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“TOJMOT” MATHEMATICAL GAME FOR GYMNASTICS OF THE MIND

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Abstract. This article describes the history of the game of mathematical mental gymnastics "Tojmot", the importance of this game in the mastery of mathematics (algebra, geometry, combinatorics, number theory, etc.), mental arithmetic. This article also examines the process of developing an artificial intelligence algorithm to play the computer game "Tojmot" against humans. In this article so as to create "Tojmot" computer game Unity3D system and Visual C# programming language were used. The algorithm which was developed in this article, the fact that "Tojmot" computer game can play against called artificial intellect algorithm, development of software for personal computers and mobile devices that allow people to play with each other or against the computer on the basis of the algorithm can be developed.

Keywords: Tojmot, national sports game, mathematics, mental gymnastics, artificial intelligence, algorithm, teaching mathematics in school.

Introduction

At the meeting of the President of the Republic of Uzbekistan with young researchers, heads of research institutions and representatives of the production sector, taking into account the potential of previously formed scientific schools in our country. At this time, the year was chosen for the development of mathematics, chemistry, biology, geology, based on the directions of our national interests and development at the present stage.

It was emphasized that Uzbekistan's potential in the field of mathematics was recognized globally, prestigious schools of functional analysis and differential equations, probability theory and algebra had been formed and were functioning, and seven mathematical scientists were members of the Academy of Sciences of the World.

In this regard, the role of the mathematical intelligence gymnastics game "Tojmot" in promoting the development of the mathematical field with the support of the public policy pursued by the President is undoubtedly incomparable.

Purpose of the research

Mathematical intellectual game "Tojmot" is a gymnastic game in which young people learn mathematics (algebra, geometry, combinatorics, number theory, etc.) to put science into practice as a method of sports medicine, which helps to better master mental arithmetic and at the same time is effective in children with delayed mental development.

Research objectives

The problem solved by the widespread introduction of cognitive gymnastics in “Tojmot” is of national importance in the science of the younger generation, and its solution ensures the quality of the following specific tasks:

to teach the population of Uzbekistan to practice sports, which strengthens thinking, strengthens and improves the development of the intellect of children;

for sports that develops thinking, develop suggestions and recommendations based on the experience of young people in sports and the implementation of best foreign practices in local conditions;

Application of modern information and communication technologies in the implementation of sports game Tojmot, consideration of effective methods and the use of effective methods on the basis of new innovative ideas;

development of a new, modern, effective method of attracting all segments of the population (teachers, students and pupils of educational institutions, employees of ministries, departments, enterprises and organizations, non-employed population in production and services, foreign citizens) to the sport (Tojmot), which develops the intellect.

Results of the study and discussion

The game Tojmot was created in 2012 based on an in-depth analysis. The inventor (Toshmatov, 2019) worked for a long time to create a game that differs from chess as a gymnastics of the mind. The game, in his opinion, would be created in a new way, on a new board, new squares, new pieces, new walking routes and walks in various combinations.

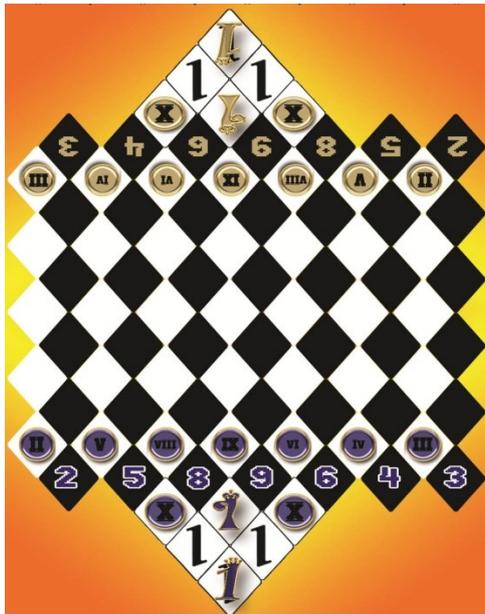
After 7 years of research, a new game of mental gymnastics "Tojmot" was created in 2012. (Toshmatov, 2019), (Toshmatov, 2020). For many years the Federation has been holding meetings, competitions (district, city, provincial competitions and schools, higher educational institutions) in the cities of Andijan, Namangan, Ferghana, Samarkand, Tashkent region, the Republic of Karakalpakstan and Tashkent and has been conducting games of Tajmut among the general public and its explanations. This game was evaluated by the Republican High School of Sportsmanship in terms of sports games as interesting in terms of developing intelligence in young people, strengthening memory, developing an outlook and playing.

In order to study the scientific foundations of the game, cooperation with the staff of the Romanowsky Research Institute of Mathematics is carried out. Before this period, in order to interest young people in this game, to explain its essence, in our country were held many circle sessions and competitions. As a result, it has helped many students deeply master the subject of mathematics, to take a high place in the International Scientific Olympiads. In a specialized school named after Mirzo Ulugbek opened a club, the lessons in this club is attended by about 100 students.

It should be noted that a lot of work is being done to make this game widely popular in foreign countries as well. In particular, in countries such as Germany, China, Malaysia, Norway, Russia, Gymnastics Tojmot Game is gradually gaining popularity among owners of various areas and interest is growing.

Nowadays the game of chess, which has become a favorite sport described by the peoples of the world as the gymnastics of the mind at present, is also popular today in our independent Uzbekistan. Considering that it is in the world of chess an interesting game called "Tojmot", which includes new styles, new pieces on a new board and different ways of walking, leaves no one indifferent, as in chess (Elofsson, 2016), (Geetha, 2020), (Cibeira, 2021).

The Tojmot game will involve figures in the form of numbers. Aside from playing tojmot, these 89 tiles are similar to a simple game of checkers, but there are also different styles of play that differ in the way you go, from the game of checkers and include their own interesting aspects. Checkers Tojmot 35 pieces are played with white squares only.



Picture 1. The plot of the game Toimot and the arrangement of the grains in it

The rules of the game are designed to be simple and straightforward for all ages, and are presented below:

Placement of boards and figure. The game is played by 2 people, facing them 18 game pieces in the form of black and white Arabic and Roman numerals. The number of decks in the game is 89 pieces (pic. 1).

Match the stones placed in the folds on the white board

Row 1-1;

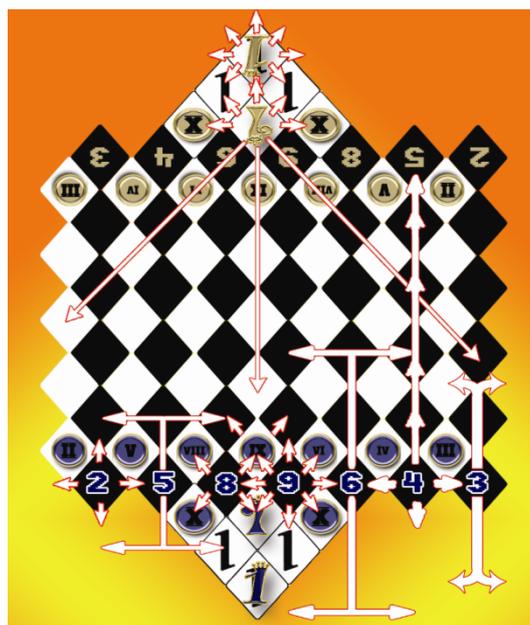
3-Row X-7-X;

4-row 2-5-8-9-6-4-3;

It is necessary to place grains of the 5th row II-V-VIII-IX-VI-IV-III.

The directions of play grains are shown in pic. 2.

To lead the game. Players take turns playing, pushing grains one at a time. The player who plays the White Grain is the first to start the turn.



Picture 2. The directions of grain movement in the Toimot game

Moving Rule. The grains take the grains that meet in their moving directions. This action is called obtaining a figure. Only the number 1 cannot be obtained.

The grains of the Roman numeral may be located 45 degrees below the grid 1, facing right or left..;

The number 1 can reach the 8th side of a square at a distance of 1 square;

And a 2-digit block can go 1 step to its own color frame, which is positioned rank and files in relation to itself;

Number 3 can move 1 step in its own color in the vertical or horizontal direction and 45 steps at an angle of 1 degree in an anti-glare color;

Number 4 can move the desired distance according to the folds of his own color;

Number 5 can move 1 time horizontally (vertically) and 1 time vertically (horizontally) according to its color;

Number 6 can move 2 steps vertically, then 1 step horizontally;

The number 7 can go in a straight line to the side of the box along the 8 lines of the box;

Number 8 can go to the right length of the right side at a 45 degree angle;

The number 9 can go to the 8 side of the box at a distance of 1 square.

The grains of Roman numerals are those in which the numbers X of the opposite side stand stacked Borganda, which is equal to itself, and the grains of X can become desired (except the number 1) Arabic number.

The grains can give a kisht (crown) to the number 1 in their direction. On exit, the path of number 1 can be blocked with other numbers or

The number 1 can go through another tile. Attacking Grains.

It is impossible to enter the area where Number 1 is located. The boundary of Number 1's territory is clearly defined on the board. The opposing side is considered the winner (mot) when Number 1 is brought into a position that cannot be passed into other

Draw. In the following cases the game ends in a draw: When no one has a chance to win (M: when there are not enough grains - 1 grain against 1 grain and b.); If the opponent has only 1 grain left and it is impossible to pass without falling into the crown on the other fold. This condition is called stalemate.

One of the features of tajmot is that it does not choose an age. The most important character in tajmot is patience. The game of Tajmot is an interesting and exciting sport, which serves to enhance human intelligence and productive leisure time of our youth, which has a unique spell of repetition, which makes a person a favorite sport.

The volume of information generated by modern humans and information and communication technologies far exceeds the ability of humans to assimilate, interpret, and make complex decisions. Therefore, there is a growing need to implement large-scale processes of collection, storage, processing and rapid decision-making based on artificial intelligence.

Artificial Intelligence (AI) is the basis for modeling human cognitive processes by creating and applying algorithms in a fast computing environment. Simply to say, artificial intelligence is a technology that allows computers to think like humans and find solutions

Today, a lot of attention is aid to the development of artificial intelligence and its wide introduction into all sectors in our country. In particular, the decree № PP-4996 of the President of Uzbekistan "On measures to create conditions for the rapid introduction of artificial intelligence technologies" from February 17, 2021, and № PP-5234 of the President of the Republic of Uzbekistan "On measures to introduce a special regime for the application of artificial intelligence technologies" from August 26, 2021 – In accordance with the " 2030 " strategy, the rapid introduction of artificial intelligence technologies and their wide application in our country, ensuring the possibility of using digital data and their high quality are important in creating favorable conditions for the training of qualified personnel in this field (1,2).

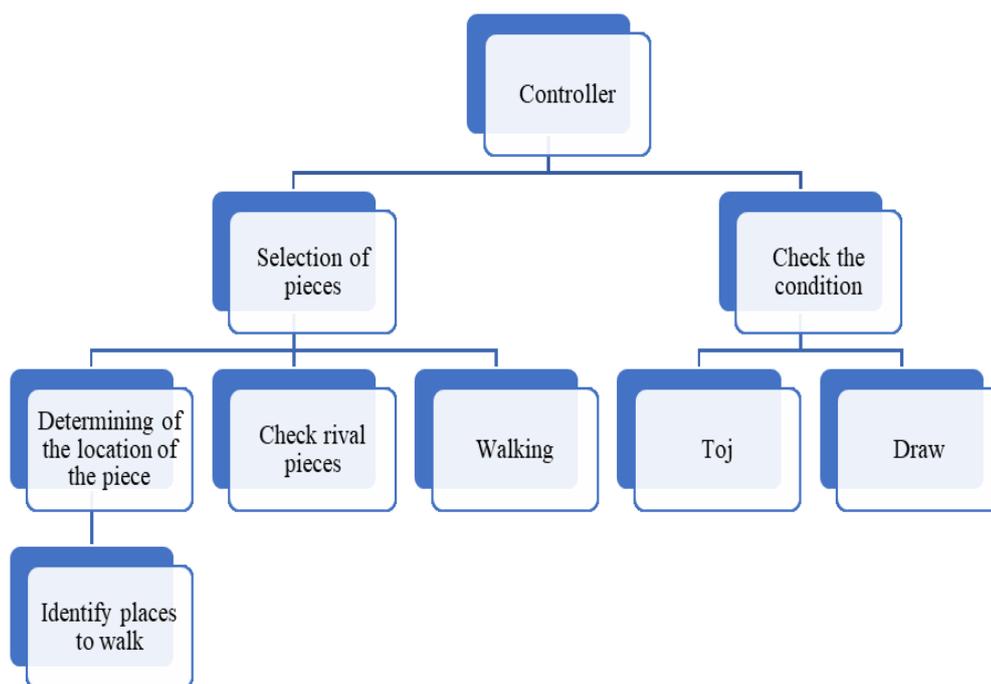
Nowadays, artificial intelligence is not only the basis of decision-making in business, but also the basis for the organization of computer games against a person, as well as the future of finding complex solutions in various computer games. As an example, in the game "tic tac toe",

most people can easily understand how not to lose. However, in this game there are 255168 unique movements, of which 46080 ends with a draw. And the number of people who are considered the great champions of the checkers game is much less, because in this game there are many different potential moves from 500 x 1018 or 500 quintillion. Computers are incredibly effective in calculating these combinations and movements, as well as finding the best solution

In 1990, a new page was opened in the development of SI. In 1997, the IBM computer named Deep Blue became the first computer in history to win the world chess champion Harry Kasparov.

In the popularization of the game "Tajmot" is very important to develop a computer game based on artificial intelligence, which allows you to play the computer against humans.

2nd picture shows the modules of the computer's anti-human algorithm in the game "Tajmot", based on artificial intelligence, developed during our research.



Picture 3. Model of the game "Tajmot" based on artificial intelligence

The modules listed in this model perform the following functions:

–The “controller” module manages tasks performed by artificial intelligence and controls the status;

– The “selection of pieces” module allows the computer to determine for itself which moves during the aging playing process to a person, and the subsequent stages are carried out with the help of these identified pieces;

–The “status check” module is used to determine the position after the walk in the game, when the crown is placed, that is, whether it is a winner or loser and draw;

–The “Determination of the position of the unit” module identifies the location, column and row of the grain chosen by artificial intelligence for the computer;

–The module “Identify places where you can walk” identifies the places where the pieces chosen by artificial intelligence for the computer can walk;

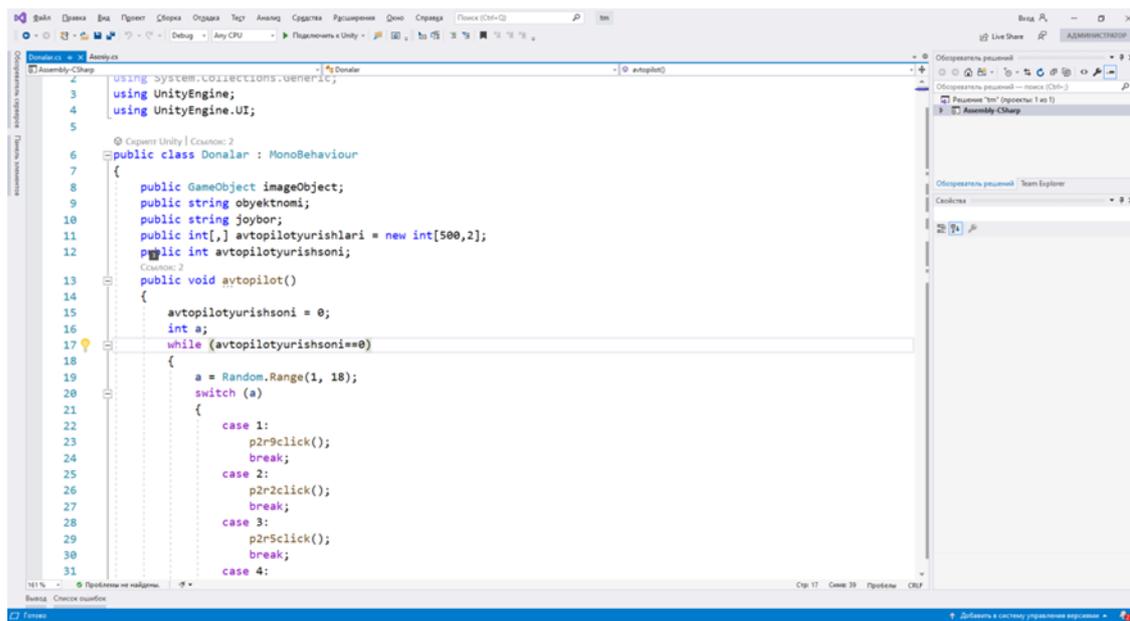
–The “Checking the opponent's pieces” module detects the locations of the opponent's grains that can be hit before the Walk of the pieces selected by artificial intelligence for the computer;

– The "Walking" module ensures that the grain chosen by artificial intelligence for the computer moves in the specified direction.

In above mentioned “Tojmot” game which is based on artificial intelligence “Controller” plays the most important role.”Controller” manages work done by artificial intelligence and controls situation. Other modules are managed through this “Controller”. There is algorithm of

“Tojmot” games “Controller” and we can see that in “Tojmot” game in order to computer could play against person it should refer to different part which is called as “turn on artificial intellectual” and this can happen only after computer is chosen as second player. So game would work as one difficult system and in the future in the process of modernization it would not face any challenges all modules must be created as different parts of programming and it must be merged as one system

In our research so as to create “Tojmot” computer game Unity3D system and Visual C# programming language were used. Programs code is separated into two modules, turning on game in “Main” module and primary settings’ code were included In “Pieces” module managing walks in the game, controlling every piece, so as that computer would play against person artificial intellect codes were included. An example of a program code written in C # for the Unity 3D program of the computer game Tojmot is shown in pic. 4.



```
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;

public class Donalar : MonoBehaviour
{
    public GameObject imageObject;
    public string obyekt nomi;
    public string joybor;
    public int[,] avtpilotyurishlari = new int[500,2];
    public int avtpilotyurishsoni;

    public void avtpilot()
    {
        avtpilotyurishsoni = 0;
        int a;
        while (avtpilotyurishsoni==0)
        {
            a = Random.Range(1, 18);
            switch (a)
            {
                case 1:
                    p2r9click();
                    break;
                case 2:
                    p2r2click();
                    break;
                case 3:
                    p2r5click();
                    break;
                case 4:

```

Picture 4. Sample code code for the Unity 3D program
of the computer game "Tojmot" written in C #.

Since all processes performed by artificial intelligence are controlled by a timer based on the speed of the computer processor, human and computer perform computer actions at a much greater speed when they play against each other (3,4).

Conclusion

In Uzbekistan it is necessary to create a mathematical model of the game based on further scientific analysis in order to teach the whole population of the country to engage in the national sports game "Tojmot", to strengthen and improve mental development in children, to develop an algorithm of the game against a man based on the mathematical model, and to develop an algorithm of the game against a man. The algorithm which was developed in our research, the fact that “Tojmot” computer game can play against called artificial intellect algorithm, development of software for personal computers and mobile devices that allow people to play with each other or against the computer on the basis of the algorithm can be developed. In order to strengthen and improve the mental development of children, as well as to improve the development of all, (students, employees of ministries, departments, enterprises and organizations, non-employed population in the sphere of production and service, foreign citizens) is a new, modern, effective method of creating the opportunity to play that develops intelligence without any restrictions.

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**МАТЕМАТИЧЕСКАЯ ИГРА «ТОЖМОТ» ДЛЯ ГИМНАСТИКИ
РАЗУМА**

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Аннотация. В статье рассказывается об истории игры математической мысленной гимнастики «Тождот», о значении этой игры в овладении математикой (алгебра, геометрия, комбинаторика, теория чисел и др.), ментальной арифметикой. В этой статье также исследуется процесс разработки алгоритма искусственного интеллекта для компьютерной игры «Тождот» против людей. Для создания компьютерной игры «Тождот» использовалась система Unity3D и язык программирования Visual C#. Разработанный алгоритм позволяет компьютерной игре «Тождот» играть против так называемого алгоритма искусственного интеллекта. Произведена разработка программного обеспечения для персональных компьютеров и мобильных устройств, позволяющих людям играть друг с другом или против компьютера.

Ключевые слова: Тождот, национальная спортивная игра, математика, мысленная гимнастика.