed a standalone application for automatic generation of question paper with the help of fuzzy logic. A question paper is generated with the set of predefined questions in the database. The

system stores fuzzy rules in the form of two dimensional array. [1]

C."Modelling an Agent for Paper Generation System Using Utility Based Approach" M. Junaid Arshad , Mamoona Naz , Yasir Saleem , Amjad Farooq , K. H. Asif have proposed utility based test paper agent. Utility theory is used in assigning utility value to question items at the time of entry of question items and picking question items at the time of test paper generation. So this UBTP Agent is utility based test paper generator. The goal of UBTP Agent is generation of test paper with required difficulty level. Utility based agents are autonomous, proactive and reactive in behavior in attaining its goal along with required efficiency. [2]

D. "A Review on Automated Test Case Generation Using Genetic Algorithms" Rijwan Khan*,

Dr. Mohd Amjad have proposed that with the use of genetic algorithm suitable test cases could be generated. A genetic algorithm is a nature inspired evolutionary algorithm in which we solve optimization problem. Genetic algorithm is used to find approximate solutions to optimization problems. Genetic algorithm handles a

population of possible solutions. It improves the efficiency and effectiveness and lowers the high cost of software testing. [3]

E. "Application of Improved Genetic Algorithm in Automatic Test Paper Generation" Kui Zhang, Lingchen Zhu have proposed the concept of improved genetic algorithm. The authors have mentioned in their paper that traditional genetic algorithm makes use of binary code. If the number of questions in the database and more in number the generated genetic string is too long and it becomes difficult to handle the string. Thus to overcome the problem the authors have suggested the technique of improved genetic algorithm. In this paper, the authors have established the chromosome structure of test paper and the fitness function, and designed genetic operators. The improved GA in automatic generation of test paper uses the decimal encoding and make segments according to the question types.

Genetic operations are carried out at each segment to ensure that the number of each question type is unchanged. The segmented decimal coding overcomes shortcomings of binary coding, such as too large search space and too long code. It reduces the

decoding time of individual and improves the speed of the solution. Application of the system helps in reducing the number of iterations. It makes the output more reasonable. The improved GA can select more optimal individual by the iterative operation. And the improved GA has larger value of fitness than that of general GA. [4]

F. "Automated Question Paper Generator System Using Apriori Algorithm and Fuzzy Logic" Aishwarya Chavan Divya Karekar, Mojitha Mohandas Rasika Manjarekar, Supriya Mandhare
The authors have presented the idea of automatic generation of question paper making use of fuzzy logic algorithm. It allows the user to generate question paper with various difficulty levels. Fuzzy Logic can utilize human reasoning effectively. They are stored in the database with their weightage and difficulty level. a multiple choice question paper can also be generated using the technique.

The authors have also described in their paper that classical logic only permits conclusions which are either true or false. However, Fuzzy logic has been extended to handle the concept of partial truth, where

the truth value may range between completely true and completely false. One such method of applying fuzzy logic is Top-N queries. Top-N query is used for limiting the number of rows returned from ordered sets of data. They are extremely useful when the top or bottom 'N' number of rows has to be returned from a set of data. In the proposed system, Top-N query helps to select random questions from the question set. Question once selected is stored in a different database and every time new questions are entered, it selects the questions apart from the ones contained by that particular database holding questions that are previously entered. Thus every time random question paper is generated.

Apriori algorithm is itemset mining. It can fetch data using subsets of subsets from large transactional databases. It proceeds by identifying the frequent individual items in the database and extending them to larger and larger item sets as long as those item sets appear sufficiently often in the database.

Apriori uses a "bottom up" approach, where frequent subsets are extended one item at a time. The algorithm terminates when no further successful extensions are found.

Apriori uses breadth-first search and a Hash tree structure to count candidate item sets efficiently.

The main purpose was to generate fuzzy logic for randomization. [5]

G. "Shuffling Algorithms for Automatic Generator Question Paper System"Nor Shahida bt Mohd Jamail & Abu Bakar Md Sultan In the paper the authors have introduced the usage of shuffling algorithm in Automatic Generator Question Paper System. The main role of the shuffling algorithms is to provide randomization technique in GQS thus different sets of question could be generated without repetition and duplication.

Shuffling algorithms is suitable and an effective ways to implement for randomization of generated question. This algorithms check for duplication and repetition of the randomize question. It uses a huge question bank which is based on the learning outcomes elements which refer to the Bloom's Taxonomy. [6]

H." Information Security and Data Mining in Big Data" Tejas P. Adhau, Prof. Dr. Mahendra A. Pund In the paper mentioned the authors have discussed the

concept of privacy-preserving data mining (PPDM).The authors have discussed about security concerns and privacy preserving techniques for each user. Knowledge Discovery in Databases KDD widely used data mining technique is a process that includes data preparation, selection, and generate result patterns. [7]

I.” Automatic Test Paper Generation Based on Ant Colony Algorithm”,Dan Liu, Jainming Wang, Lijuan Zhang the authors have proposed that automatic test paper generating system based on ant colony algorithm improves the success rate of test paper generation, and accelerates its speed, which lead to higher quality of test papers being generated that can basically accommodate to the requirements of automatic test paper generation-high success rate and instantaneity.[8]

J. “Implementing Security to information using privacy preserving data mining” Prof. Sangram S. Dandage, Miss. Sonali P. Mahindre In this paper, the authors have presented the privacy issues related to data mining from a wider perspective and investigate various approaches that can help to protect sensitive information. There are for decision maker different types of users

involved in data mining applications, namely, data provider, data collector, data miner, and decision maker. For each type of user, we discuss his privacy concerns and the methods that can be adopted to protect sensitive information. [9]

K.” Use of an Evolutionary Approach for Question Paper Template Generation” Dimple V.Paul Shankar B. Naik, Priyanka Rane , Jyoti D. Pawar have proposed an evolutionary programming technique for question paper template generation. The paper has described the use of evolutionary algorithm for the generation of question paper. The main advantage of this approach is the application of strengths of evolutionary programming for use in dynamic question paper generation.

Complexity of this template generation algorithm is proportional to the number of units and the number of levels. Evolutionary programming offers a robust non-linear search technique that is particularly suited to problems involving large number of variables.

The strength of evolutionary programming is derived from their ability to exploit, in a highly efficient manner, information about a population. The approach presented in this

paper monitors the quality of question paper based on a wide range of paper setter requirements such as the average degree of difficulty, kinds of questions, selection of modules, selection of cognitive levels, etc. [10]

L."Developing an intelligent agent for Automatic Question Paper setting" Kanchan H. Pinjani Renuka Y. Raut Prof. S.E .Yedey the authors have proposed Automatic Question Paper Generator Agent which is based on the techniques of random number generation and backtracking. In this paper, the authors have tried to introduce an intelligent agent for Automatic question paper setting system (AQPS) which will automatically select the question from the database based on the technique of random number generation and backtracking algorithm. The system proposed here contains three subsystems: Knowledge Descriptor, Questions Generator, and E-learning Executer.

The Knowledge Descriptor subsystem allows the instructor to describe the learning contents. The Questions Generator subsystem receives the learning contents and generates the corresponding multiple questions. The E-learning Executer subsystem allows the students to use the

generated questions in education process. System generated correct and wrong options question (CWOQ) algorithm is generated and had sub algorithm like only One Solution, two Solutions, all of The Above, and none Of The Above algorithms. [11]

IV. COMPARATIVE STUDY

The mechanism of automatic generation of question paper can be implemented making use of various methodologies. There are few algorithms available for automatic generation of question paper. There are a variety of test paper generation algorithms in the existing examination system such as random test method, backtracking test method and genetic algorithm method. Random test method has many advantages, such as test paper generation strategy intuitive and simple programming.

However, it has not pre-process of constraint conditions, which leads to lack of rationality in the paper and make it difficult to control the difficulty coefficient of the test paper.

Backtracking test method has high success rate of paper composition. But if there are larger numbers of paper test libraries, paper making would take a relatively long time,

which reduces the working efficiency. This system takes advantage of global optimization and fast convergence speed of GA to design an intelligent algorithm for ATPGS. Genetic algorithm method is of high efficiency, shorter time and high success rate.

Traditional genetic algorithm (GA) uses binary code. If the number of questions in a test database is large, then the binary string is too long to control genetic operations.

Classical logic only permits conclusions which are either true or false. Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false. Apriori algorithm is itemset mining. It can fetch data using subsets of subsets from large transactional databases. It proceeds by identifying the frequent individual items in the database and extending them to larger and larger item sets as long as those item sets appear sufficiently often in the database.

Ant colony algorithm is simple to implement. it avoids the blindness of random variable algorithm, it merely adjusts the process of generating test papers passively, and when the question base is

vast, the times of backtracking will be largely increased, accompanied by a large internal storage and a long period of time wasted.

IV. CONCLUSION

The paper is a comparative study of the various algorithms and methodologies used for the automatic generation of question paper. Automatic question paper generation is thus a technique to generate paper automatically with ease. This paper describe the various algorithms that have been used for the generation of question paper. Every methodology has certain advantages and disadvantages which has been described in the paper.

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REFERENCES

[1] Shivank Pandey,K.C Rajeshwari,"Automatic Question Generation Using Software Agent for Technical Institution",

International Journal of Advanced Computer Research., Volume-3 Number-4 Issue-13 December-2013

[2] Pratik Gadge, Ravikant Vishwakarma, Divya Gandhi, Advanced Question Paper Generator Using Fuzzy Logic, International Research Journal of Engineering and Technology , 2017, vol. 04,issue 03.

[3] Rizwan Khan,Dr .Mohd AmzadS,"A Review on Automatic Test Case Generation Using Genetic Algorithm," International Journal of Advanced Research in Computer Science Aand Software Engineering, vol. 04,issue 12, Dec. 2014.

[4] Kui Zhang, Lingchen Zhu, "Application of Improved genetic Algorithm in Automatic Test Paper Generation", IEEE Std 978-1-4673-7189-6/15/$31.00©2015.

[5] Aishwarya Chavan,Divya Karekar,Mojitha Mohandas,Rasika Manjarekar, "Automated Question Paper Generating System Using Apriori Algorithm and Fuzzy Logic", International Journal for

Science and Technology,vol 2,issue 11,ISSN 2349-6010, April,2016.

[6] Nor Shahida bt Mohd Jamail & Abu Bakar Md Sultan,"Shuffling Algorithm for Automatic generator Question Paper System" ,Computer and Information Science, Vol. 3, No. 2; May 2010

[7] Tejas P. Adhau, Prof. Dr. Mahendra A. Pund,"Information Security and Data Mining in Big Data."IJSRSET, vol. 03,issue 02,2017

[8] Dan Liu, Jianmin Wang, Lijuan Zheng,"Automatic Test Paper Generation Using Ant Colony Agorithm", Journal of Software, Vol. 8, N0. 10, Oct. 2013.

[9] Prof. Sangram S. Dandage, Miss. Sonali P. Mahindre,"Implementing Security to information using privacy preserving data mining",International Journal of Research in Information Technology, Volume 3, Issue 5, May 2015, Pg.26-34

[10] Dimple V.Paul Shankar B. Naik, Priyanka Rane , Jyoti D.Pawar, "Use of an Evolutionary Approach for Question Paper Template Generation", IEEE Fourth International Conference on Technology for Education,2012

[11] Kanchan H. Pinjani Renuka Y. Raut Prof. S.E .Yedey,"Developing an intelligent agent for Automatic Question Paper setting", National Conference on "Advanced Technologies in Computing and Networking"-ATCON-2015