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Semester Project's REPORT

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Tic-Tac-Toe Game

Project Report

PREFACE

This report is an introduction to the Tic-tac-toe game in MIPS. Anybody, who doesn't know even the basics of Tic-tac-toe in Assembly language, will be certainly able to understand and gain the great knowledge from this report. The report main focuses on the development of Tic-tac-toe game in the **MIPS**.

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INTRODUCTION

Tic-tac-toe is not a very challenging game for human beings. Tic-tac-toe (also known as **noughts and crosses** or **Xs and Os**) is for two players, ***X*** and ***O***, who take turns marking the spaces in a 3×3 grid. The player who succeeds in placing three of their marks in a horizontal, vertical, or diagonal row **wins** the game.

CODE

```
.data
        board: .asciiz "  1   2   3\n1   |   |   \n ---+---+---\n2   |   |   \n ---+---+---\n3   |   |   \n"
        askForMove: .asciiz "Player insert your play (column|row): "
        invalidMove: .asciiz "******Invalid Move******"
        spaceOccupied: .asciiz "****Space already occupied****\n"
        x: .asciiz "X"
        o: .asciiz "O"
        won: .asciiz "\nPlayer   Won!!!!! \n"
        tie: .asciiz  "\nTie!!!"
        gameMenu: .asciiz "\n\nChoose an option:\n[1] New Game\t[99] Quit\nOption: "
        clean: .byte ' '

.text
.globl main
main:
        li $t1, 0
```

```
                li $t2, 0
                li $t3, 0
                li $t4, 0
                li $t5, 0
                li $t6, 0
                li $t7, 0
                li $t8, 0
                li $t9, 0

                li $s0, 0
                li $s5, 0

                la $s1, board
                la $s2, askForMove
                la $s3, won

                lb $a1, clean
                sb $a1, 14($s1)
                sb $a1, 18($s1)
                sb $a1, 22($s1)
                sb $a1, 40($s1)
                sb $a1, 44($s1)
                sb $a1, 48($s1)
                sb $a1, 66($s1)
                sb $a1, 70($s1)
                sb $a1, 74($s1)

PrintBoard:
                li $v0, 4
                la $a0, board
                syscall
```

```
        beq $s5, 9, Tie
        add $s5, $s5, 1
        rem $t0, $s0, 2         #$t0 stores the remainder when $s0 is divided by 2
        add $s0, $s0, 1
        bnez $t0, Player0

PlayerX:
        lb $a1, x
        sb $a1, 7($s2)
        sb $a1, 8($s3)
        j Play
Player0:
        lb $a1, o
        sb $a1, 7($s2)
        sb $a1, 8($s3)

Play:
        li $v0, 4
        la $a0, askForMove
        syscall

        li $v0, 5       #user input
        syscall
        move $s6, $v0

        beq $s6, 11, CR11
        beq $s6, 21, CR21
        beq $s6, 31, CR31
        beq $s6, 12, CR12
        beq $s6, 22, CR22
        beq $s6, 32, CR32
```

```
          beq $s6, 13, CR13
          beq $s6, 23, CR23
          beq $s6, 33, CR33

          li $v0, 4          #Prints the message for invalid move
          la $a0, invalidMove
          syscall
          j Play

CR11:
          bnez $t1, Occupied     #Branch to the label Occupied if $t1 is not equal to zero
          bnez $t0, O11

          X11:
          li $t1, 1
          sb $a1, 14($s1)
          j CheckVictory         #jumps to the label CheckVictory to check for the victory

          O11:
          li $t1, 2
          sb $a1, 14($s1)
          j CheckVictory

CR21:
          bnez $t2, Occupied     #Branch to the label Occupied if $t2 is not equal to zero
          bnez $t0, O21

          X21:
          li $t2, 1
          sb $a1, 18($s1)
          j CheckVictory
```

```
                    O21:
                    li $t2, 2
                    sb $a1, 18($s1)
                    j CheckVictory

CR31:
                    bnez $t3, Occupied    #Branch to the label Occupied if $t3 is not equal to zero
                    bnez $t0, O31

                    X31:
                    li $t3, 1
                    sb $a1, 22($s1)
                    j CheckVictory

                    O31:
                    li $t3, 2
                    sb $a1, 22($s1)
                    j CheckVictory

CR12:
                    bnez $t4, Occupied    #Branch to the label Occupied if $t4 is not equal to zero
                    bnez $t0, O12

                    X12:
                    li $t4, 1
                    sb $a1, 40($s1)
                    j CheckVictory

                    O12:
                    li $t4, 2
                    sb $a1, 40($s1)
```

```
            j CheckVictory

CR22:
            bnez $t5, Occupied     #Branch to the label Occupied if $t5 is not equal to zero
            bnez $t0, O22

            X22:
            li $t5, 1
            sb $a1, 44($s1)
            j CheckVictory

            O22:
            li $t5, 2
            sb $a1, 44($s1)
            j CheckVictory

CR32:
            bnez $t6, Occupied     #Branch to the label Occupied if $t6 is not equal to zero
            bnez $t0, O32

            X32:
            li $t6, 1
            sb $a1, 48($s1)
            j CheckVictory

            O32:
            li $t6, 2
            sb $a1, 48($s1)
            j CheckVictory
```

```
CR13:
        bnez $t7, Occupied     #Branch to the label Occupied if $t7 is not equal to zero
        bnez $t0, O13

        X13:
        li $t7, 1
        sb $a1, 66($s1)
        j CheckVictory

        O13:
        li $t7, 2
        sb $a1, 66($s1)
        j CheckVictory

CR23:
        bnez $t8, Occupied     #Branch to the label Occupied if $t8 is not equal to zero
        bnez $t0, O23

        X23:
        li $t8, 1
        sb $a1, 70($s1)
        j CheckVictory

        O23:
        li $t8, 2
        sb $a1, 70($s1)
        j CheckVictory

CR33:
        bnez $t9, Occupied     #Branch to the label Occupied if $t9 is not equal to zero
        bnez $t0, O33
        X33:
        li $t9, 1
        sb $a1, 74($s1)
        j CheckVictory

        O33:
        li $t9, 2
        sb $a1, 74($s1)
        j CheckVictory

Occupied:
        li $v0, 4
        la $a0, spaceOccupied          #Prints the spaceOccupied message
        syscall
        j Play

CheckVictory:
        and $s7, $t1, $t2      # AND instruction, $s7 = $t1 AND $t2
        and $s7, $s7, $t3      # AND instruction, $s7 = $s7 AND $t3
        bnez $s7, Victory      #Branch to the label victory if $s7 is not equal to zero

        and $s7, $t4, $t5      # AND instruction, $s7 = $t4 AND $t5
        and $s7, $s7, $t6      # AND instruction, $s7 = $s7 AND $t6
        bnez $s7, Victory

        and $s7, $t7, $t8      # AND instruction, $s7 = $t7 AND $t8
        and $s7, $s7, $t9      # AND instruction, $s7 = $s7 AND $t9
        bnez $s7, Victory

        and $s7, $t1, $t4      # AND instruction, $s7 = $t1 AND $t4
        and $s7, $s7, $t7       # AND instruction, $s7 = $s7 AND $t7
        bnez $s7, Victory

        and $s7, $t2, $t5       # AND instruction, $s7 = $t2 AND $t5
        and $s7, $s7, $t8       # AND instruction, $s7 = $s7 AND $t8
        bnez $s7, Victory

        and $s7, $t3, $t6       # AND instruction, $s7 = $t3 AND $t6
        and $s7, $s7, $t9       # AND instruction, $s7 = $s7 AND $t9
        bnez $s7, Victory

        and $s7, $t1, $t5       # AND instruction, $s7 = $t1 AND $t5
        and $s7, $s7, $t9       # AND instruction, $s7 = $s7 AND $t9
        bnez $s7, Victory

        and $s7, $t7, $t5       # AND instruction, $s7 = $t7 AND $t5
        and $s7, $s7, $t3       # AND instruction, $s7 = $s7 AND $t3
        bnez $s7, Victory
        j PrintBoard

Victory:
        li $v0, 4
        la $a0, board
        syscall

        li $v0, 4
        la $a0, won     #Prints the won message
        syscall
        j NewGameMenu
```

Tie:

```
        li $v0, 4
        la $a0, tie       #Prints the tie message
        syscall
```

NewGameMenu:

```
        li $v0,4
        la $a0, gameMenu      #Prints gameMenu message
        syscall

        li $v0,5          #user input
        syscall
        bne $v0, 99, main     #Move to main, if $v0 is not equal to 99

        li $v0, 10        #Exit program
        syscall
```

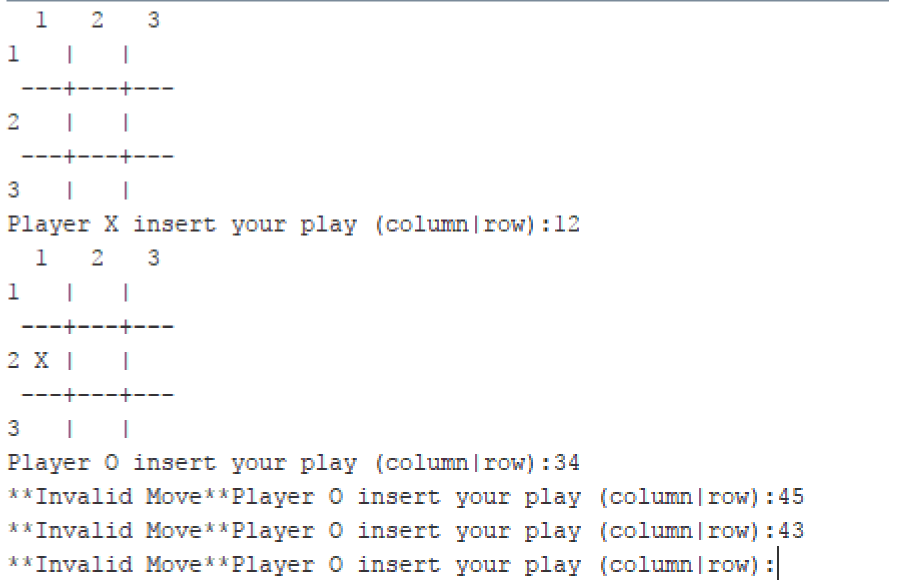
WORKFLOW:

The board is printed in console, there is choice for player to enter the column/row number. After that second player will insert its choice if the choice entered will be same which was entered by first player then it will pop up message that space is already occupied.

If the player enter the wrong move then means than wrong column and row number then show error message. After every insert it will check the victory with every possibility. If there is no victory of any player till all the boxes are filled then it will show the message that game tie. It will ask the user in the end of game that they want to play a new game or exit.

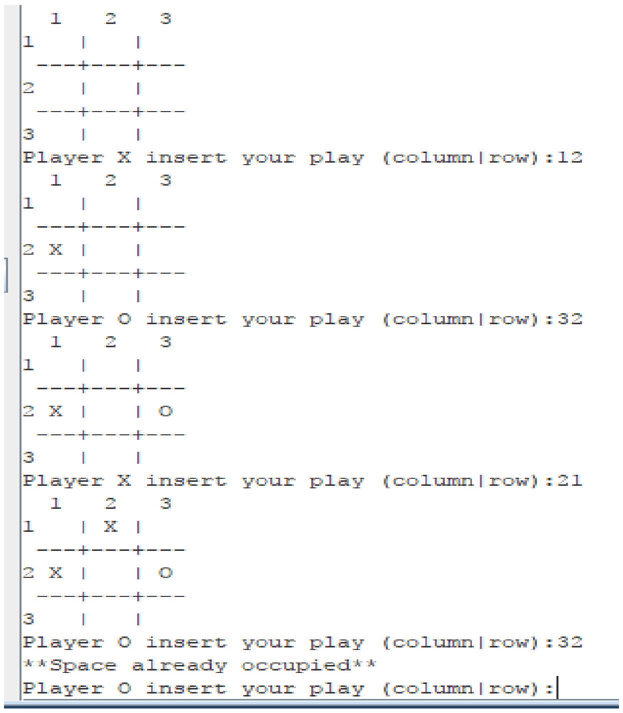
OUTPUT INTERFACES

1) Wrong move



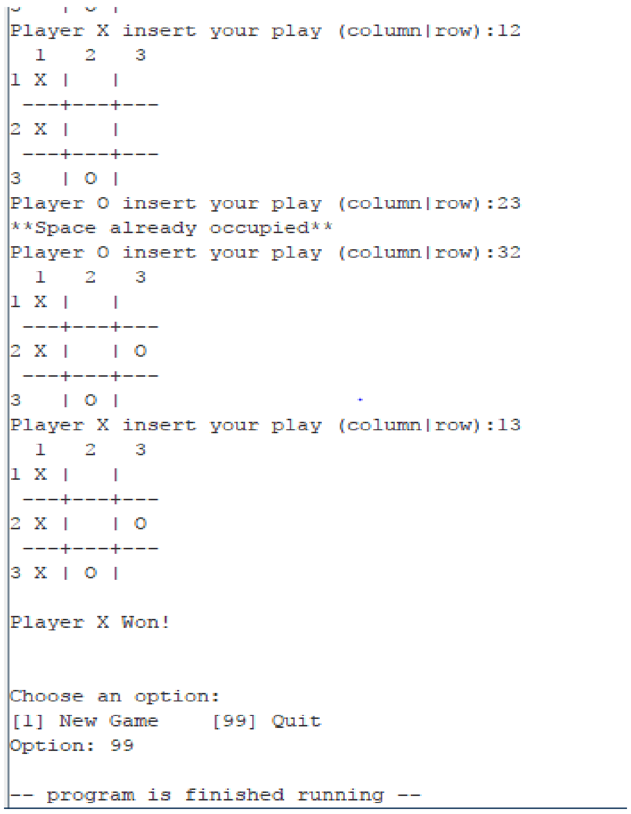
```
  1   2   3
1   |   |
 ---+---+---
2   |   |
 ---+---+---
3   |   |
Player X insert your play (column|row):12
  1   2   3
1   |   |
 ---+---+---
2 X |   |
 ---+---+---
3   |   |
Player O insert your play (column|row):34
**Invalid Move**Player O insert your play (column|row):45
**Invalid Move**Player O insert your play (column|row):43
**Invalid Move**Player O insert your play (column|row):
```

2) Space occupied



```
  1   2   3
1   |   |
 ---+---+---
2   |   |
 ---+---+---
3   |   |
Player X insert your play (column|row):12
  1   2   3
1   |   |
 ---+---+---
2 X |   |
 ---+---+---
3   |   |
Player O insert your play (column|row):32
  1   2   3
1   |   |
 ---+---+---
2 X |   | O
 ---+---+---
3   |   |
Player X insert your play (column|row):21
  1   2   3
1   | X |
 ---+---+---
2 X |   | O
 ---+---+---
3   |   |
Player O insert your play (column|row):32
**Space already occupied**
Player O insert your play (column|row):
```

3) Player won



```
Player X insert your play (column|row):12
  1   2   3
1 X |   |
 ---+---+---
2 X |   |
 ---+---+---
3   | O |
Player O insert your play (column|row):23
**Space already occupied**
Player O insert your play (column|row):32
  1   2   3
1 X |   |
 ---+---+---
2 X |   | O
 ---+---+---
3   | O |
Player X insert your play (column|row):13
  1   2   3
1 X |   |
 ---+---+---
2 X |   | O
 ---+---+---
3 X | O |

Player X Won!


Choose an option:
[1] New Game    [99] Quit
Option: 99

-- program is finished running --
```

CONCLUSION

The **Tic-tac-toe game** is most familiar among all the age groups. Intelligence can be a property of any purpose-driven programming language. A code of playing Tic tac-toe game has been presented and tested that works in efficient way. Overall the MIPS Program works without any errors.
In the conclusion of this project, we would like to say that MIPS Assembly language is an efficient and easy programming language and while creating a project like this, it has not just been a good experience but it also helped in the development of our **creativity** and **logical thinking**.