Antti Cheat of Computer Based Test Application in Enterpreneurship Exams using The Multiplicative Random Number Generator Method

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Abstract - STMIK Triguna Dharma is one of the best private universities in North Sumatra in the field of ICT. To realize an entrepreneurial university, it is necessary to have maximum efforts from all elements of management and the foundation. This reflects the quality of learning and good higher education governance. So far, there have been many test implementation techniques in several schools, such as conventional and CBT concepts. Based on the observed phenomena, the CBT that was implemented had problems including fraud in the implementation. Referring to this problem, STMIK Triguna Dharma innovates by building a web-based anti-cheat CBT application by adopting the Multi Random Number Generator Method. The advantage of this method is that it is able to randomize questions and answers with the available question packages so that this effort can properly reduce cheating, for example on semester exams. The results of this study are a web-based anti-cheat application which adopts the MRNG method which is expected to be a solution and can be used by STMIK Triguna Dharma in conducting semester exams, especially in entrepreneurship courses.

Keywords: Entrepreneurship; Anti Cheat; Computer Based Test; MRNG Method

1. INTRODUCTION

Random Number Generator is an algorithm or method for generating an irregular sequence of numbers or symbols, namely in other words a random number generator [1]. In ancient times, to get random numbers is to roll the dice or shuffle the cards. Random number generator or Random Number Generator is a numerical/arithmetic calculation using a computer that is often used in simulations like LCM method [1]–[3].

In modern times, random numbers can be obtained by forming random numbers numerically/arithmetically (using a computer) called pseudo random generators[4]. Multiplicative Random Number Generator (Multiplicative RNG) is an algorithm used to generate random numbers using mathematical formulas that are repeated as needed [5].

The exam is an activity to measure the achievement of student competence as an acknowledgment of learning achievement and or completion of an educational unit. The manual exam system has several drawbacks, such as requiring a very large fee to buy paper to be used in the exam process. In addition, an exam system like this is also vulnerable to cheating, where students can give exam questions to other students, or maybe leak the questions that will be submitted before the exam and are also vulnerable to fraud such as cheating friends' answers such as entrepreneurship exam[6]–[8].

In the Online-Based Examination, of course, techniques are needed so that students do not exchange answers, so an Online-based Examination system has been developed in which the questions between one student and another student will get different questions [4], [9]–[11].

As one of the executors of higher education, STMIK Triguna Dharma really needs technology to carry out a quality learning process for students in accordance with a predetermined curriculum. In this case the exam becomes one of the processes in evaluating teaching and learning activities. In evaluating student learning outcomes, universities will definitely conduct exams so they can pass to the next semester. In one semester, exams are usually carried out twice, namely the midterm exam and the final semester exam [11], [12]. In the implementation of the exam, it is usually carried out in a room with a maximum number of 40 students.[13]

The problem that often occurs is that the exams conducted at STMIK Triguna Dharma have so far only consisted of one package of questions given to students. Even though there are exam supervisors in the room, this is still not effective because students still exchange answers because one student with another has the same questions, and also the lack of supervision from the exam supervisor makes it easy for students to exchange answers especially in entrepreneurship with CBT [1], [14]–[16].

2. RESEARCH METHODOLOGY

In conducting research, several research methods were carried out, namely as follows: a. Data Collecting
The collection technique in this study was carried out by observation. Related to the observation made is to conduct a direct review of STMIK Triguna Dharma related to the problems that have been experienced so far in the process of administering the midterm and final semester exams.

b. Literature Study
In the study of literature, this research uses many national and international journals, credible websites and books as reference sources. In this study, a system design method was adopted, namely the waterfall. The following are the phases carried out in this research, namely:

1. Analysis of Problems and Needs
   Analysis of problems and needs is the initial phase in system design. In this phase, the actual problem points will be determined and what elements are needed to support the implementation of the midterm and final semester exams.

2. System Design
   In this phase, several indicators or elements are divided, namely: (1) system modeling using the Unified Modeling Language, (2) modeling using a flowchart system, (3) input design, and (4) output design from the semester exam CBT application.

3. System Development
   This phase explains how to code the system design which is designed both from input, process and output systems using the web programming language.

4. Test System
   This phase is the most important phase for the development of the semester exam CBT application. This is because in this phase trial and error will be carried out on all aspects of the application both coding, system design and modeling of the question randomization system.

5. Implementation or Maintenance
   This phase is the phase where the application is utilized by stakeholders who will use this system.

3. RESULT AND DISCUSSION
In solving problems related to optimizing the randomization of online exam questions based on questions that have been made and tested on students, a system is needed that can carry out processes and simulation techniques in randomizing exam questions which can later be applied to a computer system, by using the Multiplicative Random number Generator (MRNG) method. The random number algorithm that will be built by this system is pseudo random in nature, generated using mathematical formulas that are done repeatedly and can be used according to user needs.

3.1 Algorithm of MRNG Method
The following is the question data used as a sample in this study, namely as follows.

<table>
<thead>
<tr>
<th>NO</th>
<th>Questions</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>One of the characteristics of an entrepreneur is</td>
<td>a. Lazy person</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Have a spirit leadership</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. No respect of time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Likes to procrastinate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e. Problem maker</td>
</tr>
<tr>
<td>2</td>
<td>The following is one of the successful Indonesian entrepreneurs, namely</td>
<td>a. Bob Sadino</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Elon Musk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Bill Gates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Waren Buffet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e. Steve Jobs</td>
</tr>
<tr>
<td>3</td>
<td>One of the ministries that supports entrepreneurial activities, especially the creative economy in Indonesia, namely</td>
<td>a. Ministry of Religion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Ministry of Foreign Affairs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Ministry of Tourism and creative Economy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Ministry of Sports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e. Ministry of Home Affairs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Decision Making</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Problem Solver</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. Collaboration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Smart</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e. Leadership</td>
</tr>
</tbody>
</table>

Table 1. Example of Entrepreneurship questions
The following is a flowchart of the Multi RNG method, which is as follows:

Based on the above question data, a random number algorithm generated by a computer (pseudo-random) is generated using mathematical formulas that are worked on repeatedly as needed. The following is the random number algorithm in optimizing the randomization of Try Out questions:

Formula:

\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]  
\[ R_1 = Z_{i+1} / m \]

The resulting random numbers are \( R_1, R_2, R_3, R_4, R_5, \ldots \). Based on the formula above, the following calculations are obtained:

For example, if you want to find a random number of 20 numbers from the table of Indonesian language exam questions, the following numbers will be generated:

For example \( Z_0 = 12357 \), \( a = 19 \), \( c = 237 \), \( m = 128 \)

Use 4 digits after decimal point.

Resolution:

1. Random Number 1
   \[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
   \[ = (19 \cdot 12357 + 237) \mod 128 \]
   \[ = 235020 \mod 128 \]
   \[ = 12 \]
   \[ R_1 = Z_{i+1} / m \]
   \[ = 12 / 128 \]
   \[ = 0.0938 \]

2. Random Number 2
   \[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
   \[ = (19 \cdot 12 + 237) \mod 128 \]
   \[ = 465 \mod 128 \]
   \[ = 81 \]
   \[ R_1 = Z_{i+1} / m \]
   \[ = 81 / 128 \]
   \[ = 0.6238 \]

3. Random Number 3
   \[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
   \[ = (19 \cdot 81 + 237) \mod 128 \]
4. Random Number 4
\[ \text{Zi+1} = (a \cdot \text{Zi} + c) \mod m \]
\[ = (19 \cdot 112 + 237) \mod 128 \]
\[ = 2365 \mod 128 \]
\[ = 61 \]
\[ R1 = \frac{\text{Zi+1}}{m} \]
\[ = \frac{61}{128} \]
\[ = 0.48750 \]

5. Random Number 5
\[ \text{Zi+1} = (a \cdot \text{Zi} + c) \mod m \]
\[ = (19 \cdot 116 + 237) \mod 128 \]
\[ = 1396 \mod 128 \]
\[ = 116 \]
\[ R1 = \frac{\text{Zi+1}}{m} \]
\[ = \frac{116}{128} \]
\[ = 0.90363 \]

6. Random Number 6
\[ \text{Zi+1} = (a \cdot \text{Zi} + c) \mod m \]
\[ = (19 \cdot 116 + 237) \mod 128 \]
\[ = 2441 \mod 128 \]
\[ = 9 \]
\[ R1 = \frac{\text{Zi+1}}{m} \]
\[ = \frac{9}{128} \]
\[ = 0.07031 \]

7. Random Number 7
\[ \text{Zi+1} = (a \cdot \text{Zi} + c) \mod m \]
\[ = (19 \cdot 9 + 237) \mod 128 \]
\[ = 408 \mod 128 \]
\[ = 24 \]
\[ R1 = \frac{\text{Zi+1}}{m} \]
\[ = \frac{24}{128} \]
\[ = 0.18750 \]

8. Random Number 8
\[ \text{Zi+1} = (a \cdot \text{Zi} + c) \mod m \]
\[ = (19 \cdot 24 + 237) \mod 128 \]
\[ = 693 \mod 128 \]
\[ = 53 \]
\[ R1 = \frac{\text{Zi+1}}{m} \]
\[ = \frac{53}{128} \]
\[ = 0.41411 \]

9. Random Number 9
\[ \text{Zi+1} = (a \cdot \text{Zi} + c) \mod m \]
\[ = (19 \cdot 53 + 237) \mod 128 \]
\[ = 1244 \mod 128 \]
\[ = 92 \]
\[ R1 = \frac{\text{Zi+1}}{m} \]
\[ = \frac{92}{128} \]
\[ = 0.71875 \]

10. Random Number 10
\[ \text{Zi+1} = (a \cdot \text{Zi} + c) \mod m \]
\[ = (19 \cdot 92 + 237) \mod 128 \]
\[ = 1985 \mod 128 \]
\[ = 65 \]
\[ R1 = \frac{\text{Zi+1}}{m} \]
\[ = \frac{65}{128} \]
\[ = 0.50781 \]

11. Random Number 11

\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 65 + 237) \mod 128 \]
\[ = 1472 \mod 128 \]
\[ = 64 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 64 / 128 \]
\[ = 0.5000 \]

12. Random Number 12
\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 64 + 237) \mod 128 \]
\[ = 1453 \mod 128 \]
\[ = 45 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 45 / 128 \]
\[ = 0.3516 \]

13. Random Number 13
\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 45 + 237) \mod 128 \]
\[ = 1092 \mod 128 \]
\[ = 68 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 68 / 128 \]
\[ = 0.5313 \]

14. Random Number 14
\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 68 + 237) \mod 128 \]
\[ = 2536 \mod 128 \]
\[ = 37 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 37 / 128 \]
\[ = 0.2891 \]

15. Random Number 15
\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 37 + 237) \mod 128 \]
\[ = 940 \mod 128 \]
\[ = 44 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 44 / 128 \]
\[ = 0.3438 \]

16. Random Number 16
\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 44 + 237) \mod 128 \]
\[ = 1073 \mod 128 \]
\[ = 49 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 49 / 128 \]
19. Random Number 19
\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 49 + 237) \mod 128 \]
\[ = 1168 \mod 128 \]
\[ = 16 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 16 / 128 \]
\[ = 0.1250 \]

20. Random Number 20
\[ Z_{i+1} = (a \cdot Z_i + c) \mod m \]
\[ = (19 \cdot 16 + 237) \mod 128 \]
\[ = 541 \mod 128 \]
\[ = 29 \]
\[ R_1 = Z_{i+1} / m \]
\[ = 29 / 128 \]
\[ = 0.2266 \]

Table 2. Random Number

<table>
<thead>
<tr>
<th>NO</th>
<th>a</th>
<th>Zi</th>
<th>c</th>
<th>( (a \cdot Zi) + c )</th>
<th>( (a \cdot Zi) + c \mod m )</th>
<th>R1...n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>12357</td>
<td>237</td>
<td>128</td>
<td>235020</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>12</td>
<td>237</td>
<td>128</td>
<td>465</td>
<td>81</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>81</td>
<td>237</td>
<td>128</td>
<td>1776</td>
<td>112</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>112</td>
<td>237</td>
<td>128</td>
<td>2365</td>
<td>61</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>61</td>
<td>237</td>
<td>128</td>
<td>1396</td>
<td>116</td>
</tr>
<tr>
<td>...</td>
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<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>20</td>
<td>19</td>
<td>16</td>
<td>237</td>
<td>128</td>
<td>541</td>
<td>29</td>
</tr>
</tbody>
</table>

In order to be able to randomize the test questions based on the R value above, a ranking is performed for each R value. The ranking is carried out from the smallest value to the largest value. Which can be seen in the following table:

Table 3. Result of Random Number

<table>
<thead>
<tr>
<th>NO</th>
<th>a</th>
<th>Zi</th>
<th>c</th>
<th>( (a \cdot Zi) + c )</th>
<th>( (a \cdot Zi) + c \mod m )</th>
<th>R1...n</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>12357</td>
<td>237</td>
<td>128</td>
<td>235020</td>
<td>12</td>
<td>0,0938</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>12</td>
<td>237</td>
<td>128</td>
<td>465</td>
<td>81</td>
<td>0,6328</td>
</tr>
<tr>
<td>3</td>
<td>19</td>
<td>81</td>
<td>237</td>
<td>128</td>
<td>1776</td>
<td>112</td>
<td>0,8750</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>112</td>
<td>237</td>
<td>128</td>
<td>2365</td>
<td>61</td>
<td>0,4766</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>61</td>
<td>237</td>
<td>128</td>
<td>1396</td>
<td>116</td>
<td>0,9063</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>20</td>
<td>19</td>
<td>16</td>
<td>237</td>
<td>128</td>
<td>541</td>
<td>29</td>
<td>0,2266</td>
</tr>
</tbody>
</table>

Based on the table above, from the results of ranking the value of R, random exam questions are obtained. Namely as follows:
1. Question no 1 is question no 2
2. Question no 2 is question no 15
3. Question no 3 is question no 18
4. Question no 4 is question no 11
5. Question no 5 is question no 19
6. Question no 6 is question no 1
7. Question no 7 is question no 4
8. Question no 8 is question no 10
9. Question no 9 is question no 16
10. Question no 10 is question no 13
11. Question no 11 is question no 12
12. Question no 12 is question no 8
13. Question no 13 is question no 14
14. Question no 14 is question no 20
15. Question no 15 is question no 17
16. Question no 16 is question no 6
17. Question no 17 is question no 7
18. Question no 18 is question no 9
3.2 Implement

The following is the interface display of the computer based test application that was built.

**A. Participant Registration Form**

This design is a student registration page carried out by the admin and includes input of student information taking the exam.

![Figure 2. Registration Form](image)

**B. Administrator Dashboard Page Display**

The dashboard page is a page that can only be accessed by administrators who already have access rights which are used to enter participants, questions, exam sessions, and courses as well as several optimizations for adding other data, along with the interface from the admin dashboard page which has been completed.

![Figure 3. Administrator Dashboard Page Display](image)

**C. Class Page**

The class page is provided for administrators to manage class data used in the entrance exam process. The following is a class page view.

![Figure 4. Class Page](image)
D. Participant Page
The participant page is provided for administrators to manage participants including adding participants, deleting participants and changing participants who will take the entrance exam, here is the participant page view.

![Figure 5. Participant Page](image)

E. Participant Exam Page
This page shows the appearance of the exam that the participants took part in by displaying questions and multiple choice, this page also displays the select question page so that it can make it easier for participants to choose which questions to work on first, and on this page the process of randomizing exam questions has been implemented. The following is the display of the participant exam page.

![Figure 6. Participant Exam Page](image)

4. CONCLUSION
Based on the results of the discussion regarding the application of the Multiplicative random number generator in the randomization of entrepreneurship exam questions at STMIK Triguna Dharma that has been put forward, some of the conclusions can be obtained as follows: (1). To analyze the problems that occur in the randomization of online exam questions using the Multiplicative RNG method, namely first determining the questions to be randomized, in the testing the randomized questions are multiple choice, then the questions for which courses will be randomized and finally how many questions to will he random. (2). To design a system for randomizing the STMIK Triguna Dharma online exam questions, namely first create a main form, then a login form to limit the system user level, then create a data form for courses, participants, exam sessions, enroll participants, and test results reports.
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Badrul Anwar, Copyright © 2023, MIB, Page 408
Submitted: 30/12/2022; Accepted: 28/01/2023; Published: 28/01/2023