# 03-Milestone Project 1 - Complete Walkthrough Solution

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## 1 Milestone Project 1: Full Walk-through Code Solution

Below is the filled in code that goes along with the complete walk-through video. Check out the corresponding lecture videos for more information on this code!

**Step 1: Write a function that can print out a board. Set up your board as a list, where each index 1-9 corresponds with a number on a number pad, so you get a 3 by 3 board representation.**

[1]:
```
from IPython.display import clear_output

def display_board(board):
    clear_output()  # Remember, this only works in jupyter!

    print('   |   |')
    print(' ' + board[7] + ' | ' + board[8] + ' | ' + board[9])
    print('   |   |')
    print('-----------')
    print('   |   |')
    print(' ' + board[4] + ' | ' + board[5] + ' | ' + board[6])
    print('   |   |')
    print('-----------')
    print('   |   |')
    print(' ' + board[1] + ' | ' + board[2] + ' | ' + board[3])
    print('   |   |')
```

**TEST Step 1:** run your function on a test version of the board list, and make adjustments as necessary

[2]:
```
test_board = ['#','X','O','X','O','X','O','X','O','X']
display_board(test_board)
```

```
   |   |
 X | O | X
   |   |
-----------
   |   |
 O | X | O
   |   |
-----------
```

```
   |   |
 X | O | X
   |   |
```

**Step 2: Write a function that can take in a player input and assign their marker as 'X' or 'O'. Think about using *while* loops to continually ask until you get a correct answer.**

[3]:
```
def player_input():
    marker = ''

    while not (marker == 'X' or marker == 'O'):
        marker = input('Player 1: Do you want to be X or O? ').upper()

    if marker == 'X':
        return ('X', 'O')
    else:
        return ('O', 'X')
```

**TEST Step 2:** run the function to make sure it returns the desired output

[4]:
```
player_input()
```

```
Player 1: Do you want to be X or O? X
```

[4]:
```
('X', 'O')
```

**Step 3: Write a function that takes in the board list object, a marker ('X' or 'O'), and a desired position (number 1-9) and assigns it to the board.**

[5]:
```
def place_marker(board, marker, position):
    board[position] = marker
```

**TEST Step 3:** run the place marker function using test parameters and display the modified board

[6]:
```
place_marker(test_board,'$',8)
display_board(test_board)
```

```
   |   |
 X | $ | X
   |   |
-----------
   |   |
 O | X | O
   |   |
-----------
   |   |
 X | O | X
   |   |
```

**Step 4: Write a function that takes in a board and checks to see if someone has won.**

[7]:
```
def win_check(board,mark):

    return ((board[7] == mark and board[8] == mark and board[9] == mark) or #␣
↪across the top
    (board[4] == mark and board[5] == mark and board[6] == mark) or # across␣
↪the middle
    (board[1] == mark and board[2] == mark and board[3] == mark) or # across␣
↪the bottom
    (board[7] == mark and board[4] == mark and board[1] == mark) or # down the␣
↪middle
    (board[8] == mark and board[5] == mark and board[2] == mark) or # down the␣
↪middle
    (board[9] == mark and board[6] == mark and board[3] == mark) or # down the␣
↪right side
    (board[7] == mark and board[5] == mark and board[3] == mark) or # diagonal
    (board[9] == mark and board[5] == mark and board[1] == mark)) # diagonal
```

**TEST Step 4:** run the win_check function against our test_board - it should return True

[8]:
```
win_check(test_board,'X')
```

[8]:
```
True
```

**Step 5: Write a function that uses the random module to randomly decide which player goes first. You may want to lookup random.randint() Return a string of which player went first.**

[9]:
```
import random

def choose_first():
    if random.randint(0, 1) == 0:
        return 'Player 2'
    else:
        return 'Player 1'
```

**Step 6: Write a function that returns a boolean indicating whether a space on the board is freely available.**

[10]:
```
def space_check(board, position):

    return board[position] == ' '
```

**Step 7: Write a function that checks if the board is full and returns a boolean value. True if full, False otherwise.**

[11]:
```
def full_board_check(board):
    for i in range(1,10):
        if space_check(board, i):
            return False
    return True
```

**Step 8: Write a function that asks for a player's next position (as a number 1-9) and then uses the function from step 6 to check if its a free position. If it is, then return the position for later use.**

[12]:
```
def player_choice(board):
    position = 0

    while position not in [1,2,3,4,5,6,7,8,9] or not space_check(board,␣
 ↪position):
        position = int(input('Choose your next position: (1-9) '))

    return position
```

**Step 9: Write a function that asks the player if they want to play again and returns a boolean True if they do want to play again.**

[13]:
```
def replay():

    return input('Do you want to play again? Enter Yes or No: ').lower().
 ↪startswith('y')
```

**Step 10: Here comes the hard part! Use while loops and the functions you've made to run the game!**

[14]:
```
print('Welcome to Tic Tac Toe!')

while True:
    # Reset the board
    theBoard = [' '] * 10
    player1_marker, player2_marker = player_input()
    turn = choose_first()
    print(turn + ' will go first.')

    play_game = input('Are you ready to play? Enter Yes or No.')

    if play_game.lower()[0] == 'y':
        game_on = True
    else:
        game_on = False

    while game_on:
        if turn == 'Player 1':
            # Player1's turn.

            display_board(theBoard)
            position = player_choice(theBoard)
            place_marker(theBoard, player1_marker, position)

            if win_check(theBoard, player1_marker):
                display_board(theBoard)
                print('Congratulations! You have won the game!')
                game_on = False
            else:
```

```
                if full_board_check(theBoard):
                    display_board(theBoard)
                    print('The game is a draw!')
                    break
                else:
                    turn = 'Player 2'

        else:
            # Player2's turn.

            display_board(theBoard)
            position = player_choice(theBoard)
            place_marker(theBoard, player2_marker, position)

            if win_check(theBoard, player2_marker):
                display_board(theBoard)
                print('Player 2 has won!')
                game_on = False
            else:
                if full_board_check(theBoard):
                    display_board(theBoard)
                    print('The game is a draw!')
                    break
                else:
                    turn = 'Player 1'

    if not replay():
        break
```

```
   |   |
   | O | O
   |   |
-----------
   |   |
   |   |
   |   |
-----------
   |   |
 X | X | X
   |   |
Congratulations! You have won the game!
Do you want to play again? Enter Yes or No: No
```

### 1.1 Good Job!