CSC 110 – Programming Project - Spring 2023

The Game of Mastermind

Objective:
The objective of this project is to write a program in Python that will play the game of Mastermind where the computer chooses the hidden colors, and the human player attempts to guess the hidden colors.

The Game:
In the game of Mastermind, one player, the *codemaker* (in this case the computer) chooses four colored "pegs" in a particular order. The *codebreaker* (the human player) tries to guess the chosen colors by placing four pegs in the guessed order. For each guess, the codemaker provides a clue about how well the codebreaker guessed. The codebreaker has 10 guesses to break the code.

Hidden Colors
The codemaker will randomly choose four colors as the hidden colors. You can define a global list:

```
ALL_COLORS = ['red','orange','yellow','green','blue','purple']
```

The hidden colors that are chosen will not be displayed to the codebreaker.

Opponent Guess
The codebreaker will be asked to choose four colors, in a particular order, to guess what the hidden colors are. For simplicity, you will assign a number to each color so it is easier for the user to enter a guess. Your display message will look like the following:

```
-----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
Guess color:
```

The Clue
Once the codebreaker has made a guess, your program will calculate a clue to give some information about how good the guess is. The clue will consist of the following:

2 – If the guess has a correct color in the correct position

1 – If the guess has a correct color, but in the wrong position

Note that the order of the elements of the clue should not indicate anything about which colors are correct.

Examples

1) If the hidden colors are:

```
['orange', 'purple', 'blue', 'yellow']
```

and the guess is:

```
['orange', 'red', 'red', 'blue']
```

then the clue would be:

```
[1, 2]
```

The 1 because the blue guess is a correct color but in the wrong position. And the 2 because the orange guess is the correct color in the correct position.

2) If the hidden colors are:

```
['red', 'blue', 'green', 'blue']
```

and the guess is:

```
['red', 'red', 'yellow', 'yellow']
```

then the clue would be:

```
[2]
```

Note that the `'red'` in the second position of the guess does NOT produce a 1 because the `'red'` in the first position of the hidden colors is already accounted for by the 2 in the clue.

Game Play

In your program, you will allow the user to make up to 10 guesses. After the game is done, whether the user guesses correctly, or exhausts all 10 guesses, your program will ask the user if they would like to play again.

Random Code Generation

The secret code will be generated by your program randomly. In order to allow Gradescope to test this program, we will use a random number generator with a chosen seed value. This way whenever the same seed value is used, the same secret code will be generated.

The program should include the following code to allow for this:

- At the top of the program:

```
import random
```

- In the definition of the main function:

```
def main(seedIn):
```

- The first line of code in the main function:

```
random.seed(seedIn)
```

- In the function that generates the secret code, uses the `randint` function.

Testing Requirements:
You are required to use functions when writing this program. You have some freedom in how you implement this program. There are two function are required to be defined as specified below so that Gradescope can test the code:

Check the Guess:
This fucntion will check the user's guess and provide a clue. The function skeleton looks like this:

```
def checkGuess(guess, secret):
    return clue
```

where `guess` is a list of colors that the user has guessed, `secret` is the secret list of colors that the computer has generated, and `clue` is a list representing the clue to the user. The `clue` should be a list of 1s and 2s, where all 1s appear in the list before all 2s. If there are no matches, the `clue` should be an empty list.

Main Function:
The main function should take one parameter, a seed value. This will be used to seed the random number generator so that when we test the program, we can predict which secret code will be generated. The main function skeleton should be:

```
def main(seedValue):
    return
```

The first line of code in the main function should be:

```
random.seed(seedValue)
```

The rest of the main function will be your code to call your other functions and run the overall program.

Sample Output:

The following are examples of what your output should look like in various scenarios. Note the seed value fed to the main function in each example. This will help you test your code for the same scenario.

Seed Value 1:

```
The secret code has been chosen.  You have 10 tries to guess the code.

----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 1
Guess color: 1
Guess color: 1
Guess color: 1
----------------------------
Your guess is:
['orange', 'orange', 'orange', 'orange']

Your clue is:  [2]

You have 9 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 1
Guess color: 2
Guess color: 3
Guess color: 4
----------------------------
Your guess is:
['orange', 'yellow', 'green', 'blue']

Your clue is:  [1, 1, 2]

You have 8 guesses left
----------------------------
```

```
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
Guess color: 1
Guess color: 4
Guess color: 0
Guess color: 2
-----------------------------
Your guess is:
['orange', 'blue', 'red', 'yellow']

Correct! You finished in  3  guesses

Would you like to play again? (Y/N)n

Thank you for playing.  Good-bye!
>>>
```

Seed Value 1422:

```
>>> main(1422)
The secret code has been chosen.  You have 10 tries to guess the code.

-----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
Guess color: 1
Guess color: 1
Guess color: 2
Guess color: 2
-----------------------------
Your guess is:
['orange', 'orange', 'yellow', 'yellow']

Your clue is:  [2]

You have 9 guesses left
-----------------------------

Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
Guess color: 1
Guess color: 3
Guess color: 1
Guess color: 3
-----------------------------
```

```
Your guess is:
['orange', 'green', 'orange', 'green']

Your clue is:  [2, 2, 2]

You have 8 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 1
Guess color: 3
Guess color: 3
Guess color: 3
----------------------------
Your guess is:
['orange', 'green', 'green', 'green']

Correct! You finished in  3  guesses

Would you like to play again? (Y/N)n

Thank you for playing.  Good-bye!
>>>
```

Seed Value 1223:

```
>>> main(1223)
The secret code has been chosen.  You have 10 tries to guess the code.

----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 3
Guess color: 4
Guess color: 5
Guess color: 5
----------------------------
Your guess is:
['green', 'blue', 'purple', 'purple']

Your clue is:  [1, 1, 1, 1]

You have 9 guesses left
----------------------------
```

```
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 5
Guess color: 5
Guess color: 5
Guess color: 5
----------------------------
Your guess is:
['purple', 'purple', 'purple', 'purple']

Your clue is:  [2, 2]

You have 8 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 3
Guess color: 4
Guess color: 3
Guess color: 4
----------------------------
Your guess is:
['green', 'blue', 'green', 'blue']

Your clue is:  [2, 2]

You have 7 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple

----------------------------
Guess color: 5
Guess color: 5
Guess color: 3
Guess color: 4
----------------------------
Your guess is:
['purple', 'purple', 'green', 'blue']

Correct! You finished in  4  guesses

Would you like to play again? (Y/N)n

Thank you for playing.  Good-bye!
>>>
```

Seed Value 4887:

```
>>> main(4887)
The secret code has been chosen.  You have 10 tries to guess the code.

----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 0
Guess color: 2
Guess color: 2
Guess color: 2
----------------------------
Your guess is:
['red', 'yellow', 'yellow', 'yellow']

Your clue is:  [2, 2]

You have 9 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 3
Guess color: 2
Guess color: 1
Guess color: 2
----------------------------
Your guess is:
['green', 'yellow', 'orange', 'yellow']

Correct! You finished in  2  guesses

Would you like to play again? (Y/N)n

Thank you for playing.  Good-bye!
>>>
```

Seed Value 781:

```
>>> main(781)
The secret code has been chosen.  You have 10 tries to guess the code.

----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
```

```
Guess color: 1
Guess color: 2
Guess color: 1
Guess color: 4
----------------------------
Your guess is:
['orange', 'yellow', 'orange', 'blue']

Your clue is:  [1, 2]

You have 9 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 1
Guess color: 2
Guess color: 1
Guess color: 2
----------------------------
Your guess is:
['orange', 'yellow', 'orange', 'yellow']

Your clue is:  [1, 2]

You have 8 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 1
Guess color: 1
Guess color: 1
Guess color: 1
----------------------------
Your guess is:
['orange', 'orange', 'orange', 'orange']

Your clue is:  [2, 2, 2]

You have 7 guesses left
----------------------------
```

```
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 1
Guess color: 1
Guess color: 3
Guess color: 1
----------------------------
Your guess is:
['orange', 'orange', 'green', 'orange']

Correct! You finished in  4  guesses

Would you like to play again? (Y/N)n

Thank you for playing.  Good-bye!
>>>
```

Play Again:

```
>>> main(2)
The secret code has been chosen.  You have 10 tries to guess the code.

----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 0
Guess color: 0
Guess color: 0
Guess color: 0
----------------------------
Your guess is:
['red', 'red', 'red', 'red']

Your clue is:  [2, 2, 2]

You have 9 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
```

```
----------------------------
Guess color: 0
Guess color: 0
Guess color: 0
Guess color: 2
----------------------------
Your guess is:
['red', 'red', 'red', 'yellow']

Correct! You finished in  2  guesses

Would you like to play again? (Y/N)y
The secret code has been chosen.  You have 10 tries to guess the code.

----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 5
Guess color: 5
Guess color: 5
Guess color: 5
----------------------------
Your guess is:
['purple', 'purple', 'purple', 'purple']

Your clue is:  [2, 2]

You have 9 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 1
Guess color: 5
Guess color: 5
Guess color: 2
----------------------------
Your guess is:
['orange', 'purple', 'purple', 'yellow']

Correct! You finished in  2  guesses

Would you like to play again? (Y/N)Y
The secret code has been chosen.  You have 10 tries to guess the code.
```

```
-----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
Guess color: 2
Guess color: 4
Guess color: 2
Guess color: 4
-----------------------------
Your guess is:
['yellow', 'blue', 'yellow', 'blue']

Your clue is:  [2, 2, 2]

You have 9 guesses left
-----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
Guess color: 2
Guess color: 4
Guess color: 1
Guess color: 4
-----------------------------
Your guess is:
['yellow', 'blue', 'orange', 'blue']

Correct! You finished in  2  guesses

Would you like to play again? (Y/N)N

Thank you for playing.  Good-bye!
>>>
```

Error Handling:

```
>>> main(1)
The secret code has been chosen.  You have 10 tries to guess the code.

-----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
```

```
Guess color: a
Invalid number, try again:
Guess color: x
Invalid number, try again:
Guess color: 9
Invalid guess, try again:
Guess color: 7
Invalid guess, try again:
Guess color: 1
Guess color: xxx
Invalid number, try again:
Guess color: 4
Guess color: 9
Invalid guess, try again:
Guess color: 0
Guess color: 11
Invalid guess, try again:
Guess color: 2
-----------------------------
Your guess is:
['orange', 'blue', 'red', 'yellow']

Correct! You finished in  1  guesses

Would you like to play again? (Y/N)n

Thank you for playing.  Good-bye!
>>>
```

No More Guesses:

```
>>> main(200)
The secret code has been chosen.  You have 10 tries to guess the code.

-----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
-----------------------------
Guess color: 1
Guess color: 1
Guess color: 1
Guess color: 1
-----------------------------
Your guess is:
['orange', 'orange', 'orange', 'orange']


Your clue is:  [2]

You have 9 guesses left
-----------------------------
```

```
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 2
Guess color: 2
Guess color: 2
Guess color: 2
----------------------------
Your guess is:
['yellow', 'yellow', 'yellow', 'yellow']

Your clue is:  []

You have 8 guesses left
----------------------------
```

.
.
.

```
You have 2 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
Guess color: 5
Guess color: 4
Guess color: 3
Guess color: 2
----------------------------
Your guess is:
['purple', 'blue', 'green', 'yellow']

Your clue is:  [1]

You have 1 guesses left
----------------------------
Make a guess of four colors:
0  -  red
1  -  orange
2  -  yellow
3  -  green
4  -  blue
5  -  purple
----------------------------
```

```
Guess color: 2
Guess color: 3
Guess color: 4
Guess color: 5
----------------------------
Your guess is:
['yellow', 'green', 'blue', 'purple']

Your clue is:  [2]


No more guesses, the hidden colors were:

['red', 'orange', 'purple', 'purple']

Would you like to play again? (Y/N)n

Thank you for playing.  Good-bye!
>>>
```

Program Requirements:
Your program should meet the following requirements:

1) Your program should *work correctly*. Your program should do at least the following correctly:
    a. Randomly choose the hidden colors.
    b. Ask the user to make a guess of the colors.
    c. Test the guess and provide a correct clue to the user.
    d. Allow the user to guess at most 10 times.
    e. Tell the user if the guess was correct.

2) Your program should use good *modular design*. It should use functions for each of the main tasks of the program.

3) Your program should be *well-documented*. This should include your name and an overall description of the program at the top of the file. It should also include a description of any algorithms that are used in the code.

4) Your program should use *well-named* functions and variables. The code should be simple to read and understand what is going on given the names of the functions, and variables along with the comments in the code.

What to Submit:
Please submit your code in a file called `projMastermind.py` to Gradescope in the assignment called *Programming Project - Mastermind*.

NOTE: DO NOT use Gradescope to test and debug your code. You should be doing all of your testing and debugging in IDLE. Once you are confident that the code is correct, you can submit to Gradescope.

More About Mastermind:
For other descriptions of the game of Mastermind, see these links:

https://www.wikihow.com/Play-Mastermind
https://www.ultraboardgames.com/mastermind/game-rules.php

Grading the Assignment:
See the Grading Rubric for the Mastermind Programming Project to see how the assignment will be graded.