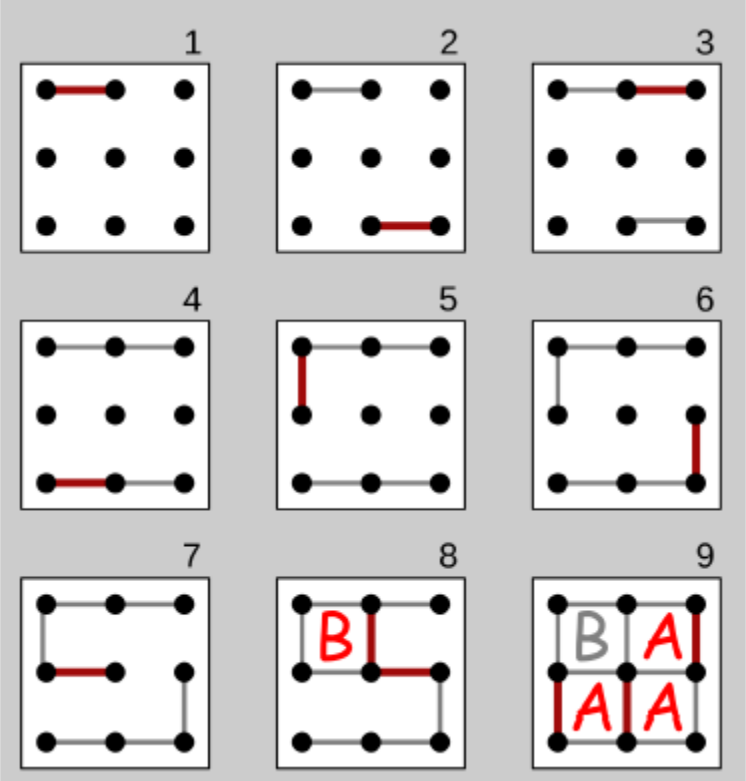
Alexandria University
Faculty of Engineering

Computer and Systems Engineering Department



Project Report

Dots & Boxes

Instructors:

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- Eng. Ahmed Hamdy
- Eng. Reham Osman

Team members:

- Michael Saiid
- Arsany Atef

Description:

-We make a game Called “Dots & Boxes”.

-This game allows two players playing against each other or one player playing against the computer.

-The goal of the game is to connect dots and take as much boxes as you can and mark them with your color. The board may be of any size (till size of 9).

-The main menu consists of :

-Start game

- choose size of the grid.
- choose mode of the game (computer-VS-player) & (player-VS-player).

-Load game

- Choose the mode of the game (human VS human - computer VS human).
- Choose the file from the saved list.
- The file will be saved by the name of the players in the first case.
- The file will be saved by the name of the player only in the second case.

-Overview

- Contains information about the game.

-How to play

- A simple game appears to show how to play.

-Exit

Features:

- Using arrows instead of points (the arrow appears as color).
- Using colors.
- Using sound while pressing buttons.
- Saving file's name by the name of the two players.
- You can use the undo of computer "ctrl-z" to undo your play
- You can use the redo of computer "ctrl-y" to redo your play
- You can use "ESC button" to exit from the game.

Design Overview:

- Welcoming window to the game appears first , then main menu window of the previous options appears .
- While playing the grid appears at the left of the console ,above it the players' score and move, under it the number of boxes drawn and number of lines left.
- At the end of the game the name of the winner appears and if it is draw game it will appears draw
- To use arrows we used the function "getch" twice ,first to know if it is special character in ascii code "224" , second to know if it is up "72" ,down "80" ,right "77" or left "75" arrow (this numbers of arrows from the ascii code).
- To use "Enter button" we use "13" from ascii code.
- To use "Esc button" we use "27" from ascii code.
- To use "ctrl-z" we use "26" from ascii code.
- To use "ctrl-y" we use "25" from ascii code.
- To draw horizontal line we use "196" from ascii code.
- To draw vertical line we use "179" from ascii code.
- To draw boxes we use "219" from ascii code.
- To calculate time we use function "clock()" in time.h library, and calculate the difference between the starting of the game and the execution time of the program.
- To use sound "Beep()" function in windows.h library.

Assumptions:

- Any point has two co-ordinates (x, y).
  If x1 = x2 draw vertical line, if y1 = y2 draw horizontal line.
- We save each element in the game in an array like (horizontal lines – vertical lines – boxes – points – colors of boxes).
- The assumption of AI:
  - We make the computer not to draw any line which make the player able to have a box.
  - If the computer able to complete a box it will draw the first box in his path (Greedy).
  - The only case which make the computer be a looser if it is its turn and there is no place of line to draw which make the user not be able to have a box.

Data structures:

- Arrays of
  i. Points.
  ii. Vertical lines.
  iii. Horizontal lines.
  iv. Boxes.
  v. Colors of boxes.
  vi. Structures.
- Structure of
  i. players.
  ii. Time.
- Files of
  i. Saving game.
  ii. Ranks of (player VS computer) & (player VS player).

Description of the important functions:

- Found_lines.
  To know if line is drawn or not.
- Found_boxes.
  To know if box is drawn or not.
- May_be_boxes.
  -If the computer able to complete a box it will draw the first box in his path (Greedy).
  -The only case which make the computer be a looser if it is its turn and there is no place of line to draw which make the user not be able to have a box.
- Position_boxes.
  To decide in which the box must be drawn.
- Undo.
  To undo line , move , turn , boxes (if found) , score.
- Redo.

  To redo line , move , turn , boxes (if found) , score.

- Save_game.
  To save game in a file if the player need it in file its name will be the name of the two players.
- Load_game.

  To load game from a file if the player need it from list of the saved file.

- Print_line.
  The function which print the game (lines , boxes , moves , scores , grid).
- Com_player.
  The AI of the play.
- Rank.
  Print the rank of the winners in the game.
- Header files.
  Main menu.h
  Contains the function which is used in main menu like (welcomeScreen – printScreen – menuInput – confirmBox)
  Loop game.h
  Contains the function which is used in game like (found_line - found_boxes – undo – redo - print_game - save_game – load_game – may_be_boxes) .

Flow chart & pseudocode:

- ***Flow chart:***
  - Com_player:

    "click on the link to open the flow chart"

    com_player function.pdf

- ***Pseudocode:***
  - Found_boxes:

    If the line drawn is horizontal in the middle of the grid(y1 == y2):

    Check the upper & lower horizontal lines.

    Check the adjacent upper & lower vertical lines.

    If one box of any of the two boxes in the first and second case must be drawn then check the other one , if one must be drawn the function returns 1

    Else if two boxes must be drawn it returns 2

    Else it returns 0

    If the line drawn is vertical in the middle of the grid(x1 == x2):

    Check the right & left vertical lines.

    Check the adjacent upper & lower horizontal lines.

If one box of any of the two boxes in the first and second case must be drawn then check the other one , if one must be drawn the function returns 1

Else if two boxes must be drawn it returns 2

Else it returns 0

<u>If the line drawn is horizontal in the upper part of the grid (y1 == y2):</u>

Check the lower horizontal line.

Check the adjacent lower vertical lines.

If there is a box must be drawn the function returns 1

Else it returns 0.

<u>If the line drawn is horizontal in the lower part of the grid (y1 == y2):</u>

Check the upper horizontal line.

Check the adjacent upper vertical lines.

If there is a box must be drawn the function returns 1

Else it returns 0.

<u>If the line drawn is vertical in the right part of the grid (y1 == y2):</u>

Check the left vertical line.

Check the adjacent left horizontal lines.

If there is a box must be drawn the function returns 1

Else it returns 0.

If the line drawn is vertical in the left part of the grid (y1 == y2):

Check the right vertical line.

Check the adjacent left horizontal lines.

If there is a box must be drawn the function returns 1

Else it returns 0.

- May be boxes:

  If the line which will be drawn is horizontal in the middle of the grid

  (y1 == y2):

  1. Check the upper or lower horizontal lines.
  2. Check the adjacent upper & lower vertical lines.
  3. Check the upper horizontal line with the adjacent left or right vertical line.
  4. Check the lower horizontal line with the adjacent left or right vertical line.

  If any of the previous four cases happened {return 1;}

  Else {return 0;}

  If the line which will be drawn is vertical in the middle of the grid (x1 == x2):

  1. Check the left or right vertical lines.
  2. Check the adjacent left & right horizontal lines.
  3. Check the left vertical line with the adjacent upper or lower horizontal line.
  4. Check the right vertical line with the adjacent upper or lower horizontal line.

  If any of the previous four cases happened {return 1;}

  Else {return 0;}

If the line which will be drawn is horizontal in the upper part of the grid (y1 == y2)

1. Check the adjacent lower vertical lines.
2. Check the lower horizontal line with the adjacent left or right vertical line.

If any of the previous two cases happened {return 1;}
Else {return 0;}.

If the line which will be drawn is horizontal in the lower part of the grid (y1 == y2):

1. Check the adjacent upper vertical lines.
2. Check the upper horizontal line with the adjacent left or right vertical line.

If any of the previous two cases happened {return 1;}
Else {return 0;}.

If the line which will be drawn is vertical in the right part of the grid (y1 == y2):

1. Check the adjacent left horizontal lines.
2. Check the left vertical line with the adjacent upper or lower horizontal line.

If any of the previous two cases happened {return 1;}
Else {return 0;}.

If the line which will be drawn is vertical in the left part of the grid (y1 == y2):

1. Check the adjacent right horizontal lines.
2. Check the right vertical line with the adjacent upper or lower horizontal line.

If any of the previous two cases happened {return 1;}
Else {return 0;}.

- Undo:

check the turn:

check the drawn line complete a box or not:

if not { move of the other player --;

change turn;}

else {his move--;

his score--;

not change turn;}.

- Redo:

check the turn:

check the drawn line complete a box or not:

if not {his move++;

change turn;}.

else {his move++;

his score++;

not change turn;}

User manual:

-**To play:** use the arrows button and it appears as color of the player (green & violet) , to select point enter “Enter Button”.

-**To draw line** from this point choose another **adjacent** point by the same way.

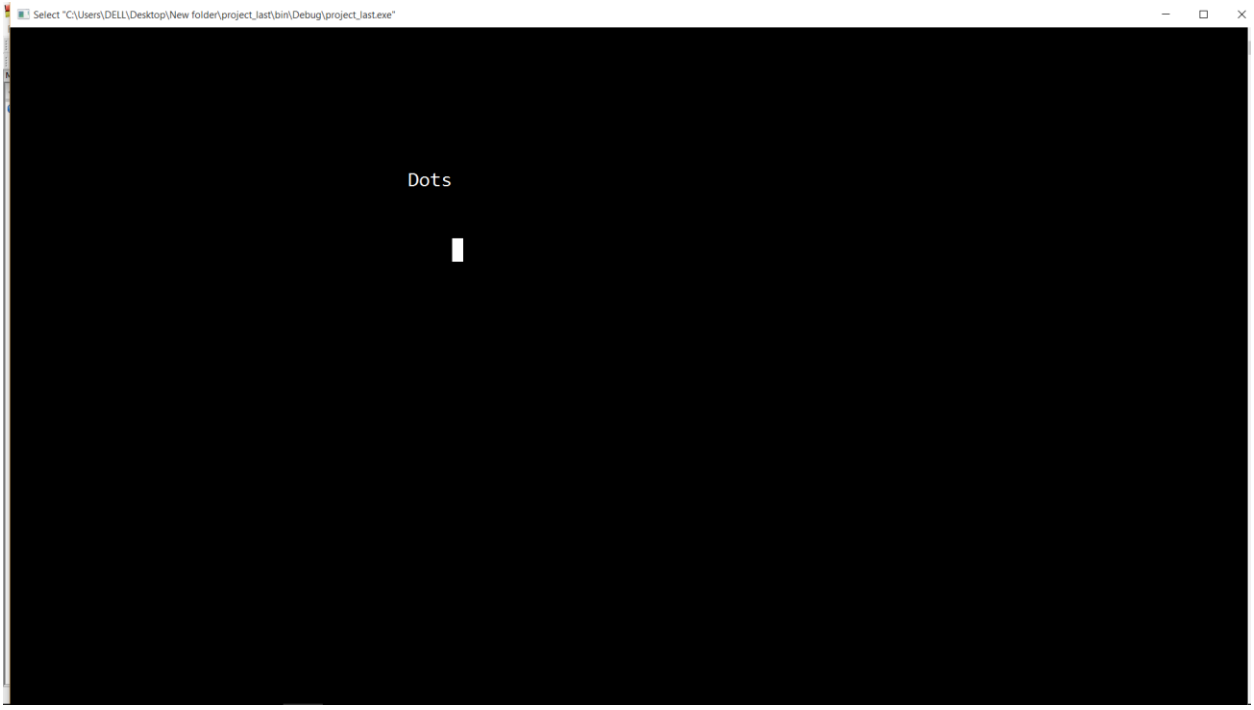
-**To save the game:** press “ESC” at any time ,then the name of file in which the game saved will appear to you.

- **To undo:** press “ctrl-z” to undo your play.

- **To redo:** press “ctrl-y” to redo your play.

-In the “how to play” in the “main menu” of the game we show to the user how to play a game through a simple game.

Sample runs: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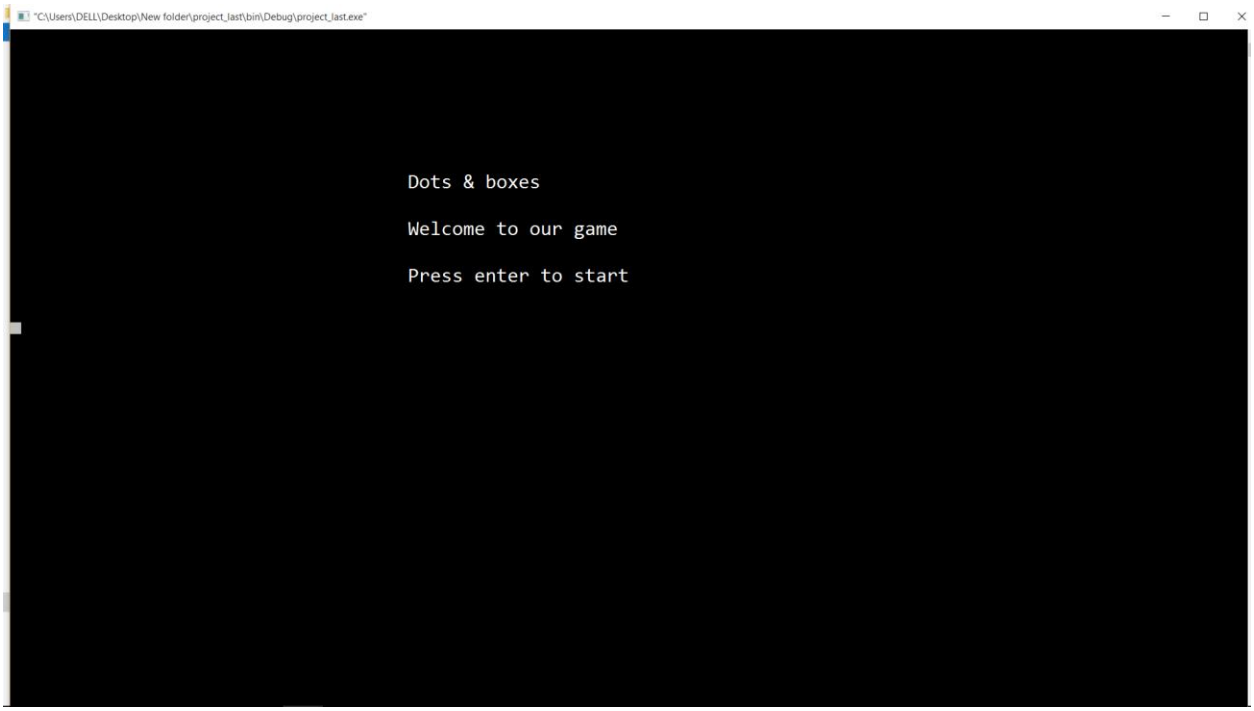
Dots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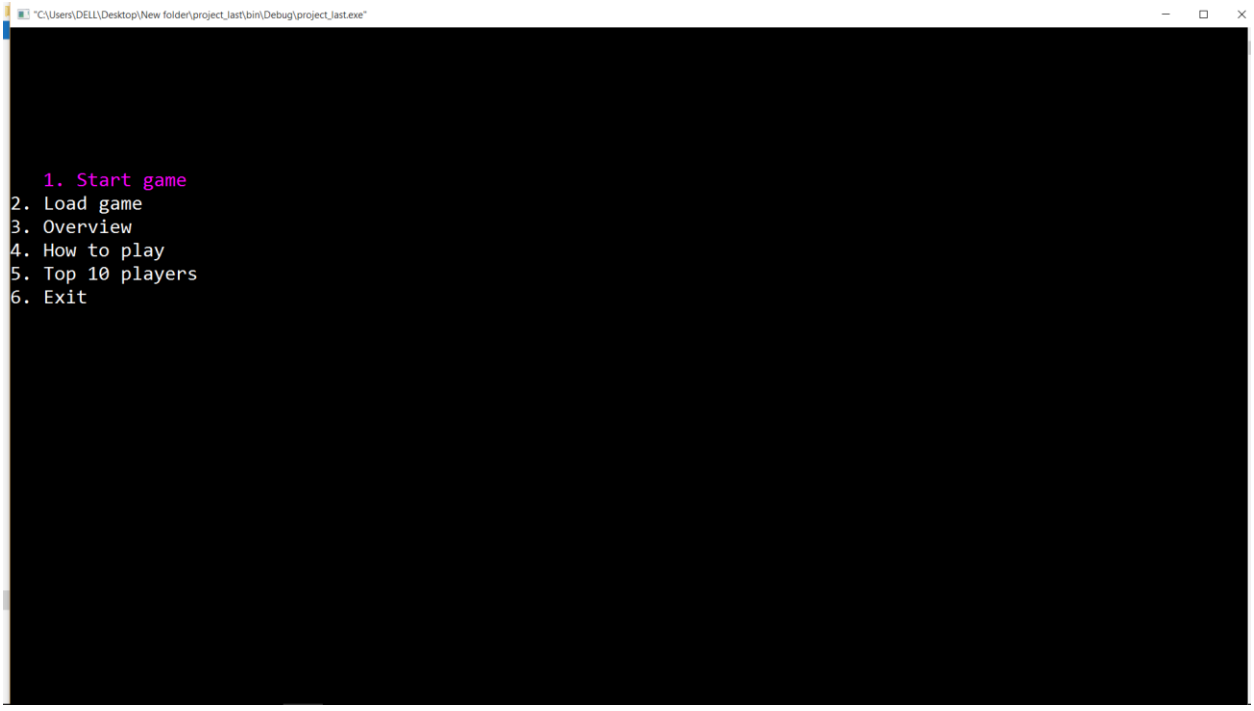
Dots & boxes
Welcome to our game
Press enter to start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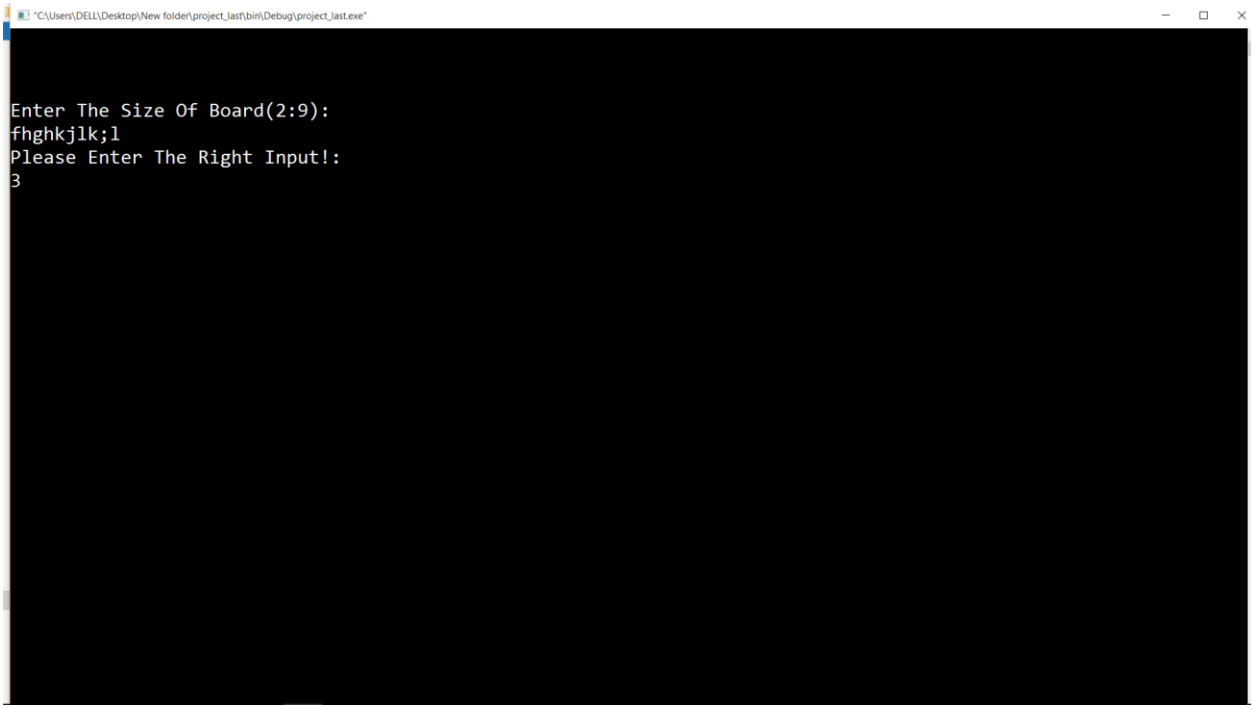
1. Start game
2. Load game
3. Overview
4. How to play
5. Top 10 players
6. Exit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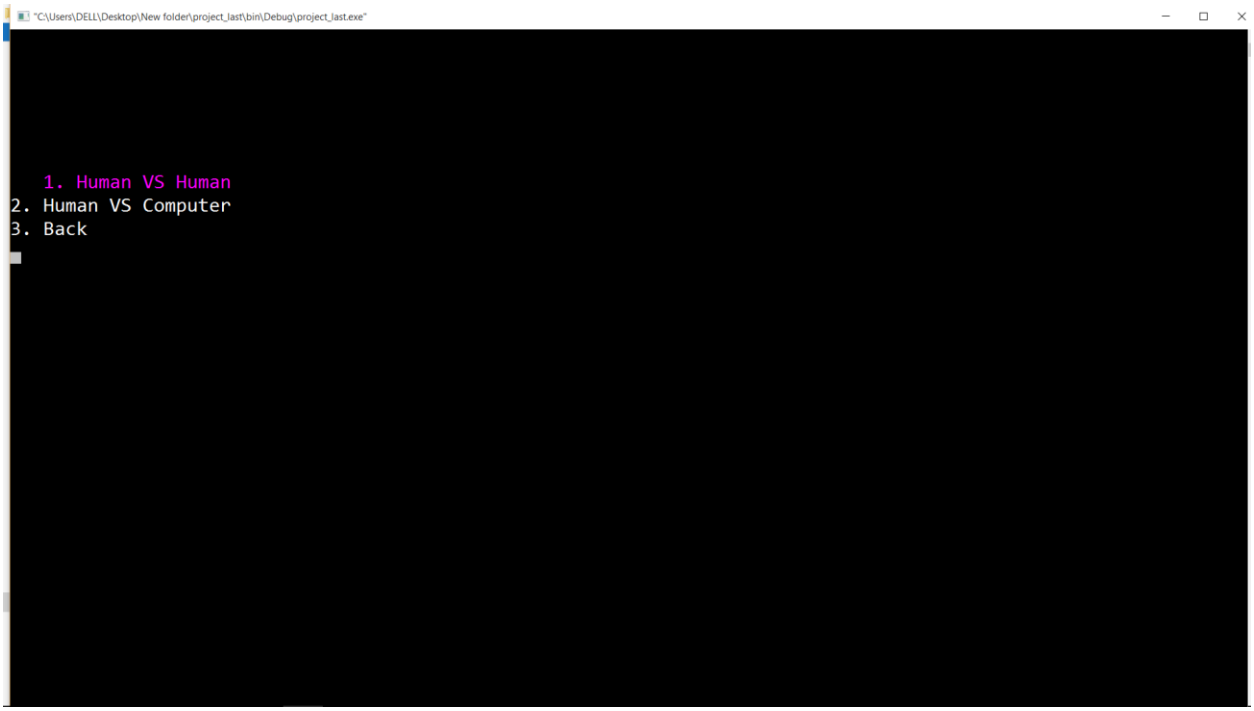
Enter The Size Of Board(2:9):
fhghkjlk;l
Please Enter The Right Input!:
3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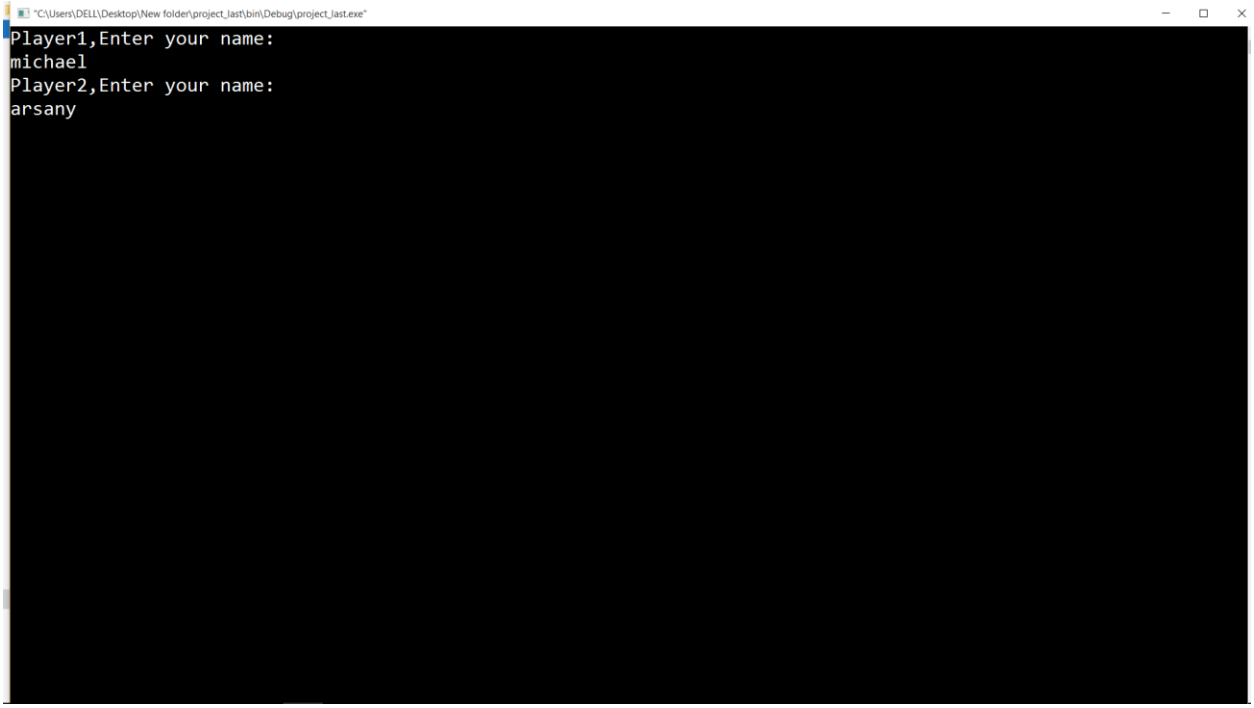
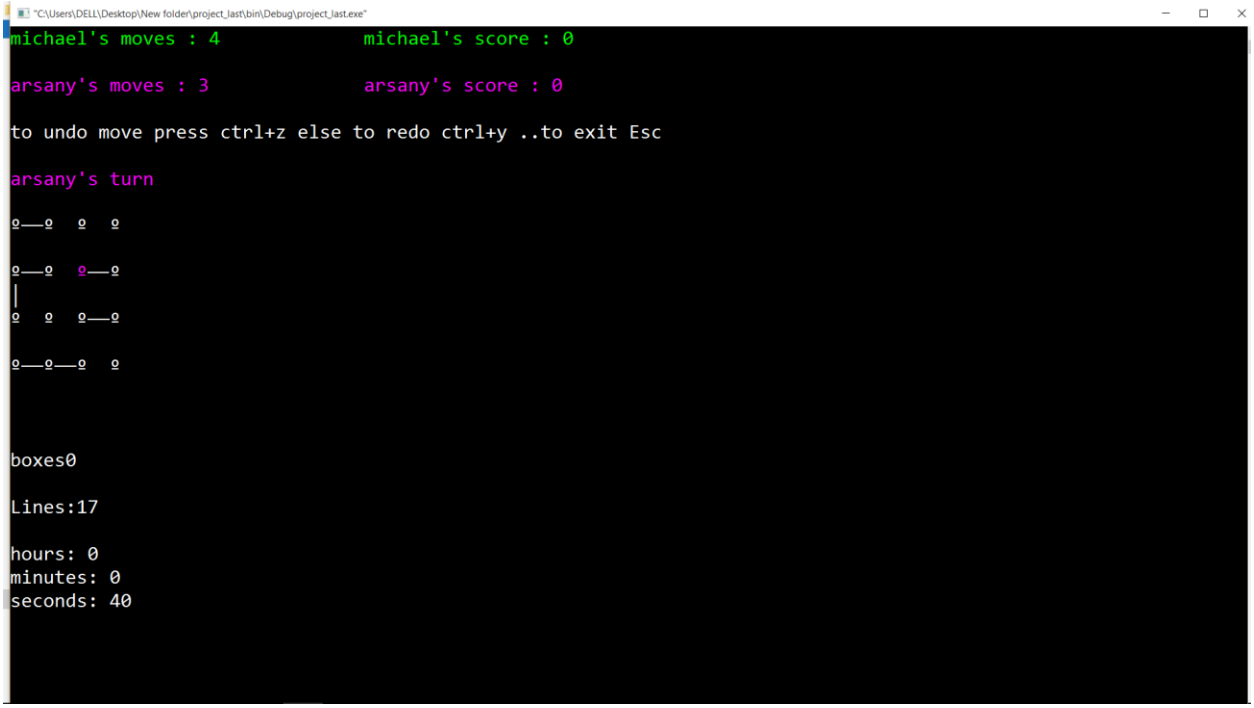
1. Human VS Human
2. Human VS Computer
3. Back


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
Player1,Enter your name:
michael
Player2,Enter your name:
arsany


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
michael's moves : 0 michael's score : 0
arsany's moves : 0 arsany's score : 0
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
michael's turn
o o o o
o o o o
o o o o
o o o o
boxes0
Lines:24
hours: 0
minutes: 0
seconds: 0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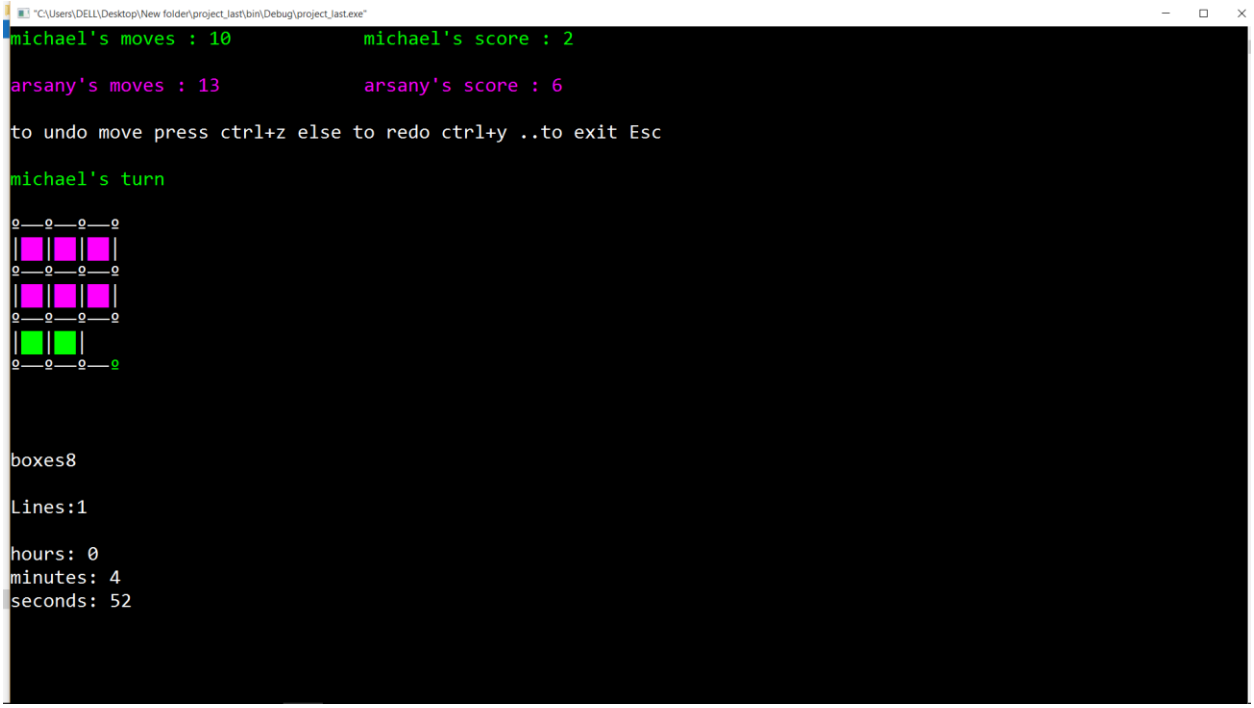
michael's moves : 4 michael's score : 0
arsany's moves : 3 arsany's score : 0
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
arsany's turn
boxes0
Lines:17
hours: 0
minutes: 0
seconds: 40


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
michael's moves : 7 michael's score : 0
arsany's moves : 7 arsany's score : 1
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
arsany's turn
boxes1
Lines:10
hours: 0
minutes: 1
seconds: 52


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
michael's moves : 8
michael's score : 0
arsany's moves : 12
arsany's score : 6
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
arsany's turn
boxes6
Lines:4
hours: 0
minutes: 3
seconds: 45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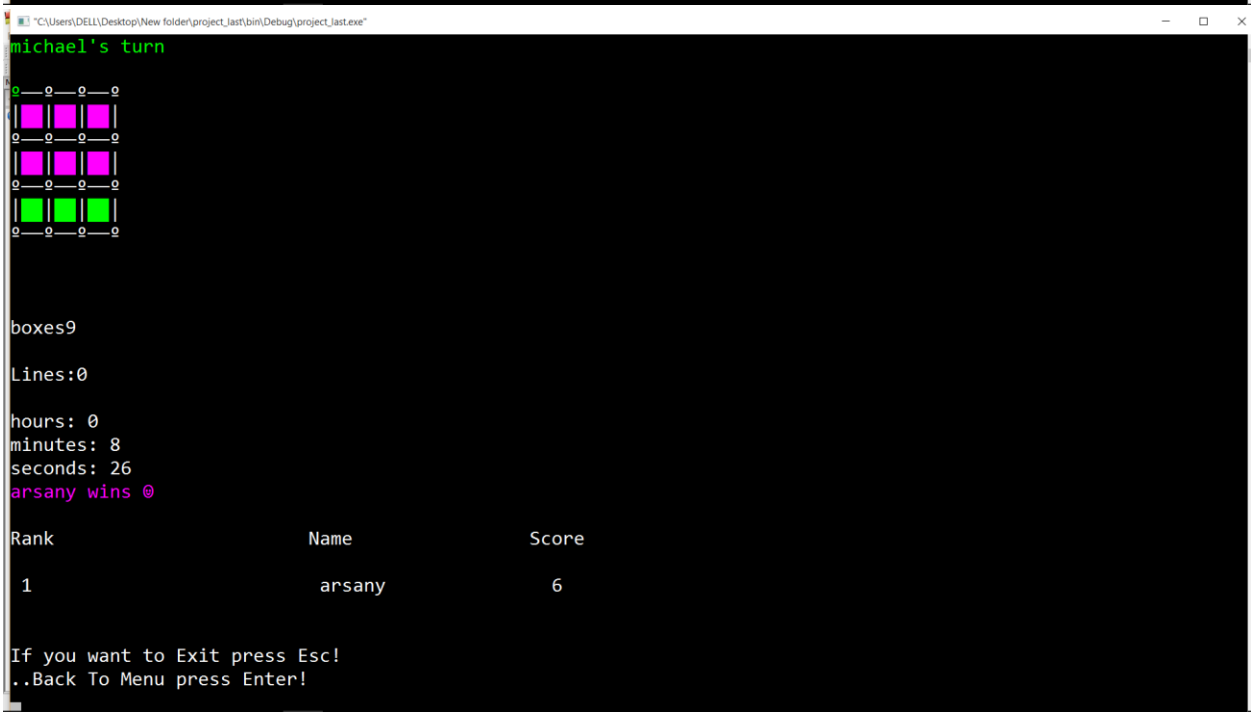
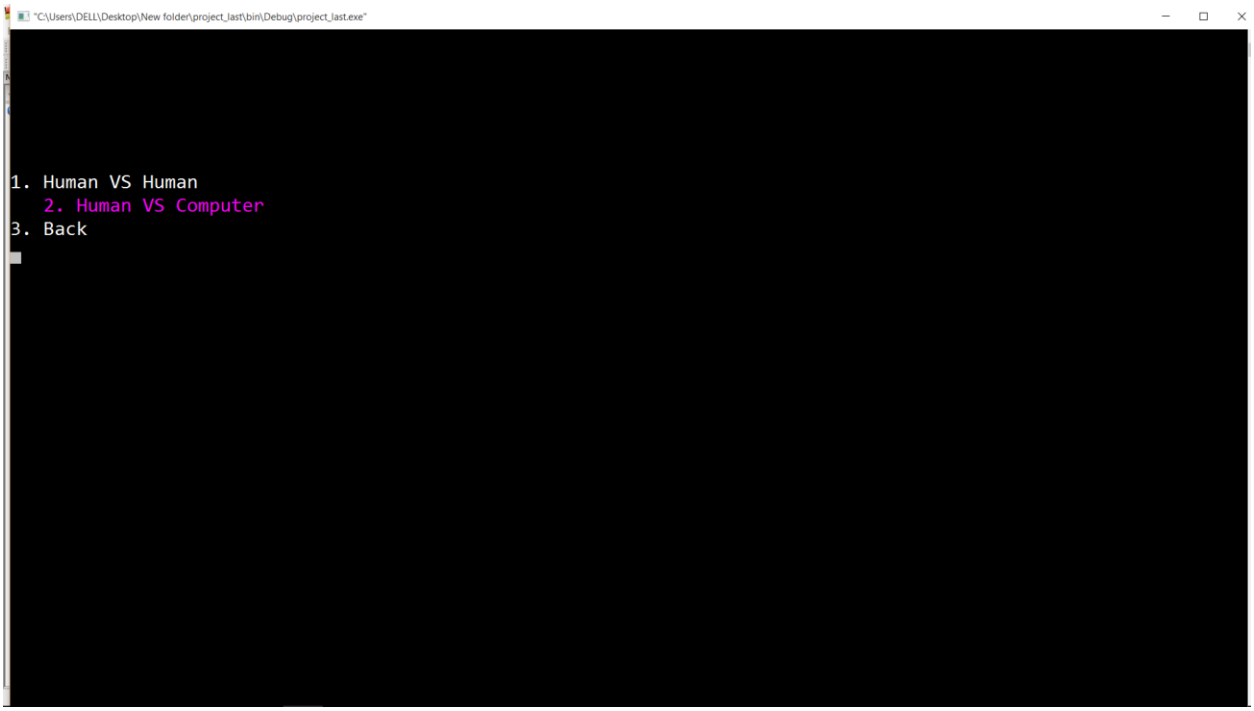
michael's moves : 10
michael's score : 2
arsany's moves : 13
arsany's score : 6
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
michael's turn
boxes8
Lines:1
hours: 0
minutes: 4
seconds: 52


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
michael's turn
boxes9
Lines:0
hours: 0
minutes: 8
seconds: 26
arsany wins @
Rank
Name
Score
1
arsany
6
If you want to Exit press Esc!
..Back To Menu press Enter!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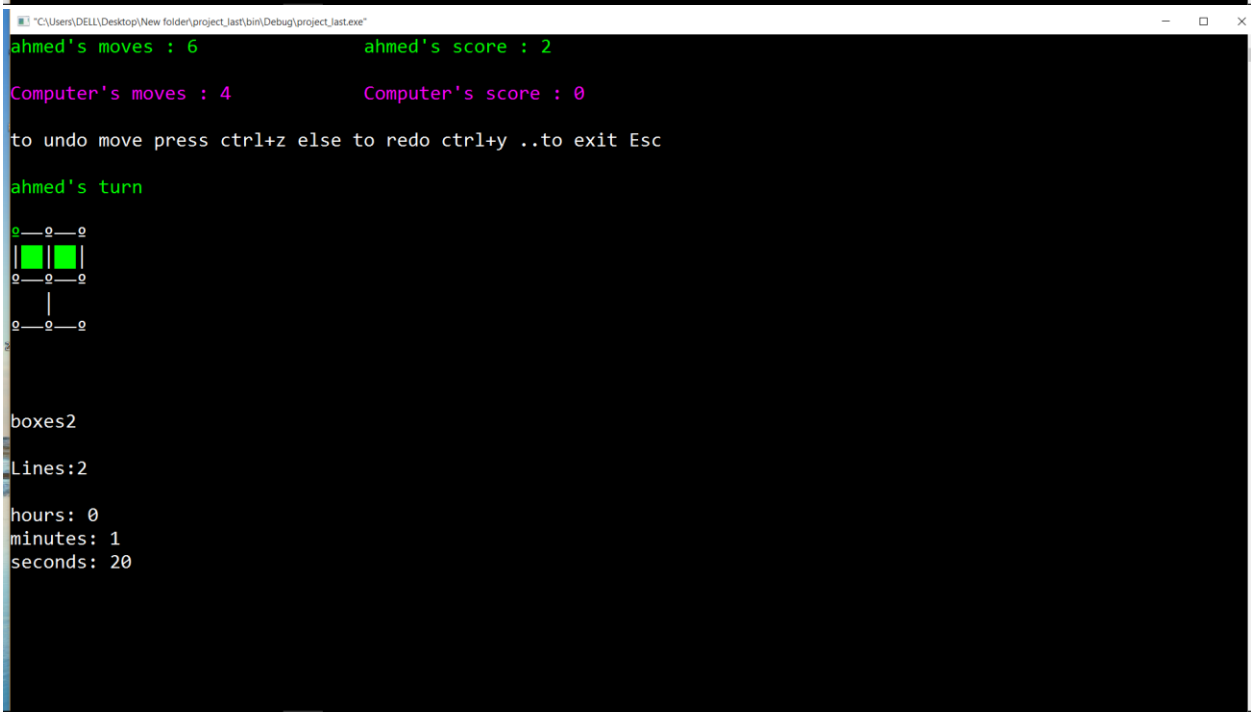
2. Human VS Computer
3. Back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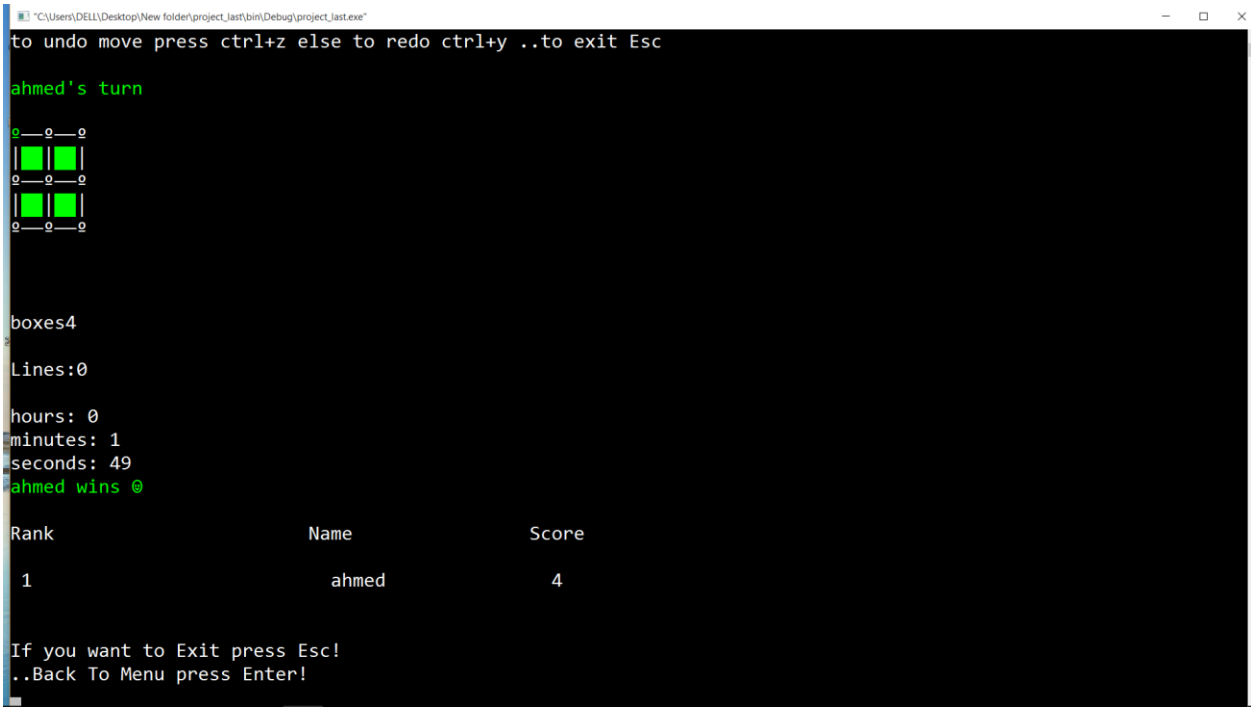
ahmed's moves : 6
ahmed's score : 2
Computer's moves : 4
Computer's score : 0
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
ahmed's turn
boxes2
Lines:2
hours: 0
minutes: 1
seconds: 20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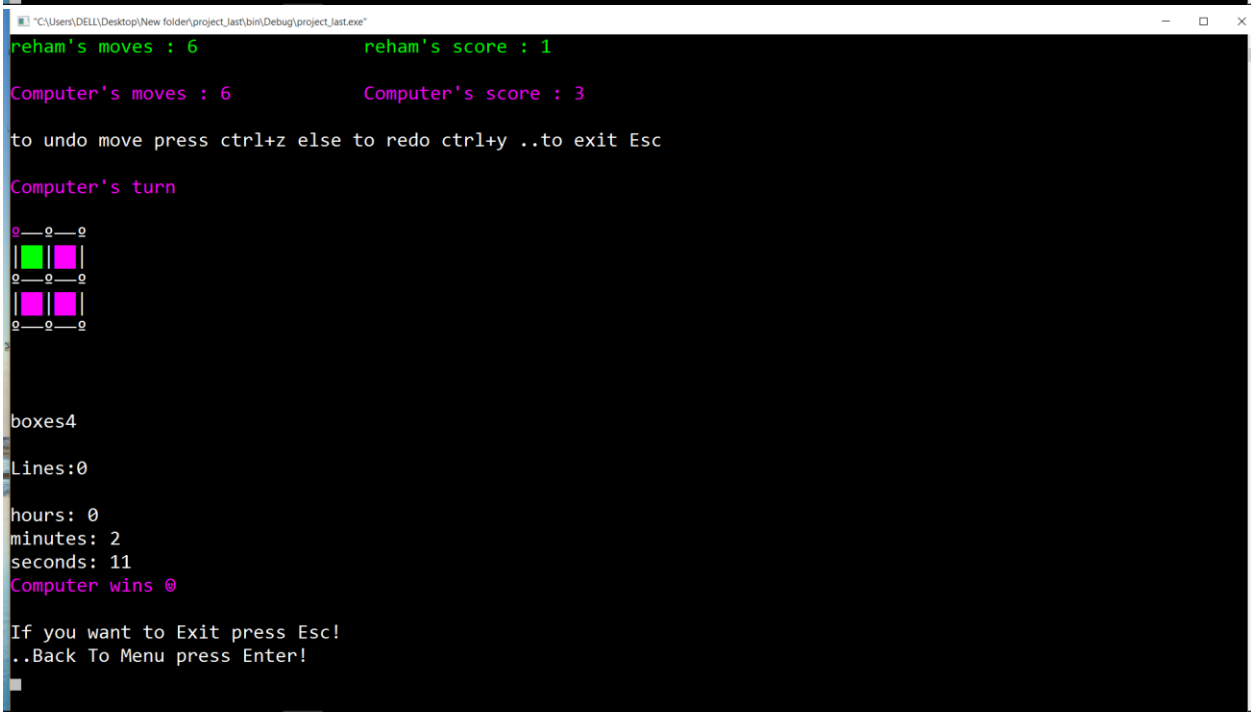
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
ahmed's turn
boxes4
Lines:0
hours: 0
minutes: 1
seconds: 49
ahmed wins @
Rank Name Score
1 ahmed 4
If you want to Exit press Esc!
..Back To Menu press Enter!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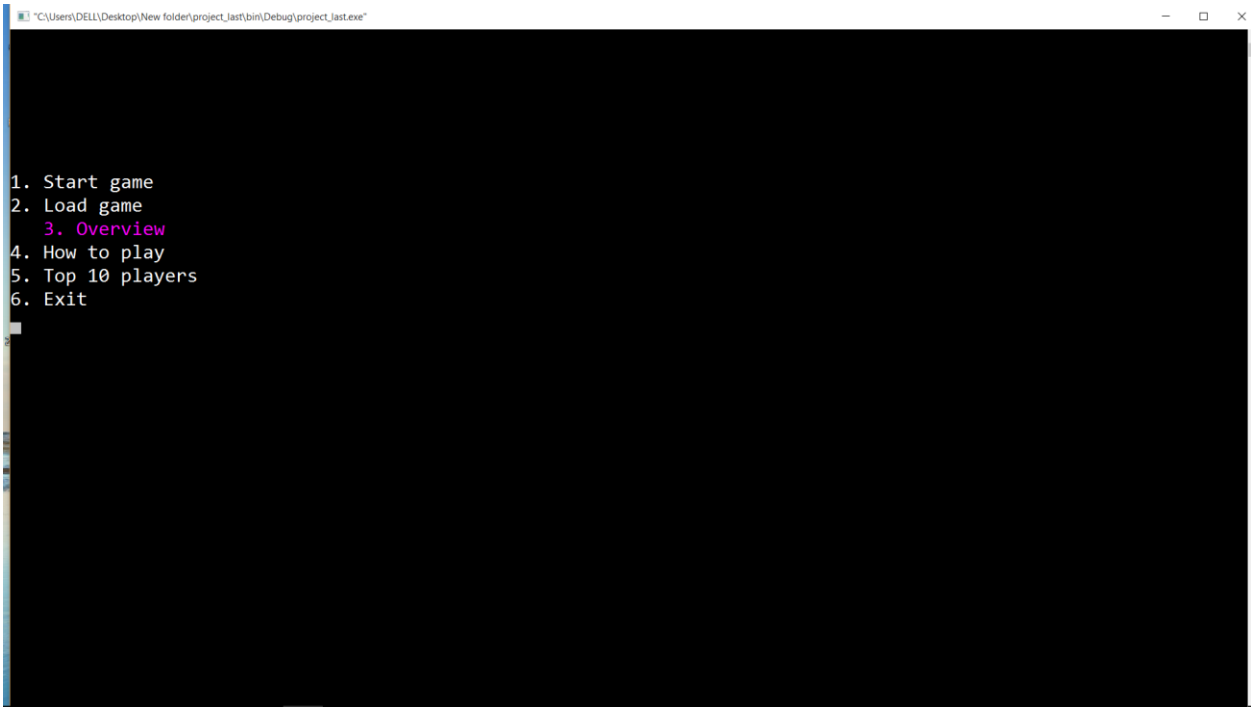
reham's moves : 6
reham's score : 1
Computer's moves : 6
Computer's score : 3
to undo move press ctrl+z else to redo ctrl+y ..to exit Esc
Computer's turn
boxes4
Lines:0
hours: 0
minutes: 2
seconds: 11
Computer wins @
If you want to Exit press Esc!
..Back To Menu press Enter!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2. Load game
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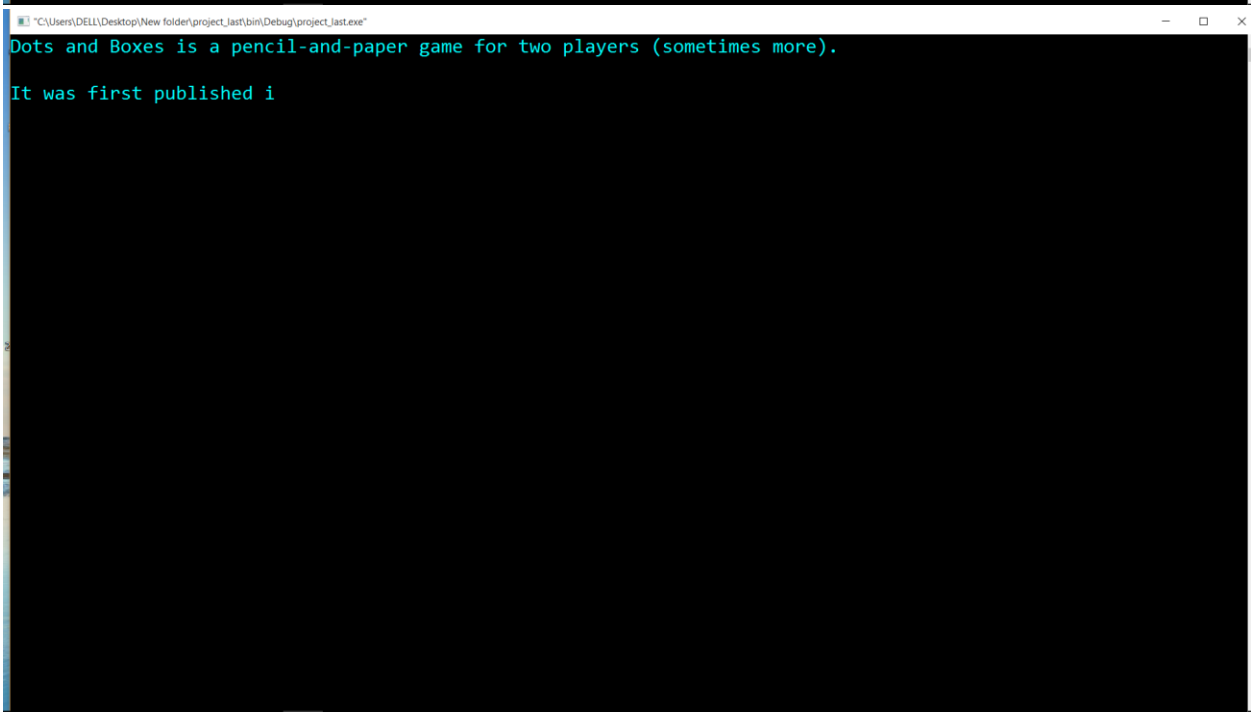
"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
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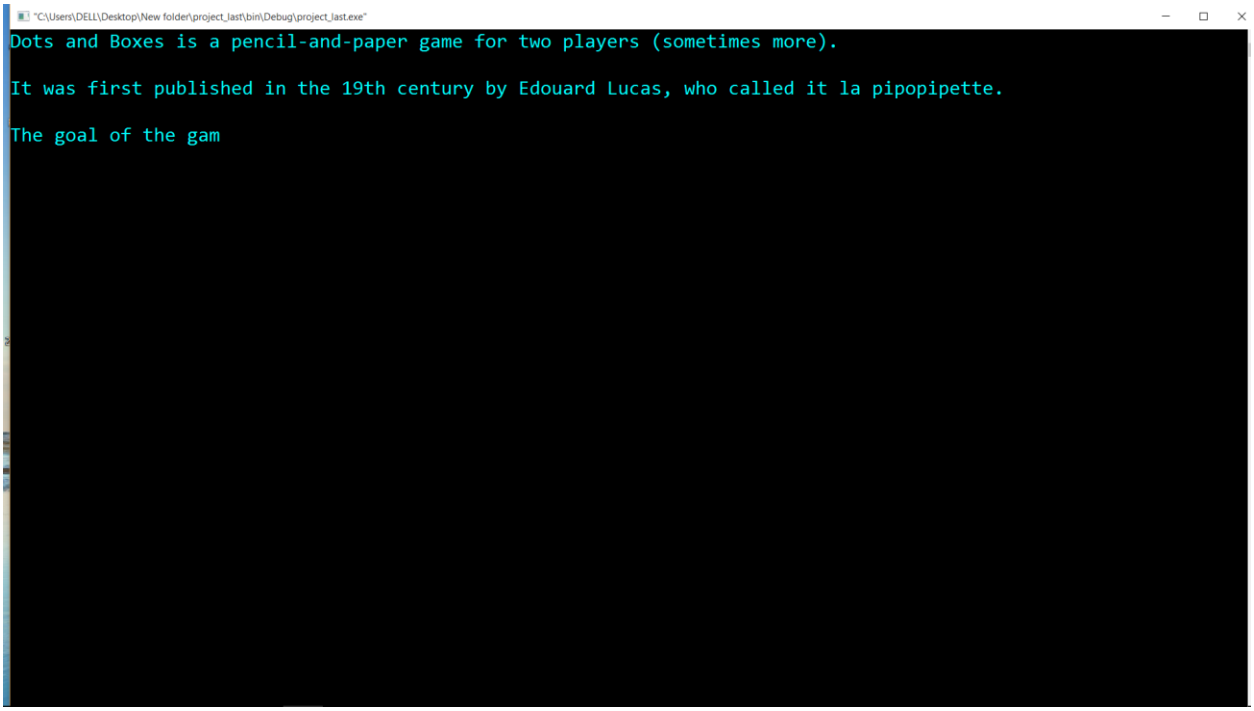
It was first published i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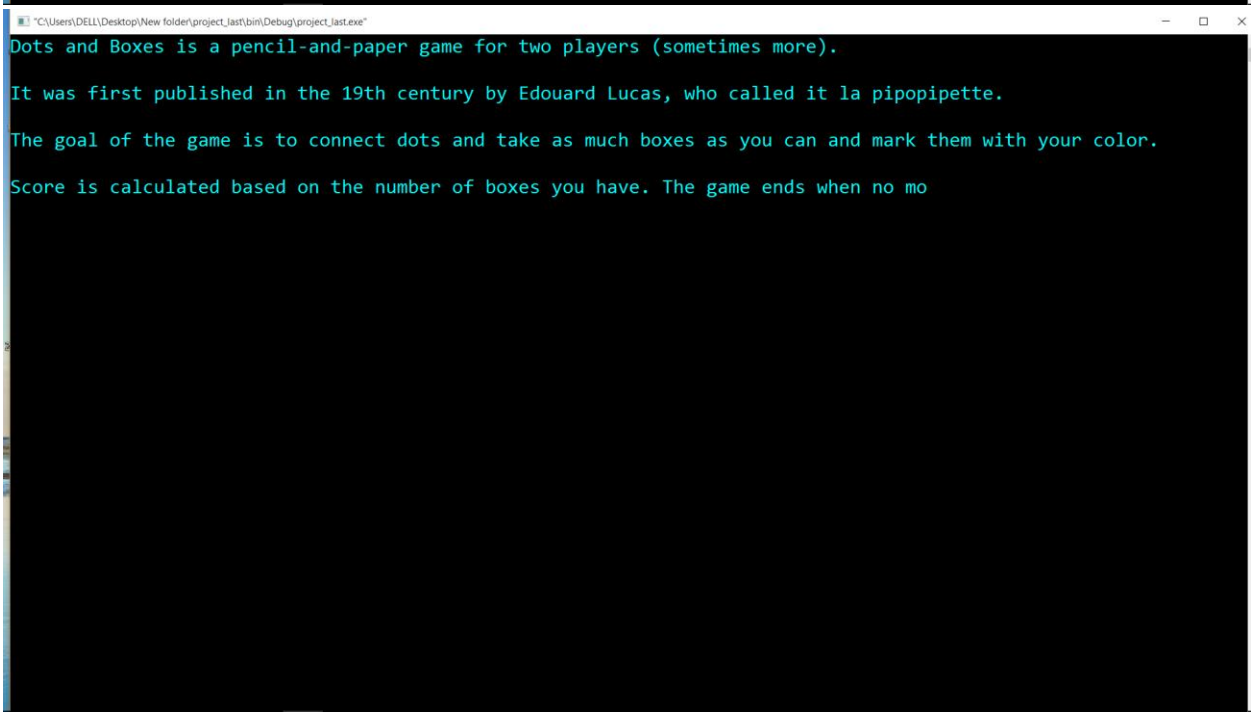
It was first published in the 19th century by Edouard Lucas, who called it la pipopipette.
The goal of the gam


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
Dots and Boxes is a pencil-and-paper game for two players (sometimes more).
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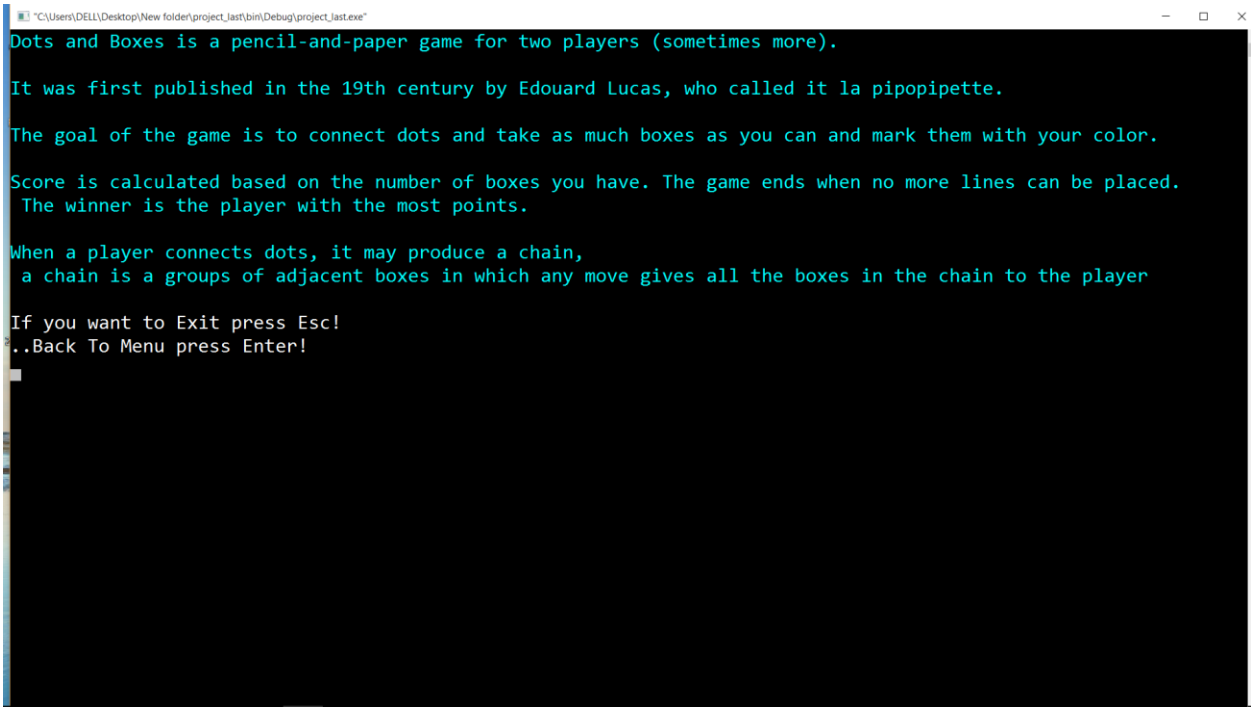
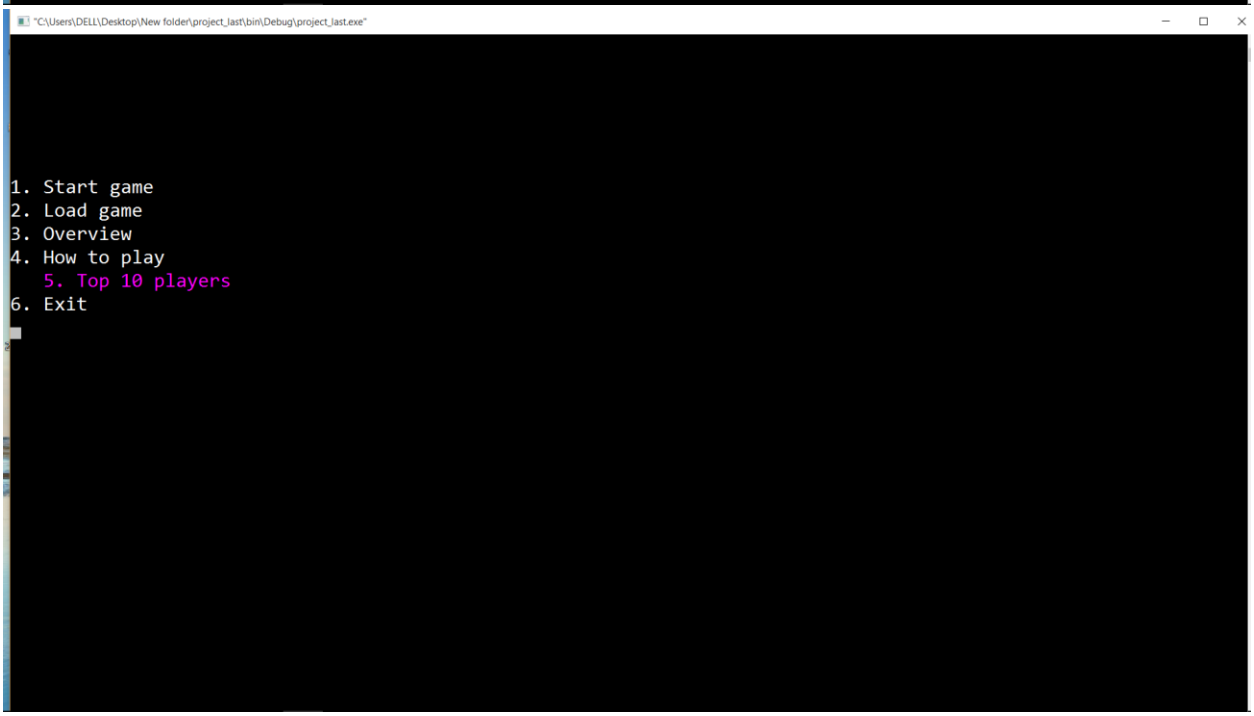

"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
Dots and Boxes is a pencil-and-paper game for two players (sometimes more).
It was first published in the 19th century by Edouard Lucas, who called it la pipopipette.
The goal of the game is to connect dots and take as much boxes as you can and mark them with your color.
Score is calculated based on the number of boxes you have. The game ends when no more lines can be placed.
The winner is the player with the most points.
When a player connects dots, it may produce a chain,
a chain is a groups of adjacent boxes in which any move gives all the boxes in the chain to the player
If you want to Exit press Esc!
..Back To Menu press Enter!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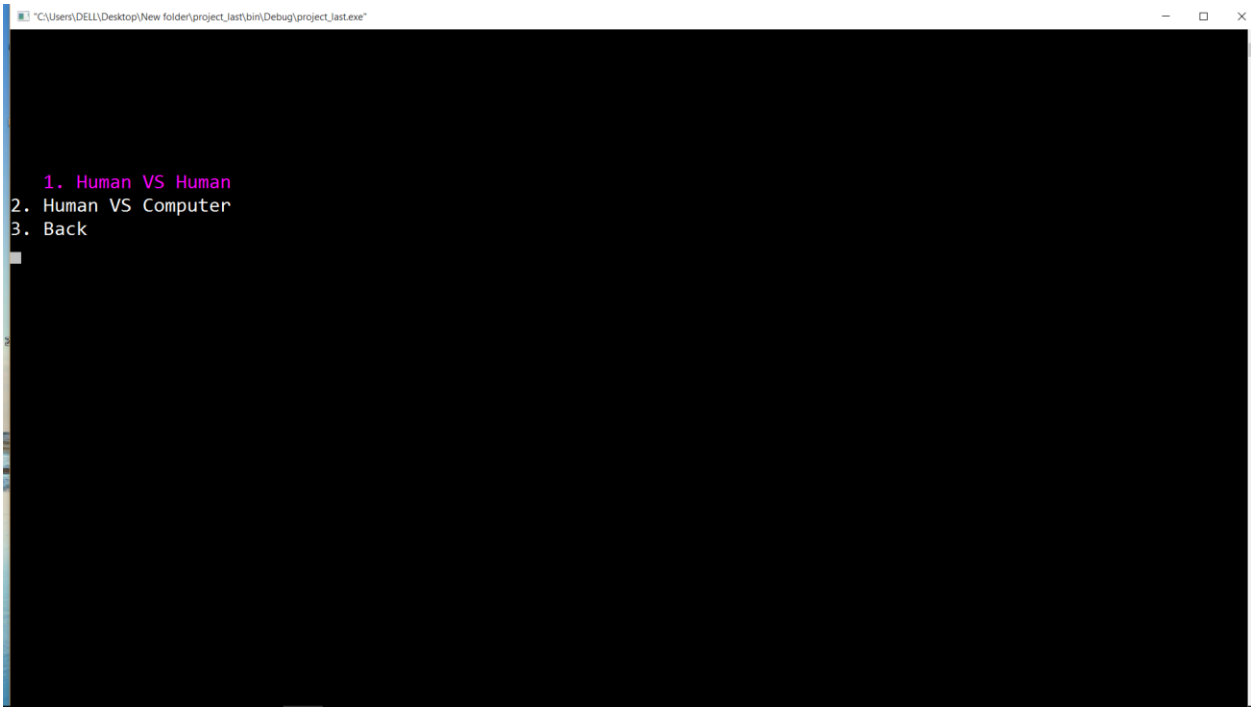
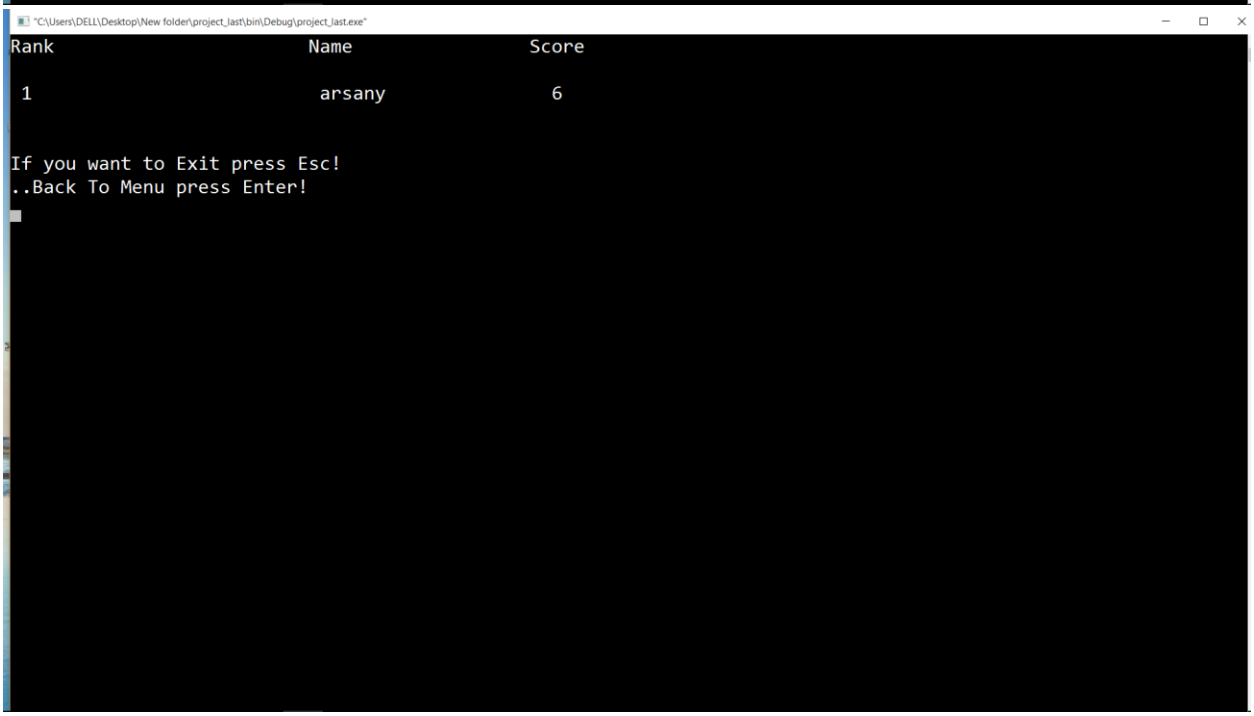
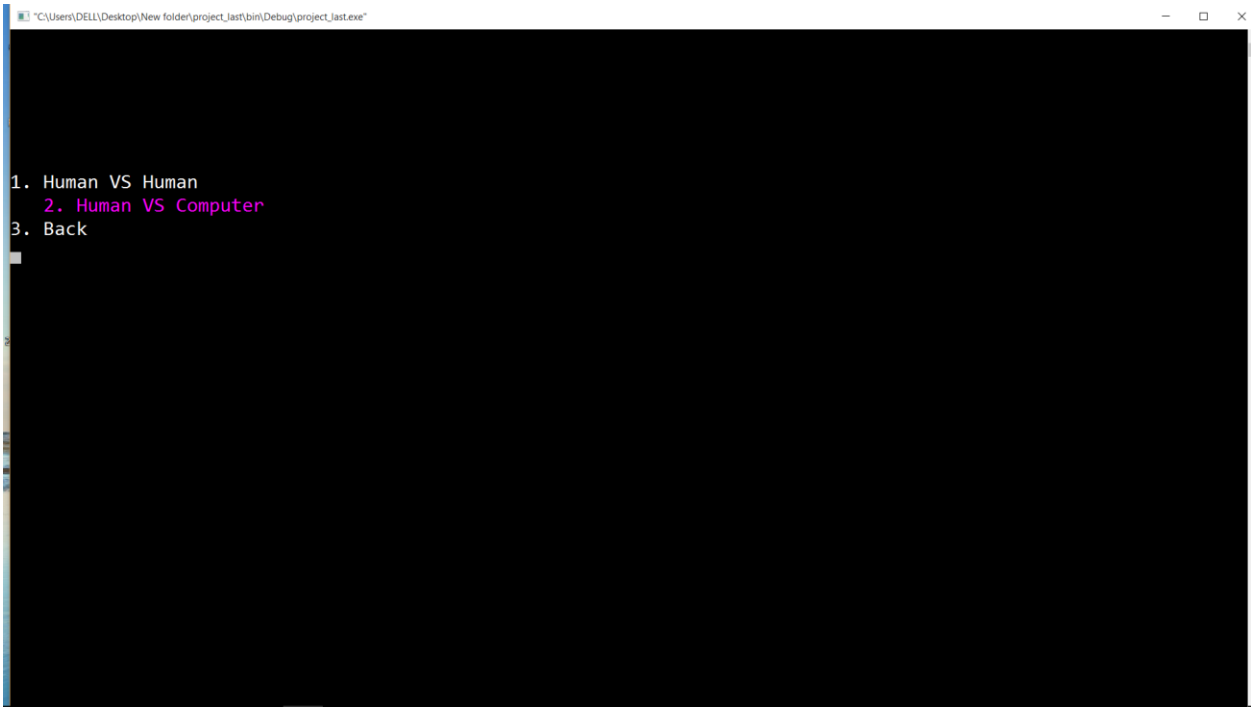
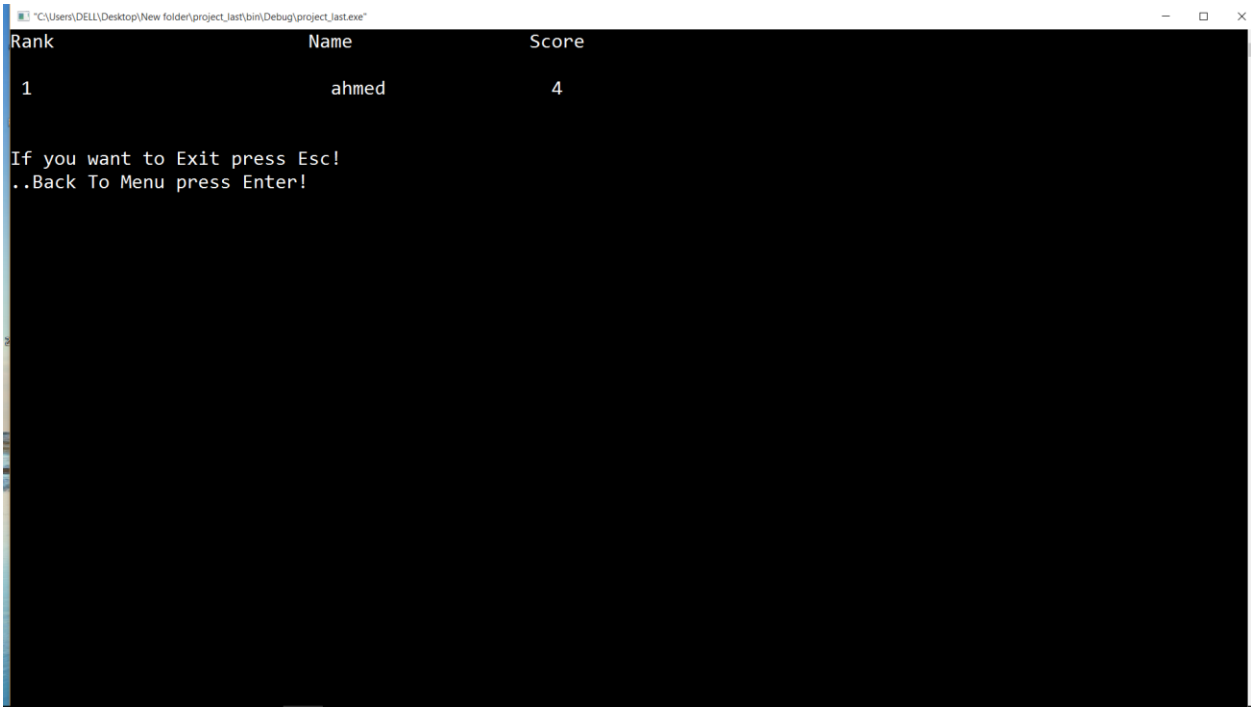
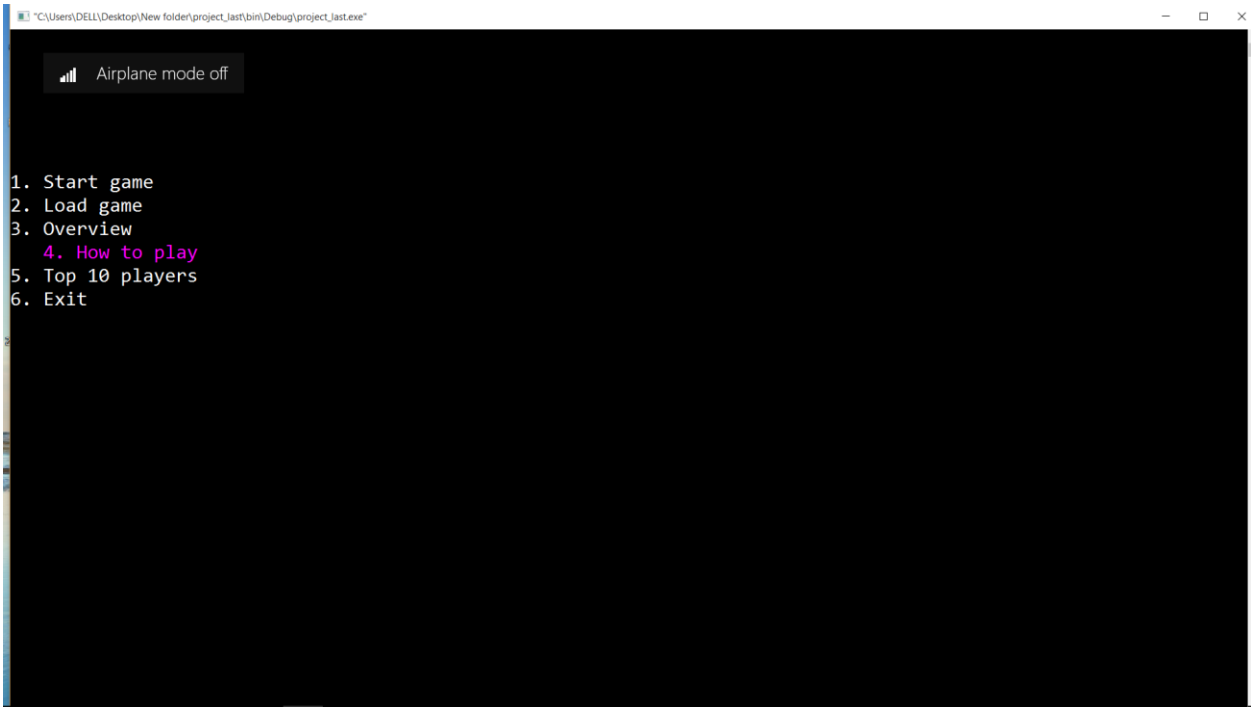
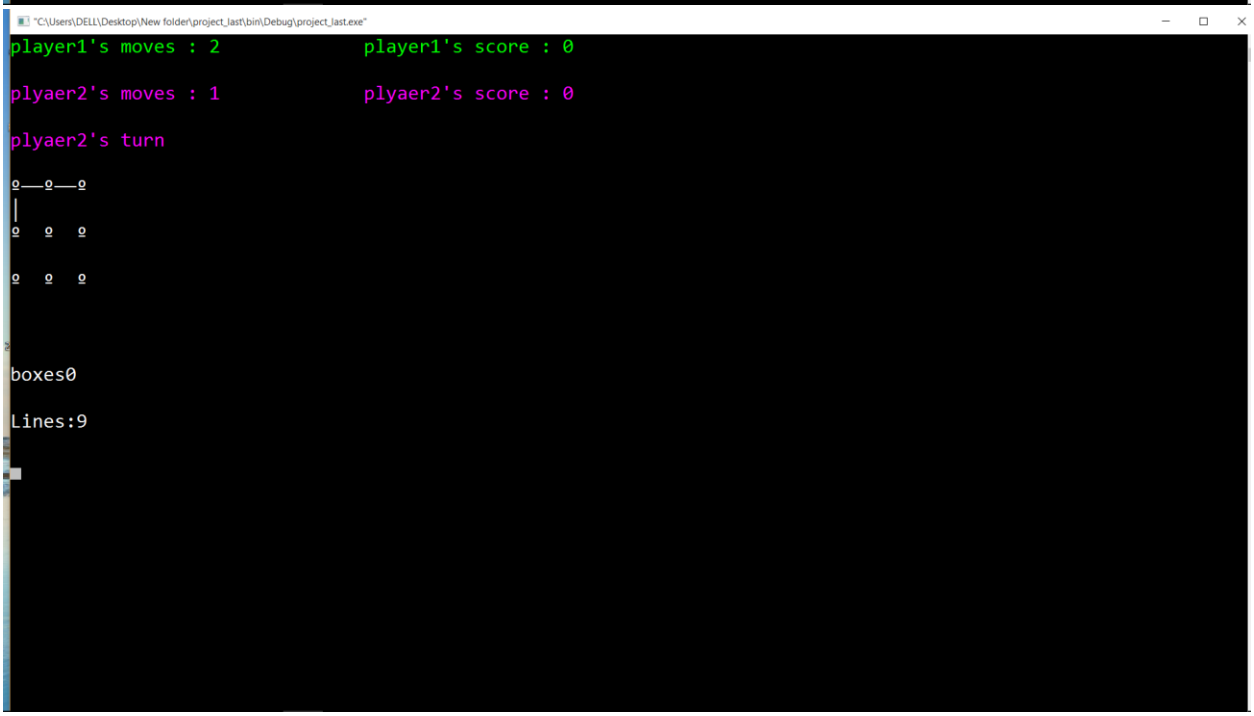

"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
1. Human VS Human
2. Human VS Computer
3. Back

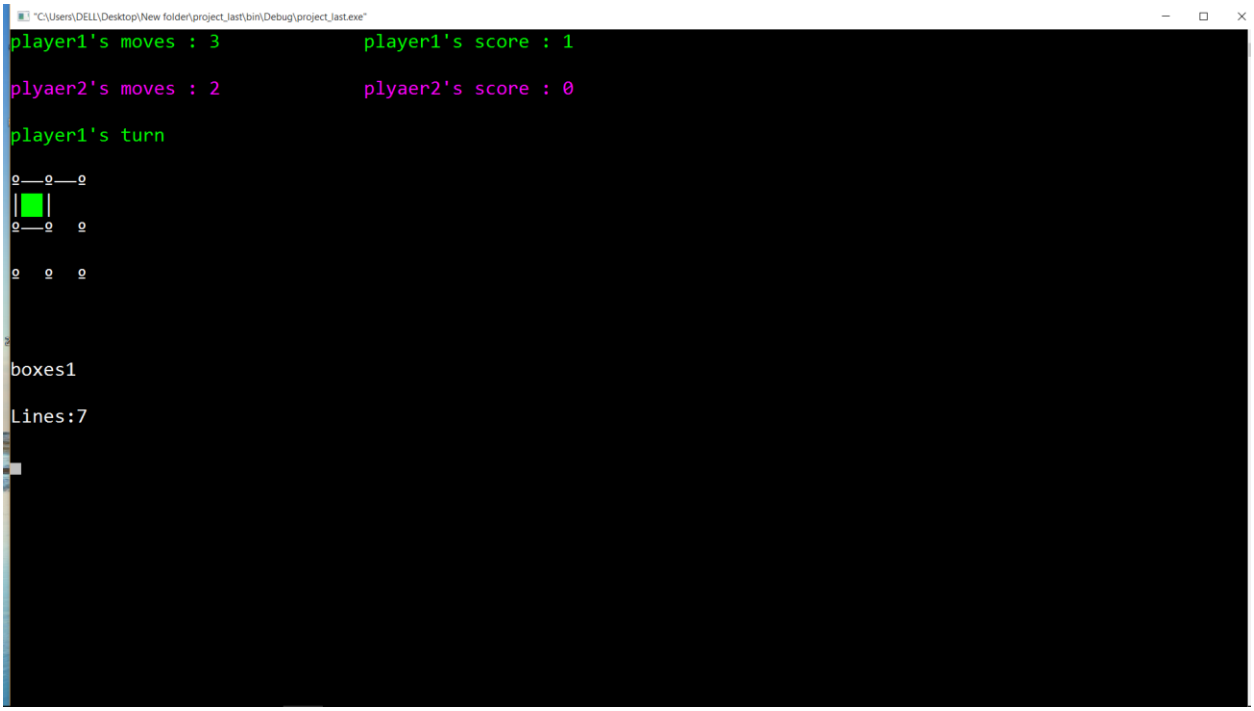

"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
Rank Name Score
1 arsany 6
If you want to Exit press Esc!
..Back To Menu press Enter!

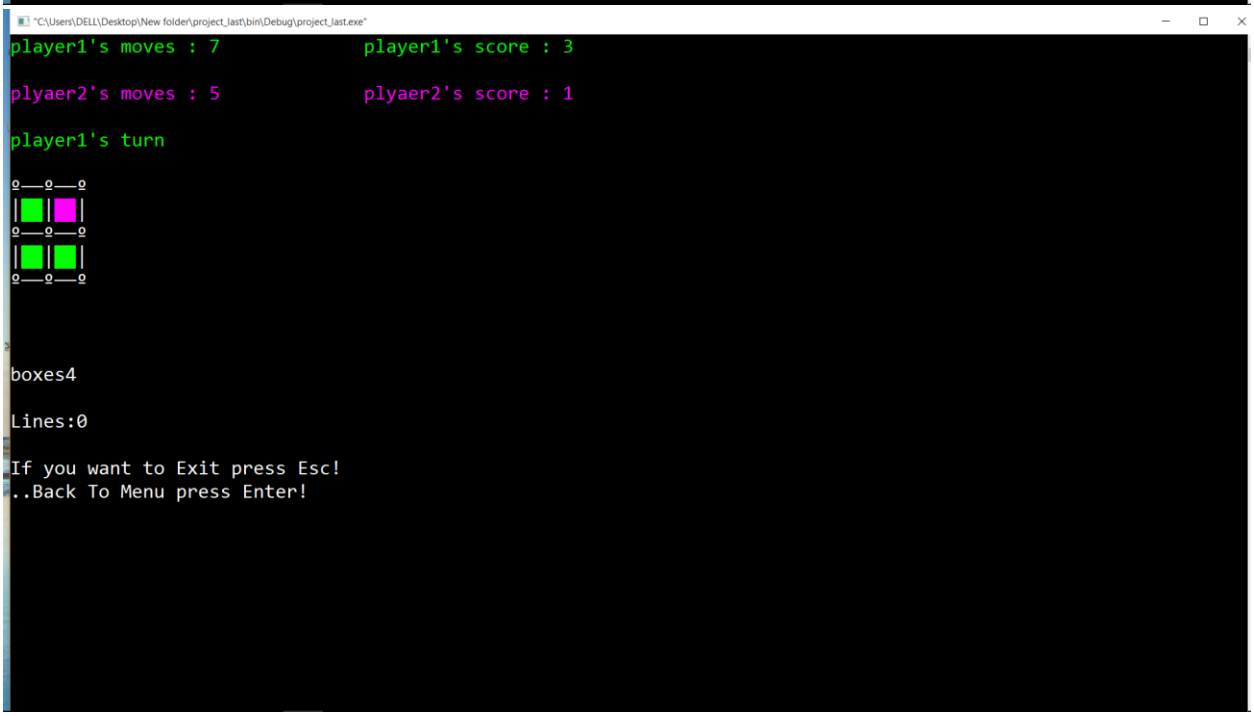

"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
1. Human VS Human
2. Human VS Computer
3. Back


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
Rank Name Score
1 ahmed 4
If you want to Exit press Esc!
..Back To Menu press Enter!


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
Airplane mode off
1. Start game
2. Load game
3. Overview
4. How to play
5. Top 10 players
6. Exit


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
player1's moves : 2
player1's score : 0
plyaer2's moves : 1
plyaer2's score : 0
plyaer2's turn
o——o——o
o o o
o o o
boxes0
Lines:9


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
player1's moves : 3
player1's score : 1
plyaer2's moves : 2
plyaer2's score : 0
player1's turn
boxes1
Lines:7


"C:\Users\DELL\Desktop\New folder\project_last\bin\Debug\project_last.exe"
player1's moves : 7
player1's score : 3
plyaer2's moves : 5
plyaer2's score : 1
player1's turn
boxes4
Lines:0
If you want to Exit press Esc!
..Back To Menu press Enter!

References :

- Stack over flow
  - Ascii code.
  - Arrows.
  - Colors.
  - Time.
- C board. c programming
  - Using sleep function.
- Code in code blocks
  - Delay function.
- Last section
  - Files
- Dream in code
  - Writing 2d array to a file.