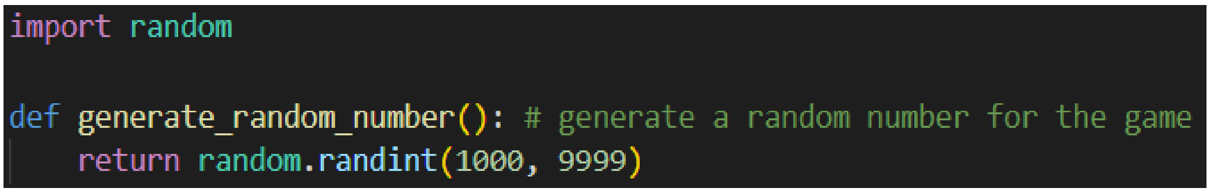
Github Link: https://github.com/h102136/Software-Unit-Testing-Report.git
Requirement of the game:

1. Randomly generate a four-digit number:

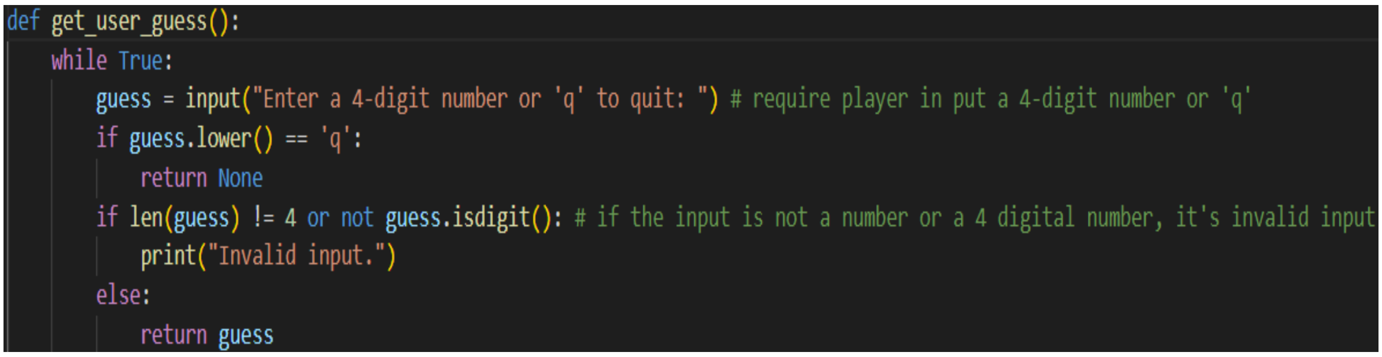
   import the inner function "random" to generate a random number



```python
import random

def generate_random_number(): # generate a random number for the game
    return random.randint(1000, 9999)
```

2. The program will keep asking the user to guess the number until the player guesses it correctly or has quitted:

   the variable 'guess' is a value from the input of players, the function require players input a four-digital number or 'q' for quitting game



```python
def get_user_guess():
    while True:
        guess = input("Enter a 4-digit number or 'q' to quit: ") # require player in put a 4-digit number or 'q'
        if guess.lower() == 'q':
            return None
        if len(guess) != 4 or not guess.isdigit(): # if the input is not a number or a 4 digital number, it's invalid input
            print("Invalid input.")
        else:
            return guess
```

3. When the number is entered, the program will respond with hints using 'circle' and 'x' to show how accurate the guess was:
   a. A 'circle' indicates that one digit is correct and is in the right spot
   b. A 'x' indicates that one digit is correct but in the wrong spot

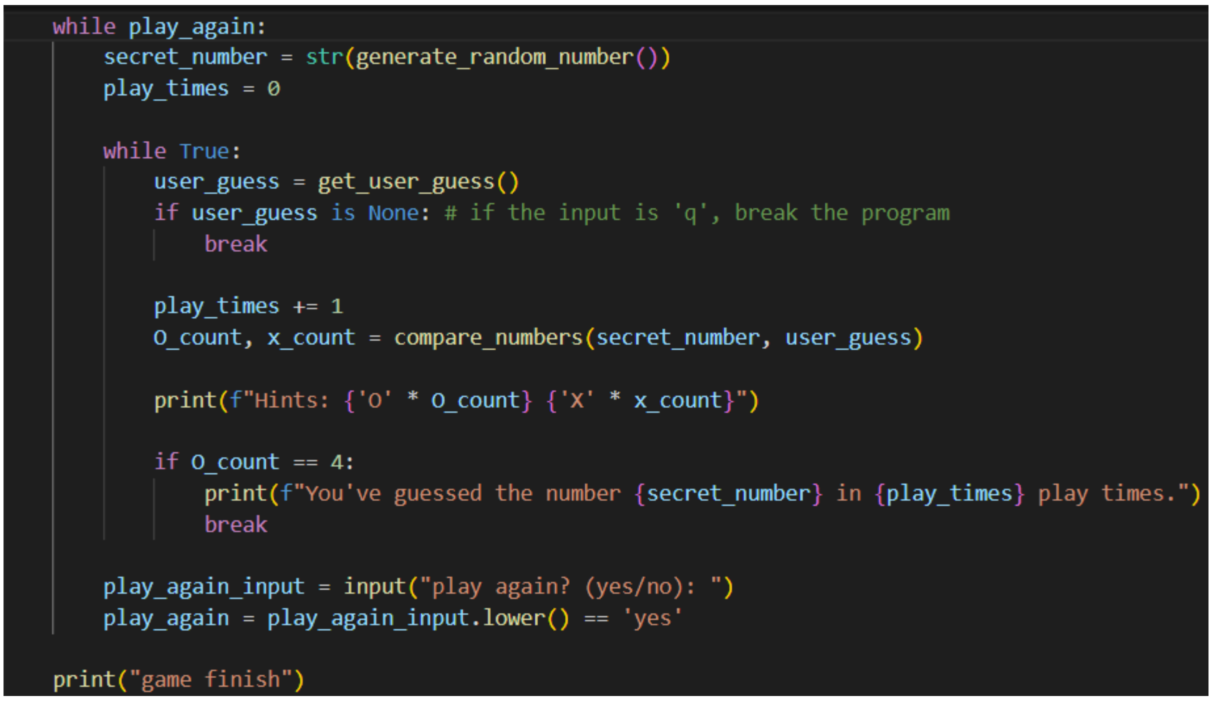
   - translate the input to a string and compare each position of the random and each position of the input whether it matches.
   - if the number and position are correct, add 1 in the variable 'O_count',
   - if the number is correct only, add 1 in the variable "X_count"
   - print the number of O and the number of X to show players

4. Once the game is finished,
   a. The number of attempts taken will be displayed
   b. the player will be asked to quit or to play again

   - when the game repeats, add 1 in the variable "play_times" to compute how many times players play.
   - the program will ask plays whether continue the game at the end before the game finishes.

5. <u>Player can quit the game anytime:</u>

players can quit game at any time when the input is “q”



```python
while play_again:
    secret_number = str(generate_random_number())
    play_times = 0

    while True:
        user_guess = get_user_guess()
        if user_guess is None: # if the input is 'q', break the program
            break

        play_times += 1
        O_count, x_count = compare_numbers(secret_number, user_guess)

        print(f"Hints: {'O' * O_count} {'X' * x_count}")

        if O_count == 4:
            print(f"You've guessed the number {secret_number} in {play_times} play times.")
            break

    play_again_input = input("play again? (yes/no): ")
    play_again = play_again_input.lower() == 'yes'

print("game finish")
```

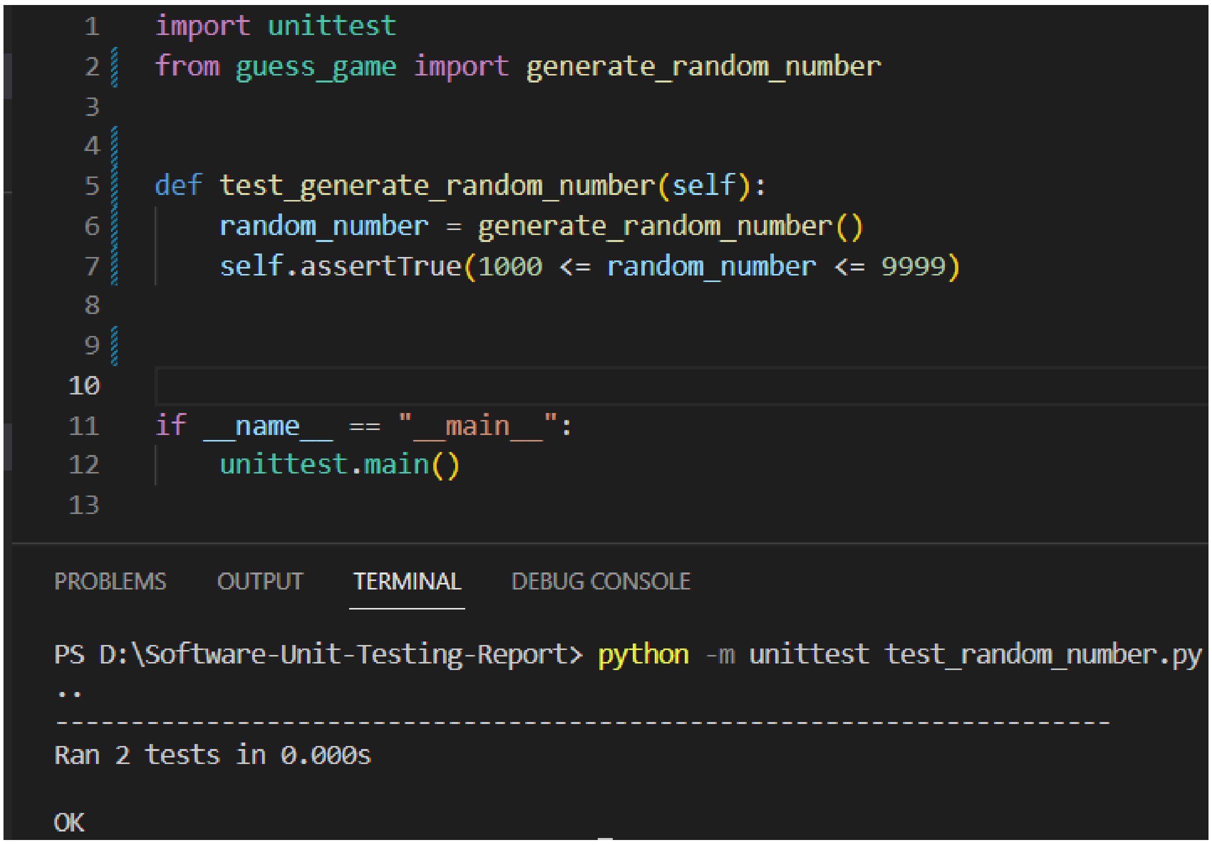
Automated unit testing tool: unittest

1. Test the function of generating a random number:

   Object:
   Make sure the generate_random_number function generates random numbers in the range between 1000 and 9999

   Requirement:

   - Use “self.assertTrue()” to assert that a condition is true
   - “generate_random_number()” function returns a random number, which we store in “random_number variable”
   - use “1000 <= random_number <= 9999” to make sure “random_number” is between 1000 and 9999



```
import unittest
from guess_game import generate_random_number


def test_generate_random_number(self):
    random_number = generate_random_number()
    self.assertTrue(1000 <= random_number <= 9999)



if __name__ == "__main__":
    unittest.main()

```

```
PS D:\Software-Unit-Testing-Report> python -m unittest test_random_number.py
..
----------------------------------------------------------------------
Ran 2 tests in 0.000s

OK
```

2. Test the function of getting the input that players guess

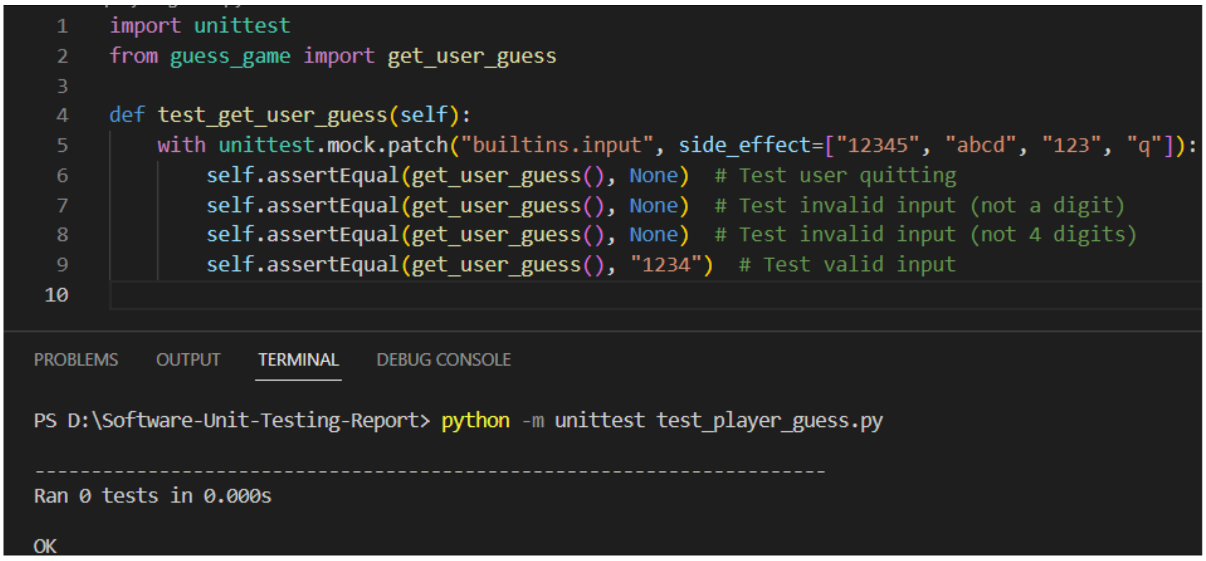
   Object:
   The goal of the test is to verify that the “get_user_guess” function behaves correctly in different situations, including player exits, invalid input, and valid input.

Requirement:

- test that if players input ‘q’ and the function should return “None”, the game will finish.

- test that if players input “abcd”, it’s a invalid value, the function should print “Invalid input.” to show players.

- test that if players input “123”, it’s a invalid value, the function should print “Invalid input.” to show players.



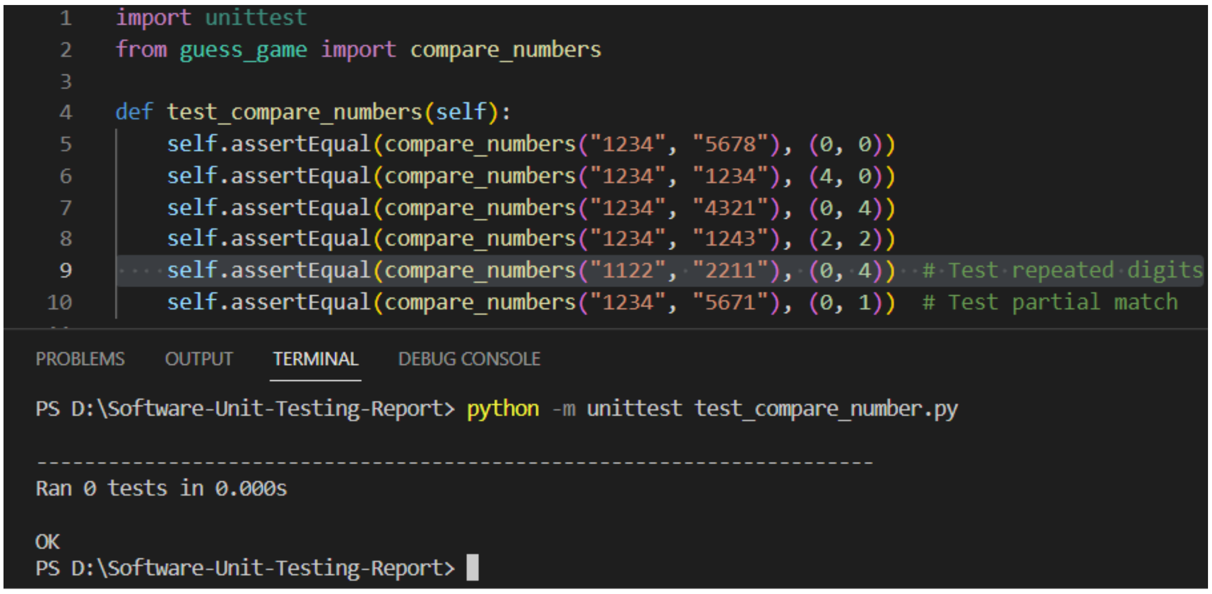
```python
import unittest
from guess_game import get_user_guess

def test_get_user_guess(self):
    with unittest.mock.patch("builtins.input", side_effect=["12345", "abcd", "123", "q"]):
        self.assertEqual(get_user_guess(), None)  # Test user quitting
        self.assertEqual(get_user_guess(), None)  # Test invalid input (not a digit)
        self.assertEqual(get_user_guess(), None)  # Test invalid input (not 4 digits)
        self.assertEqual(get_user_guess(), "1234")  # Test valid input

```

```
PS D:\Software-Unit-Testing-Report> python -m unittest test_player_guess.py

----------------------------------------------------------------------
Ran 0 tests in 0.000s

OK
```

3. Test the function of comparing the input and the random number

Object:
The goal of the test is to ensure that the “compare_numbers” function correctly calculates and returns the corresponding hints (O and X) for different guesses and correct answers

Requirement:
- when no numbers match, the function will return (0, 0)
- when numbers and position all match , the function will return (4, 0)
- when numbers match but position not match, the function will return (0, 4)
- when numbers all match but two of them of position not match, the function will return (2, 2)



```
import unittest
from guess_game import compare_numbers

def test_compare_numbers(self):
    self.assertEqual(compare_numbers("1234", "5678"), (0, 0))
    self.assertEqual(compare_numbers("1234", "1234"), (4, 0))
    self.assertEqual(compare_numbers("1234", "4321"), (0, 4))
    self.assertEqual(compare_numbers("1234", "1243"), (2, 2))
    self.assertEqual(compare_numbers("1122", "2211"), (0, 4))  # Test repeated digits
    self.assertEqual(compare_numbers("1234", "5671"), (0, 1))  # Test partial match
```

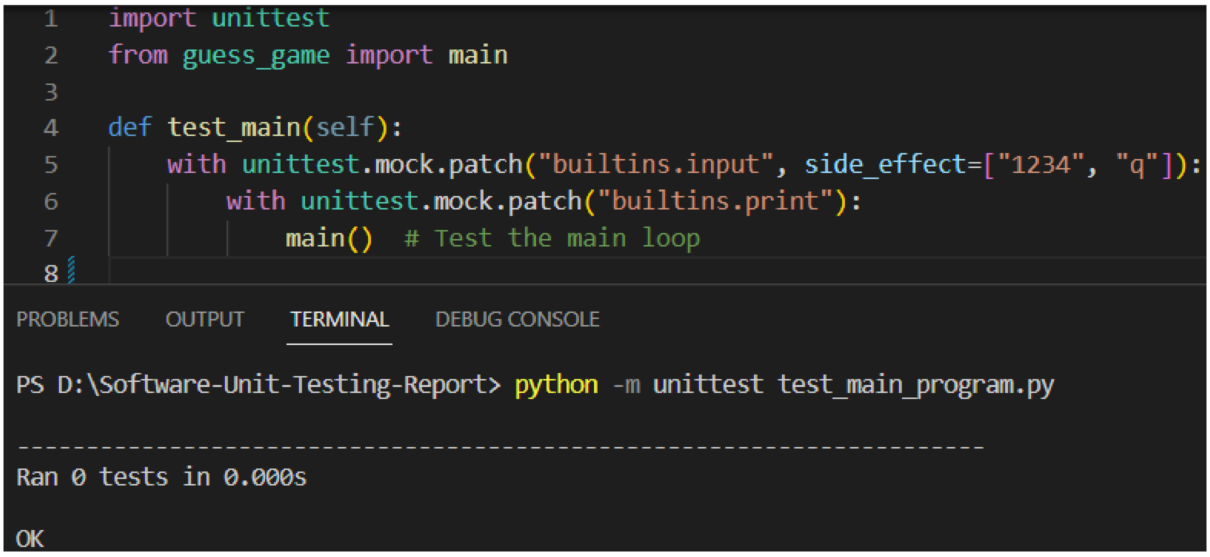
```
PS D:\Software-Unit-Testing-Report> python -m unittest test_compare_number.py

----------------------------------------------------------------------
Ran 0 tests in 0.000s

OK
PS D:\Software-Unit-Testing-Report>
```

4. Test the main program

Object:
The test goal is to verify that the game program executes correctly in the loop of the game, and handles player input, compares guesses, displays results

Requirement:

- Use “unittest.mock.patch” to simulate the behavior of input and print functions
- Enter "1234" followed by "q" to simulate the player wishing to quit the game after two guesses



```
import unittest
from guess_game import main

def test_main(self):
    with unittest.mock.patch("builtins.input", side_effect=["1234", "q"]):
        with unittest.mock.patch("builtins.print"):
            main()  # Test the main loop

```

```
PS D:\Software-Unit-Testing-Report> python -m unittest test_main_program.py

----------------------------------------------------------------------
Ran 0 tests in 0.000s

OK
```

Conclusion:

Testing with “unittests” enables you to predict and fix potential problems, and make sure future changes don't break existing functionality, use simulation to isolate, isolate the tested code from external dependencies, and simulate different situations.
Automated testing catches bugs and issues early in the development process, with this approach, a numbers guessing game with reliable and tested components is achieved