Tower of Hanoi

(A) Start   (B) Middle   (C) Goal

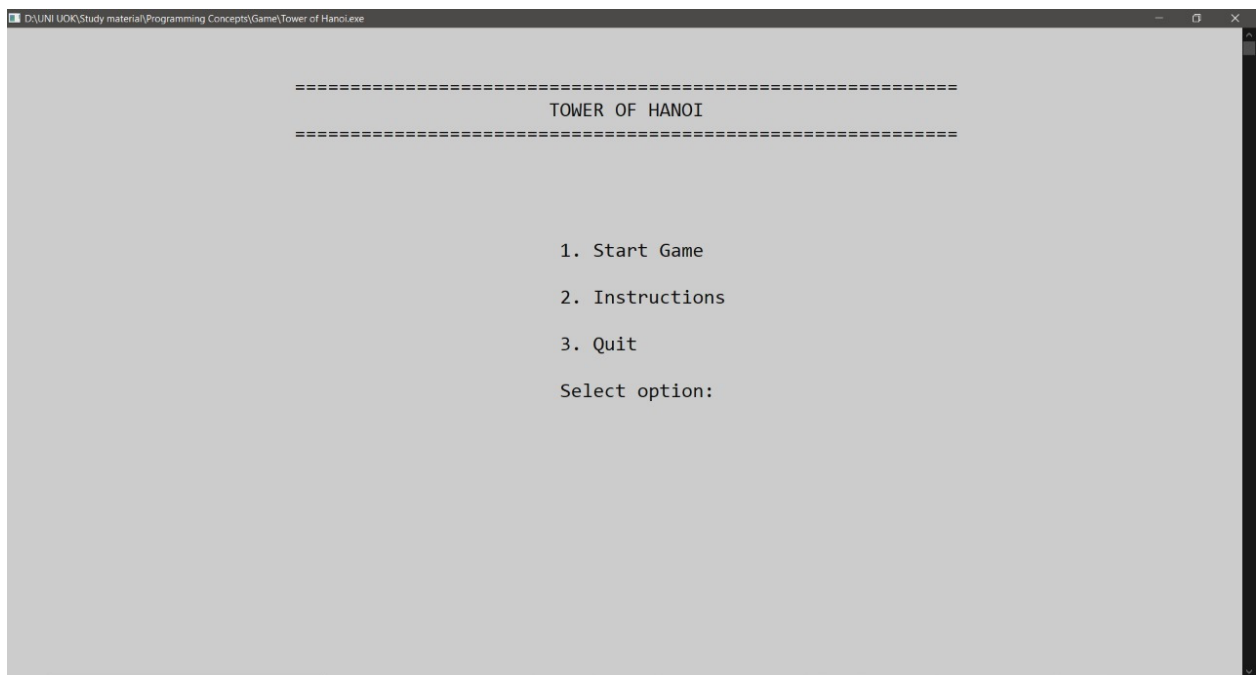CONSOLE GAME (C++ PROGRAM)

GROUP 1

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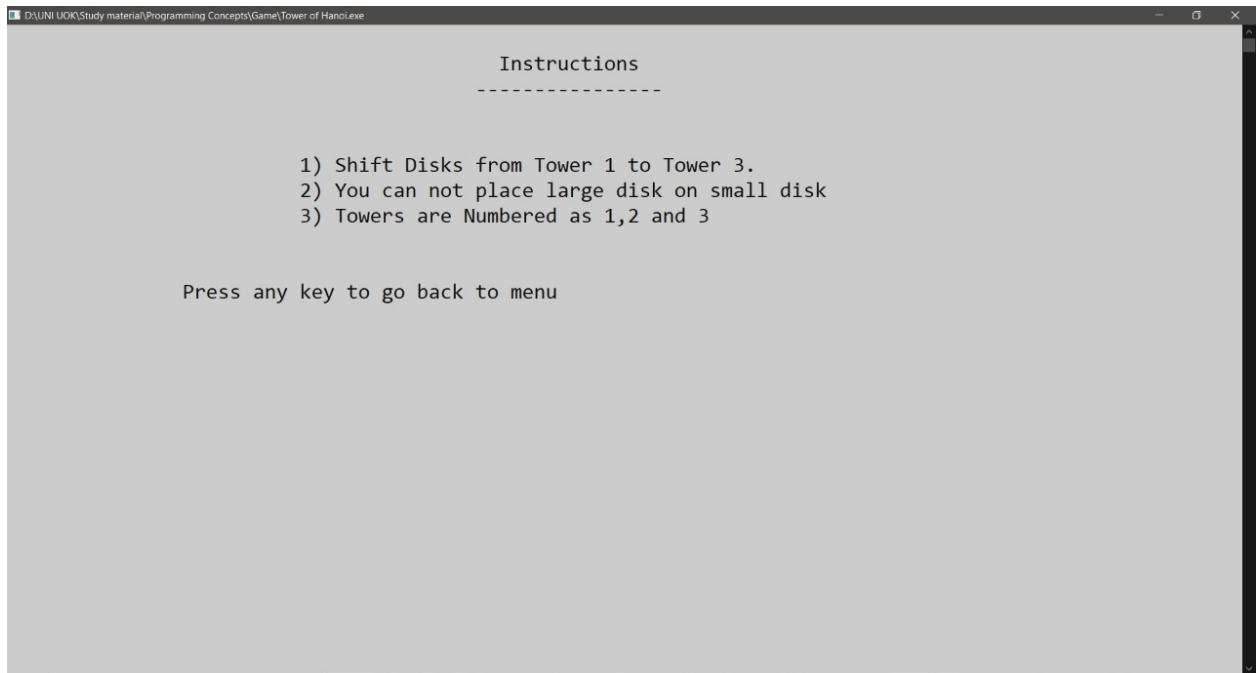
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Basic Documentation

Tower of Hanoi is a mathematical game or puzzle consisting of three rods and a number of disks of various diameters, which can slide onto any rod. The player is expected to follow the instructions of the game and change the stack from rod 1 to rod 3

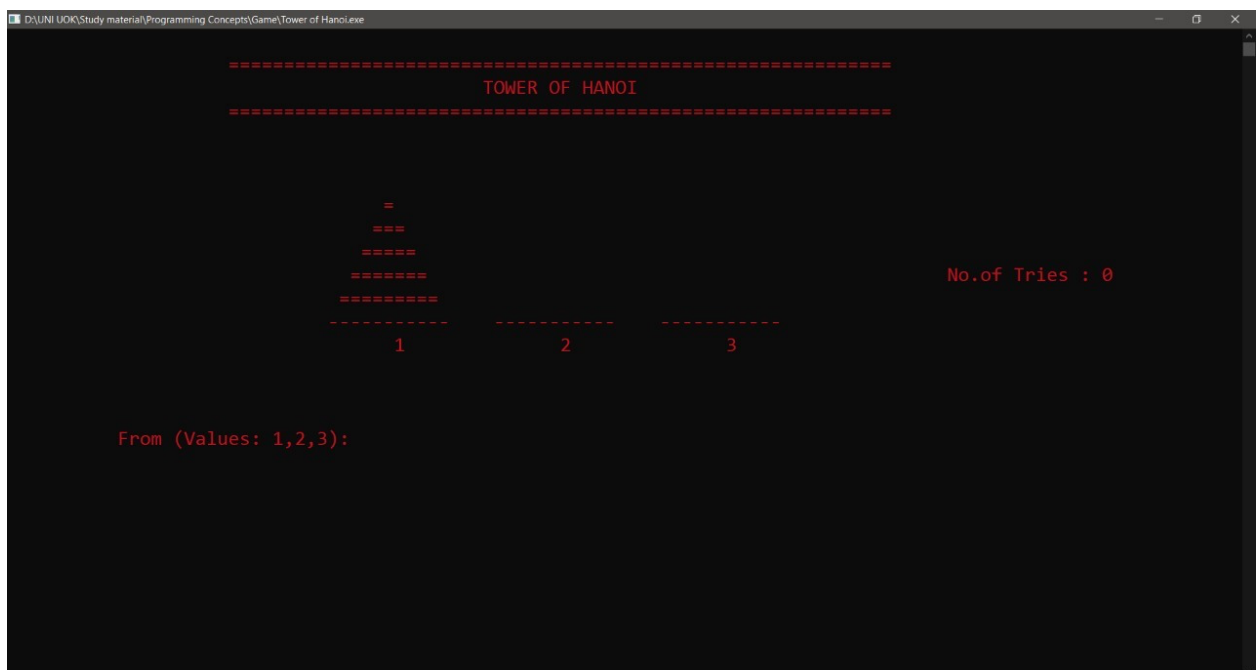When opening the game, the player is taken to the Main menu:

- Here he/she can select one of the 3 options by inputting a number on to the console

```
============================================================
                        TOWER OF HANOI
============================================================



                        1. Start Game

                        2. Instructions

                        3. Quit

                        Select option:
```

- If no 2 is selected the player is taken to the instructions panel ;

  (After pressing any key player is taken back to the Main menu)

```
                          Instructions
                          ----------------


              1) Shift Disks from Tower 1 to Tower 3.
              2) You can not place large disk on small disk
              3) Towers are Numbered as 1,2 and 3


      Press any key to go back to menu
```

- If no 1 is selected the player is taken to the game;(Player can start playing the game)

```
          =============================================================
                              TOWER OF HANOI
          =============================================================



                     =
                    ===
                   =====
                  =======                                    No.of Tries : 0
                 =========
                -----------    -------------    -----------
                     1              2                3


        From (Values: 1,2,3):
```
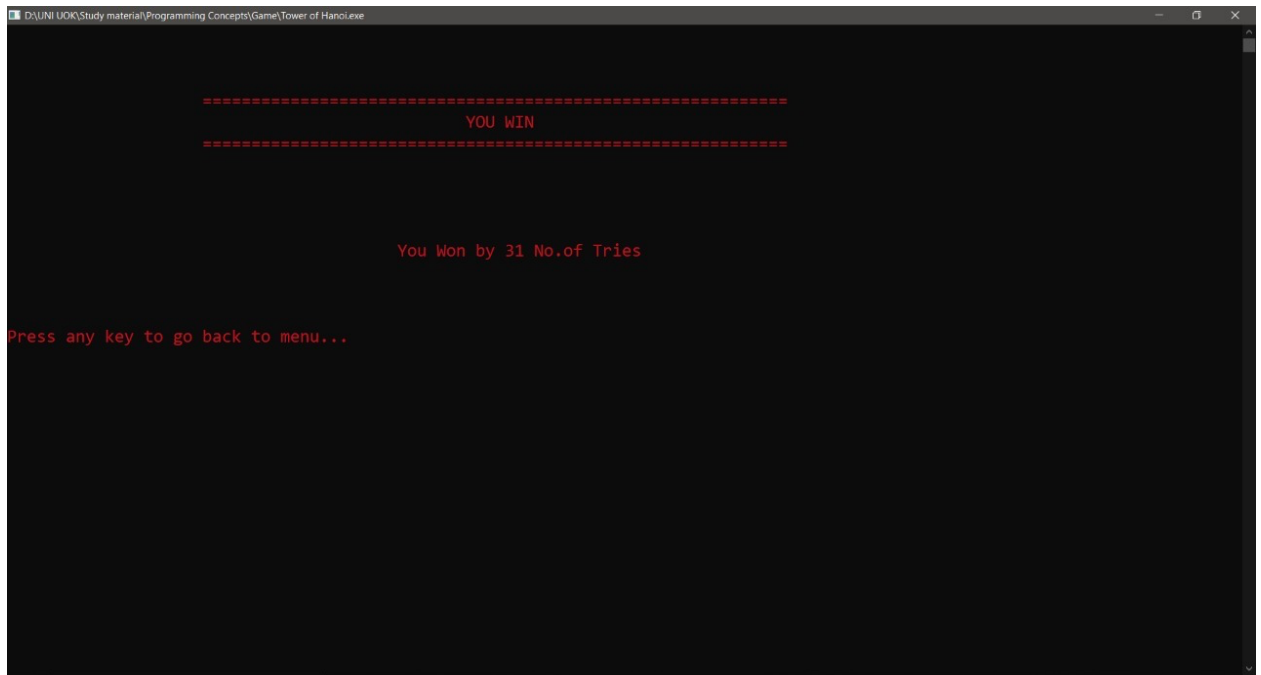
- Player can start playing the game

- The movements will be counted(even if the player tries a invalid move it will be counted as a try)

- After player won the game he will be directed to the following screen;(After pressing any key he is taken back to the Main menu)

Instructions on How to Play Tower of Hanoi

The objective of the puzzle is to move the entire stack to the last rod, obeying the following instructions:

- Only one disk may be moved at a time.
- The player can select the column from which he or she expects to move the plate and where to move it
- Each move consists of taking the upper disk from one of the selected stack and placing it on top of another stack of choosing or on an empty rod.
- RESTRICTIONS : No disk may be placed on top of a disk that is smaller than itself.

Problems and Challenges had with the Project.

- Initially we tried to type the whole code inside the main function. But it was confusing to understand the codes separately and same things had to repeat certain times.
  - To resolve, we created several user defined functions to minimize complexity of the code and make it more understandable.

- Playing the game for a long time was dull
  - To make it interesting we added a sound and some colors to the console.

- The game crashed when the player input a character instead of a number
  - Used stringstream function from sstream library to convert numbers in a char value to integers.

What we would do different in the future.

- We would make a separate interface rather than making tower of Hanoi an console game
- After making this game a game with an interface add some pictures, colored disks animations and backgrounds to make this game attractive
- Give the player the opportunity to select several levels by changing the number of disks he can play with
- Let the player have the opportunity to save his/her high scores and beat that high score in the future

Code.

```cpp
/*
    MINI Project done by
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The Game : Tower Of Hanoi */

#include<iostream>
#include<conio.h>
#include<windows.h>
#include <sstream>
using namespace std;

int towers[3][5];//difine the towers as an array
int towerTop[3] = {4,-1,-1};//assing the number of disk in the each tower in the
initial state.

// user defined funtions used in the game.
void instructions();
void gotoxy(int x, int y);
void drawDisks(int tower, int tileNo, int y);
void drawTower(int tower);
int isEmpty(int towerNo);
int move(int from, int to);
int validate(int from, int to);
int win();
void play();


int main(){
    while(1){

        //funtions used to colour the fonts and the background
        HANDLE console_menu = GetStdHandle(STD_OUTPUT_HANDLE);
        SetConsoleTextAttribute(console_menu, BACKGROUND_BLUE | BACKGROUND_GREEN |
BACKGROUND_RED);

        system("cls");//clear the console screen

        gotoxy(26,2);
cout<<"================================================================"<<endl;
        gotoxy(26,3); cout<<"                          TOWER OF HANOI
"<<endl;
```

```cpp
        gotoxy(26,4);
cout<<"================================================================"<<endl<<endl;

        gotoxy(50,9);  cout<<"1. Start Game";
        gotoxy(50,11); cout<<"2. Instructions";
        gotoxy(50,13); cout<<"3. Quit";
        gotoxy(50,15); cout<<"Select option: ";

        char op = getche();//get a input from the keyboard to select the relevent
option.(No need to press enter affter inputing a number like in getchar().)

        if(op=='1'){

            Beep(1000,300);// used to make sounds.

            play();//to strat the Game

        }else if(op=='2'){Beep(700,300);
            instructions();//to go to the instructin menue
        }else if(op=='3'){Beep(200,300);
            exit(0);//to exit from the game.
        }

    }
    return 0;
}

//function which is used to define the positions of elements in the console.
void gotoxy(int x, int y){
    HANDLE console = GetStdHandle(STD_OUTPUT_HANDLE);
    COORD CursorPosition;
    CursorPosition.X = x;
    CursorPosition.Y = y;
    SetConsoleCursorPosition(console, CursorPosition);
}

//function which is used to draw the disks of the tower
void drawDisks(int tower, int tileNo, int y){
    int x;
    if( tower == 1 ) x = 35;
    else if( tower == 2 ) x = 50;
    else if( tower == 3 ) x = 65;

    x -= tileNo;

    //making the disks in the tower
    for(int j=0; j<((tileNo)*2)-1; j++){
        gotoxy(x,y);
        cout<<"=";
```

```cpp
            x++;
        }
}

//function which is used to make the tower of disks
void drawTower(int tower){
    int y = 11;

    gotoxy(29, 12); cout<<"------------";
    gotoxy(44, 12); cout<<"------------";
    gotoxy(59, 12); cout<<"------------";

    gotoxy(35, 13); cout<<"1";
    gotoxy(50, 13); cout<<"2";
    gotoxy(65, 13); cout<<"3";

    //draw the disks of a specific tower.
    for(int i=0; i<5; i++){
        drawDisks(tower, towers[tower-1][i], y);
        y--;
    }
}

//function which is used to make the instruction menue.
void instructions(){

    system("cls");
    gotoxy(42, 1);cout<<"Instructions";
    gotoxy(40, 2);cout<<"-----------------";
    gotoxy(25, 5);cout<<"1) Shift Disks from Tower 1 to Tower 3. ";
    gotoxy(25, 6);cout<<"2) You can not place large disk on small disk";
    gotoxy(25, 7);cout<<"3) Towers are Numbered as 1,2 and 3";
    gotoxy(15, 10);cout<<"Press any key to go back to menu";
    getch();
    Beep(200,300);
}

//function which is used to check whether a tower is empty.
int isEmpty(int towerNo){
    for(int i=0; i<5; i++)
        if( towers[towerNo][i] != 0 )
            return 0;
    return 1;
}

//function which is used to move a disk from one tower to another.
int move(int from, int to){
    if( isEmpty(from) ){
```

```cpp
            Beep(300,500);
            return 0;
        }

    if( validate(from, to) ){
        if( towers[from][towerTop[from]] != 0 ){
            towerTop[to]++;
            towers[to][towerTop[to]] = towers[from][towerTop[from]];
            towers[from][towerTop[from]] = 0;
            towerTop[from]--;
            Beep(1000,300);
            return 1;
        }
    }
    Beep(300,500);
    return 0;
}

//function which is used to check is it valid to move from one tower to another.
int validate(int from, int to){
    if( !isEmpty(to) ){

        //check whether size of the disk 'from' tower is smaller than the size of the
disk in the 'to' tower
        if( towers[from][towerTop[from]] < towers[to][towerTop[to]] )
            return 1;
        else
            return 0;
    }
    return 1;
}

//function which is used to pop up when the game won.
int win(){
    for(int i=0; i<5; i++)
        if( towers[2][i] != 5-i )
            return 0;
    return 1;
}

//function which is used play the game.
void play(){
    int from=0, to=0, tries=0;
    string str_from, str_to;

    HANDLE console_play = GetStdHandle(STD_OUTPUT_HANDLE);
    SetConsoleTextAttribute(console_play, FOREGROUND_RED);
```

```cpp
    for(int i=0; i<5; i++)
        towers[0][i] = 5-i;
    for(int i=0; i<5; i++)
        towers[1][i] = 0;
    for(int i=0; i<5; i++)
        towers[2][i] = 0;

    while(1){
        system("cls");

        gotoxy(20,1);
cout<<"==============================================================="<<endl;
        gotoxy(20,2); cout<<"                        TOWER OF HANOI
"<<endl;
        gotoxy(20,3);
cout<<"==============================================================="<<endl<<endl;

        drawTower(1);
        drawTower(2);
        drawTower(3);

        if( win() ){
            system("cls");


gotoxy(20,3);cout<<"==============================================================="<<end
l;
            gotoxy(20,4);cout<<"                        YOU WIN
"<<endl;

gotoxy(20,5);cout<<"==============================================================="<<end
l;

            gotoxy(40,10);
            cout<<"You Won by "<<tries<<" No.of Tries";
            cout<<endl<<endl<<endl<<endl;
            cout<<"Press any key to go back to menu...";
            getch();
            break;
        }

        gotoxy(85,10);
        cout<<"No.of Tries : "<<tries;

        //Get the tower nubmers where a disk is moving from to.
        gotoxy(10,17);
        cout<<"From (Values: 1,2,3): ";
        cin>>str_from;
```

```cpp
        stringstream int_from(str_from); //stringstream is a function in sstream to
convert numbers in a char into a intger value.
        int_from >> from;

        gotoxy(10,18);
        cout<<"To (Values: 1,2,3): ";
        cin>>str_to;
        stringstream int_to(str_to);
        int_to >> to;

        //check whether input values are valid.
        if( to < 1 || to > 3 ) {
            Beep(200,500);
            continue;
        }
        if( from < 1 || from > 3 ) {
            Beep(200,500);
            continue;
        }
        if( from == to ) {
            Beep(200,500);
            continue;
        }

        from--;
        to--;

        move(from, to);


        //count the number of tries has done.
        tries++;

    }
}
```

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