## Testing the solution

### Test planning

| Description of Test | Test Data | Expected Results | Actual Results |
|---|---|---|---|
| The instructions are displayed and a prompt is shown for the user. | None | Instructions displayed and prompt allows keyboard entry. | As expected - **Figure 1** |
| A random 4 digit number is generated without duplicates | None | A test print output shows that a valid random number is generated. | Number [2, 3, 0, 8] has been generated and will be used for further tests. See **Figure 1** |
| Test that valid data is entered in the user prompt | 1234 | The number is accepted and checked against the random number. A count of cows and bulls is shown. | **Error found**, **Figure 2a**. The user entered number gave an error that the **user_entry** was an integer and had no length value.<br>Retested, As expected – **Figure 2b**. Using the results from test 2 a count of 2 cows and 0 bulls is shown. |
| Test that erroneous data is entered, 4 non-digits | abcd | An error message is output stating that invalid data has been entered. | As expected – **Figure 3.** |
| Test that boundary data is entered, more than 4 digits | 12345 | An error message is output stating that the number is the wrong length | As expected – **Figure 3**. |
| Test that boundary data is entered, less than 4 digits | 123 | An error message is output stating that the number is the wrong length | As expected – **Figure 3**. |
| Test that erroneous data is entered, duplicate digits | 1123 | An error message is output stating that the number has duplicates. | As Expected – **Figure 3**. |

| Description of Test | Test Data | Expected Results | Actual Results |
|---|---|---|---|
| Test that the number entered has correct number of bulls and cows. | Based on random generated number | A message is output stating correct number of cows and bulls. | As expected – **Figure 4**. |
| Test that the number entered matches the random number and number of guesses is correct. | Based on random generated number | A message is output stating 4 bulls and congratulations. | As expected – **Figure 5**. |
| Exit typed before any guesses made. | Exit | Program exits with message output. | Program did not exit but gave an invalid format error – **Figure 6a.**<br>Input case sensitive, so code corrected to use lower() python format function.<br>Retested As Expected **Figure 6b** |
| Additional test to ensure program working with errors fixed. | None | Program accepted incorrect input with error messages, and correct guesses. | **Figure 7.** |

## Testing evidence

**Figure 1.**

The line [2, 3, 0, 8] shows the randomly generated number.

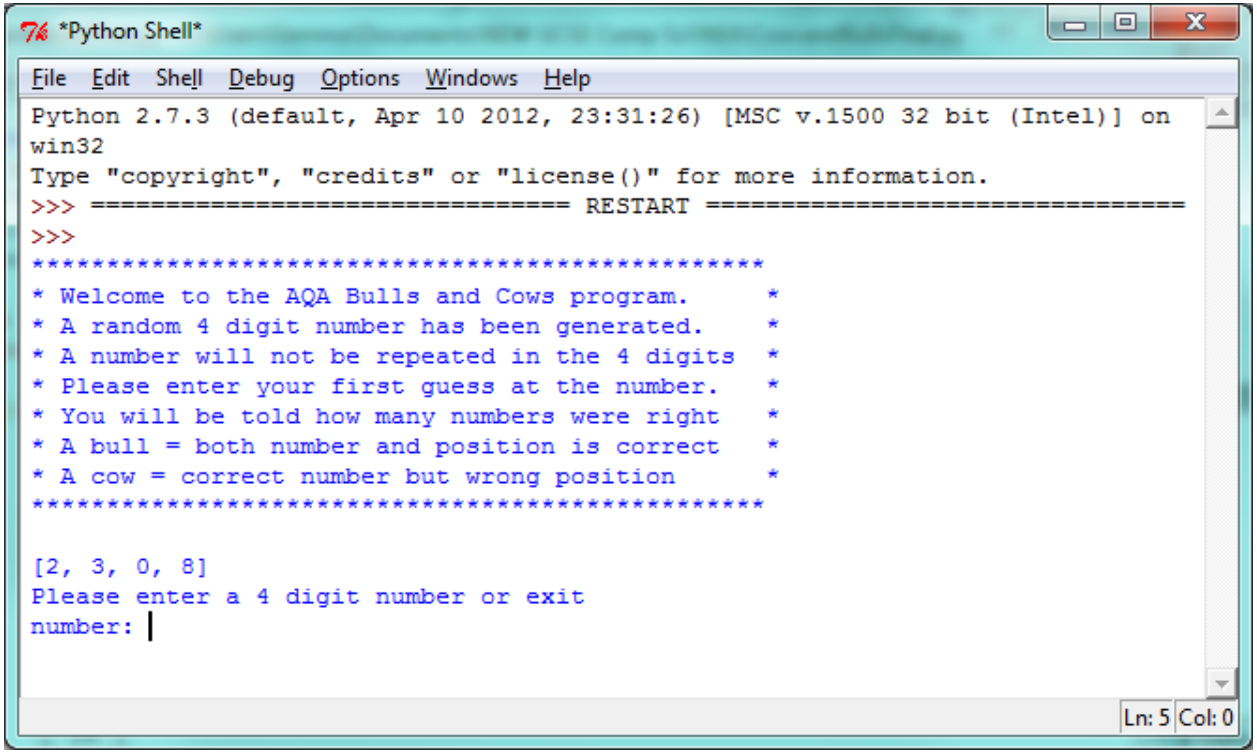
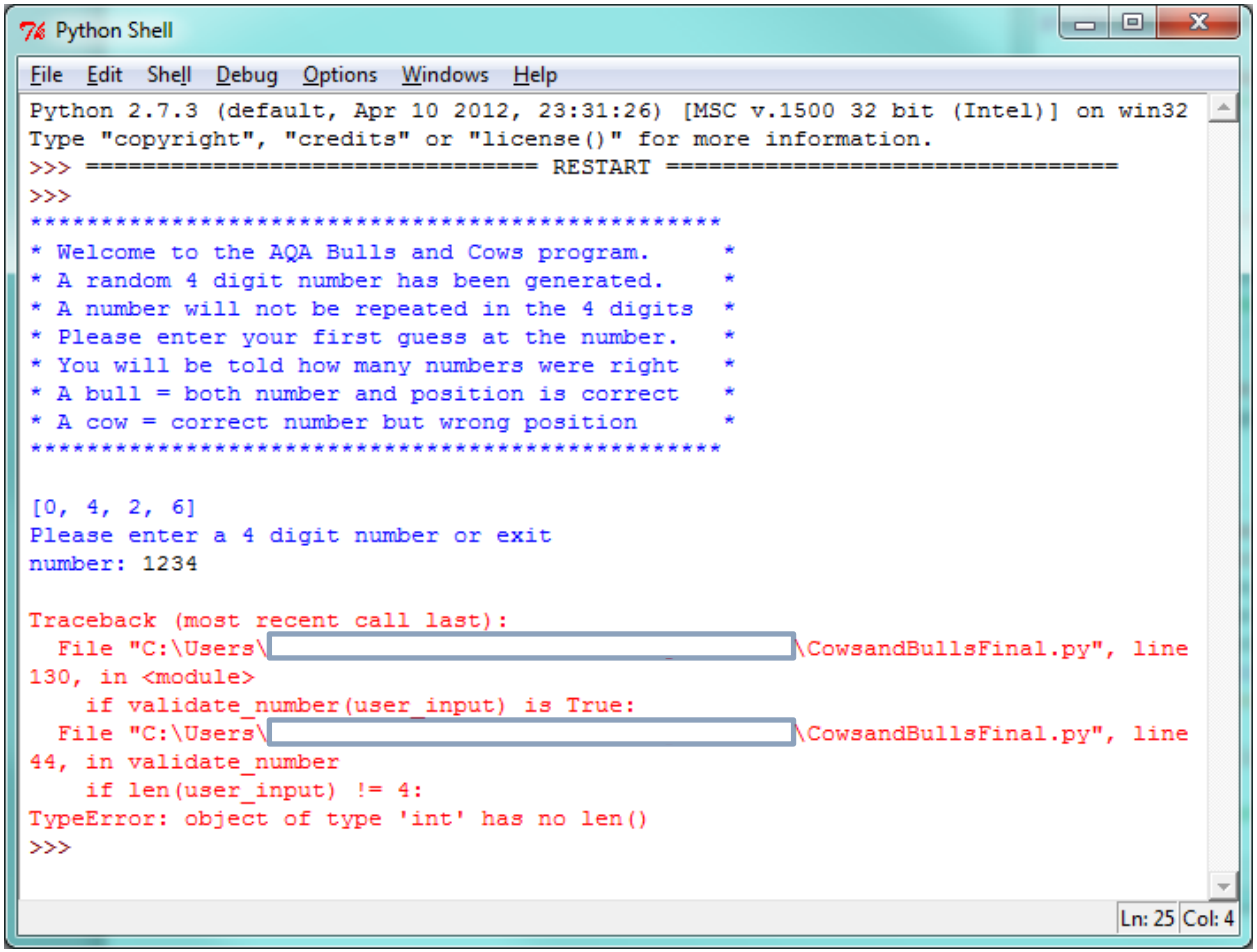


**Figure 2a.**




```
while user_input != "exit":
    print("Please enter a 4 digit number or exit")
    user_input = input("number: ")
```

This was a problem because I had used the function input() for the user input.  I changed the code to use raw_input() and it worked.

```
while user_input != "exit":
    print("Please enter a 4 digit number or exit")
    user_input = raw_input("number: ")
```

Fixed code

**Figure 2b.**

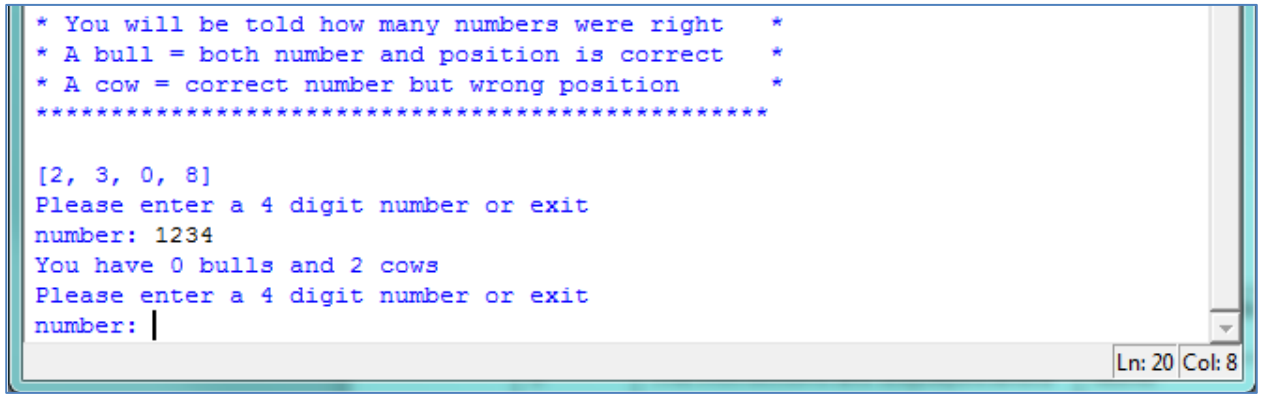


**Figure 3.**

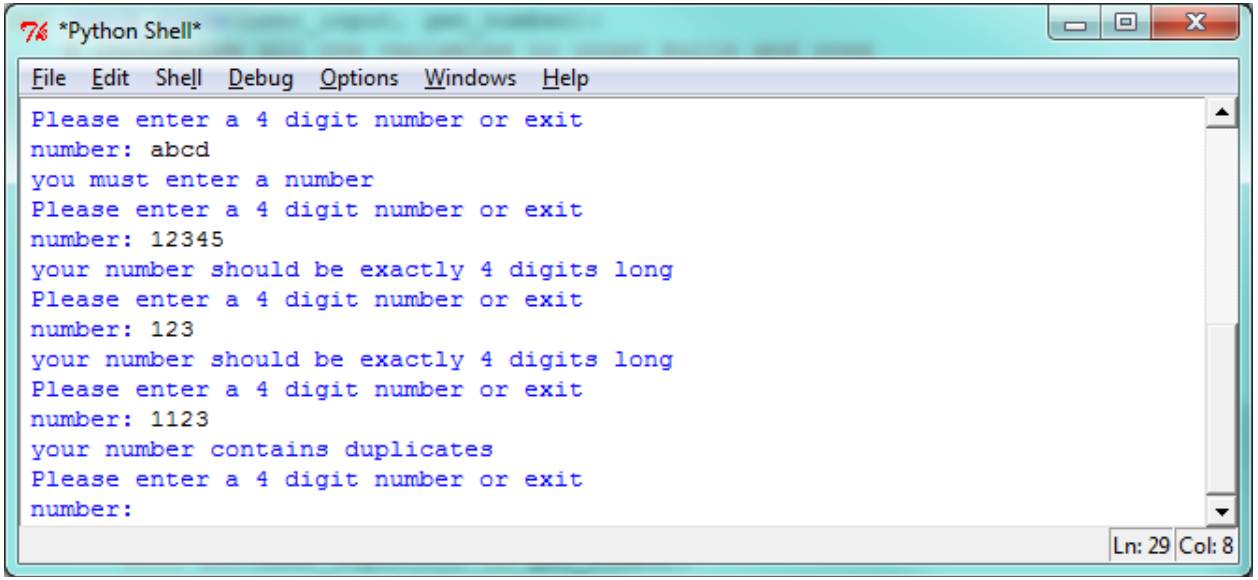

*Python Shell*
File Edit Shell Debug Options Windows Help
Please enter a 4 digit number or exit
number: abcd
you must enter a number
Please enter a 4 digit number or exit
number: 12345
your number should be exactly 4 digits long
Please enter a 4 digit number or exit
number: 123
your number should be exactly 4 digits long
Please enter a 4 digit number or exit
number: 1123
your number contains duplicates
Please enter a 4 digit number or exit
number:
Ln: 29 Col: 8

**Figure 4.**

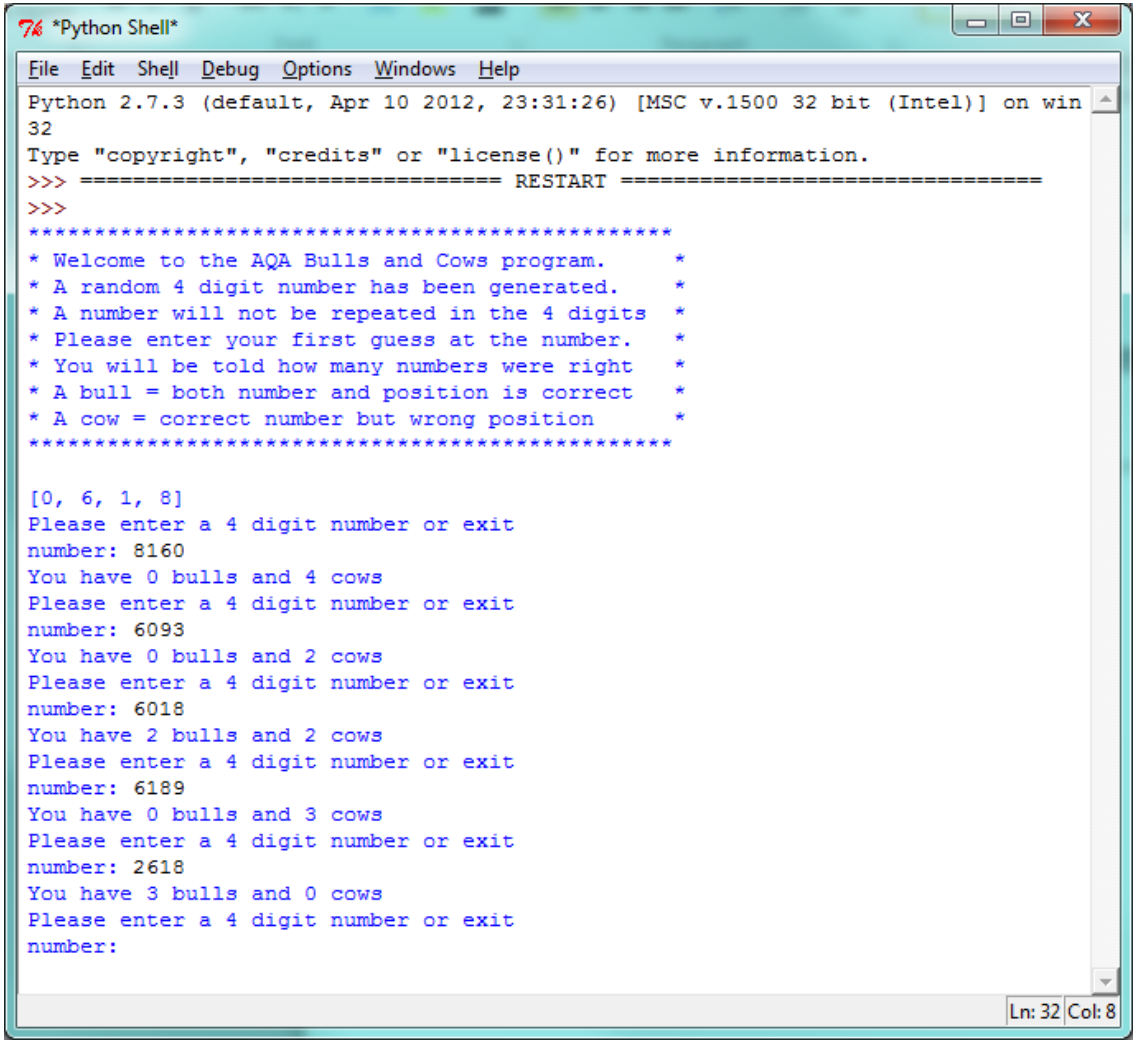

*Python Shell*
File Edit Shell Debug Options Windows Help
Python 2.7.3 (default, Apr 10 2012, 23:31:26) [MSC v.1500 32 bit (Intel)] on win
32
Type "copyright", "credits" or "license()" for more information.
>>> ========== RESTART ==========
>>>
**********
* Welcome to the AQA Bulls and Cows program. *
* A random 4 digit number has been generated. *
* A number will not be repeated in the 4 digits *
* Please enter your first guess at the number. *
* You will be told how many numbers were right *
* A bull = both number and position is correct *
* A cow = correct number but wrong position *
**********
[0, 6, 1, 8]
Please enter a 4 digit number or exit
number: 8160
You have 0 bulls and 4 cows
Please enter a 4 digit number or exit
number: 6093
You have 0 bulls and 2 cows
Please enter a 4 digit number or exit
number: 6018
You have 2 bulls and 2 cows
Please enter a 4 digit number or exit
number: 6189
You have 0 bulls and 3 cows
Please enter a 4 digit number or exit
number: 2618
You have 3 bulls and 0 cows
Please enter a 4 digit number or exit
number:
Ln: 32 Col: 8

**Figure 5**

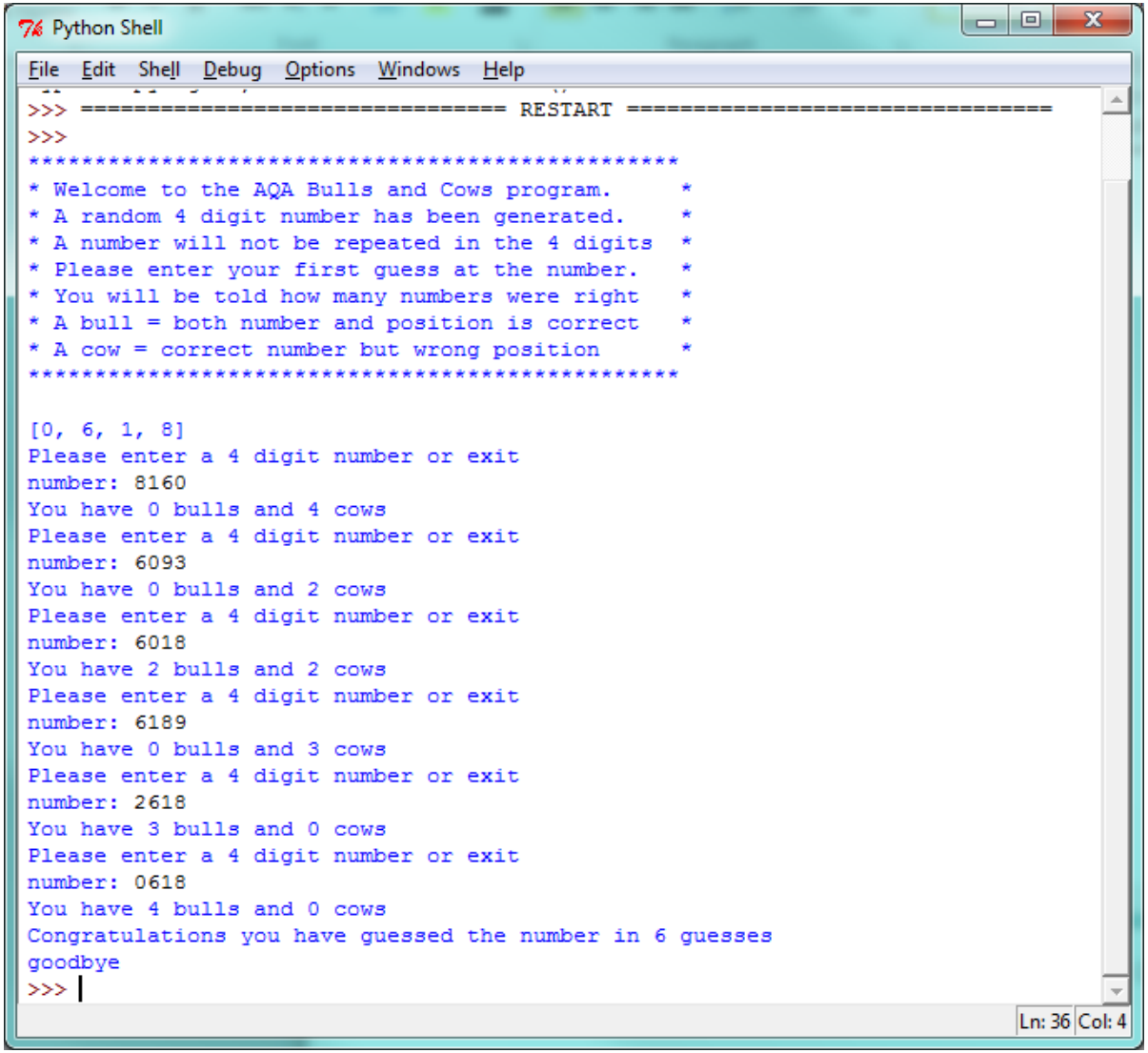

Python Shell
File Edit Shell Debug Options Windows Help
>>> ========== RESTART ==========
>>>
**********
* Welcome to the AQA Bulls and Cows program. *
* A random 4 digit number has been generated. *
* A number will not be repeated in the 4 digits *
* Please enter your first guess at the number. *
* You will be told how many numbers were right *
* A bull = both number and position is correct *
* A cow = correct number but wrong position *
**********
[0, 6, 1, 8]
Please enter a 4 digit number or exit
number: 8160
You have 0 bulls and 4 cows
Please enter a 4 digit number or exit
number: 6093
You have 0 bulls and 2 cows
Please enter a 4 digit number or exit
number: 6018
You have 2 bulls and 2 cows
Please enter a 4 digit number or exit
number: 6189
You have 0 bulls and 3 cows
Please enter a 4 digit number or exit
number: 2618
You have 3 bulls and 0 cows
Please enter a 4 digit number or exit
number: 0618
You have 4 bulls and 0 cows
Congratulations you have guessed the number in 6 guesses
goodbye
>>>
Ln: 36 Col: 4

**Figure 6a**

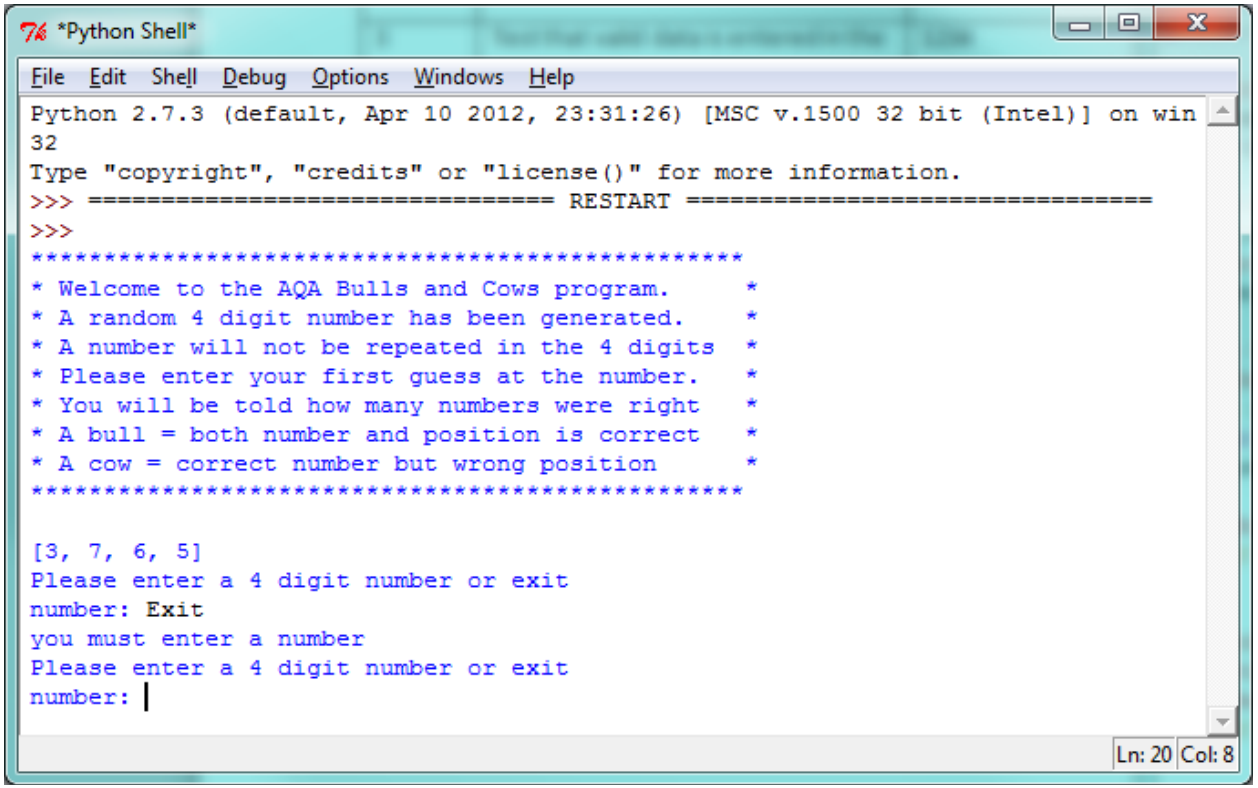
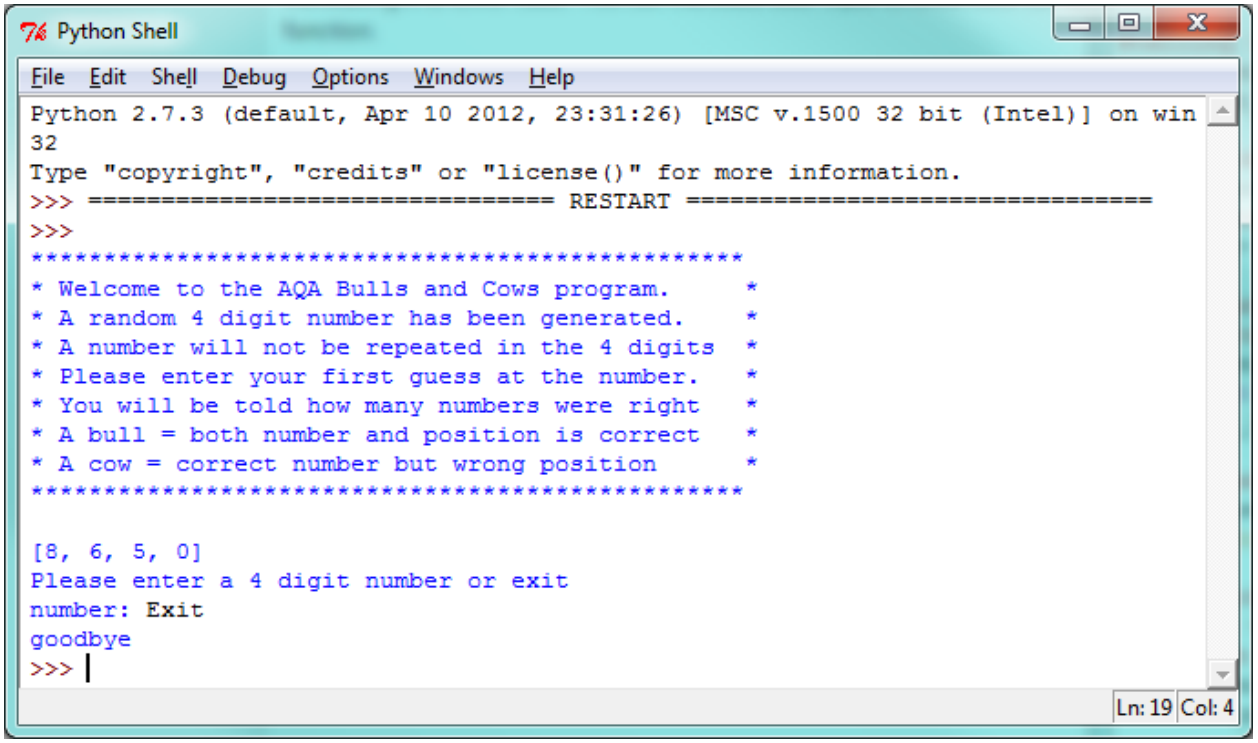

*Python Shell*
File Edit Shell Debug Options Windows Help
Python 2.7.3 (default, Apr 10 2012, 23:31:26) [MSC v.1500 32 bit (Intel)] on win
32
Type "copyright", "credits" or "license()" for more information.
>>> ========== RESTART ==========
>>>
**********
* Welcome to the AQA Bulls and Cows program. *
* A random 4 digit number has been generated. *
* A number will not be repeated in the 4 digits *
* Please enter your first guess at the number. *
* You will be told how many numbers were right *
* A bull = both number and position is correct *
* A cow = correct number but wrong position *
**********
[3, 7, 6, 5]
Please enter a 4 digit number or exit
number: Exit
you must enter a number
Please enter a 4 digit number or exit
number:
Ln: 20 Col: 8

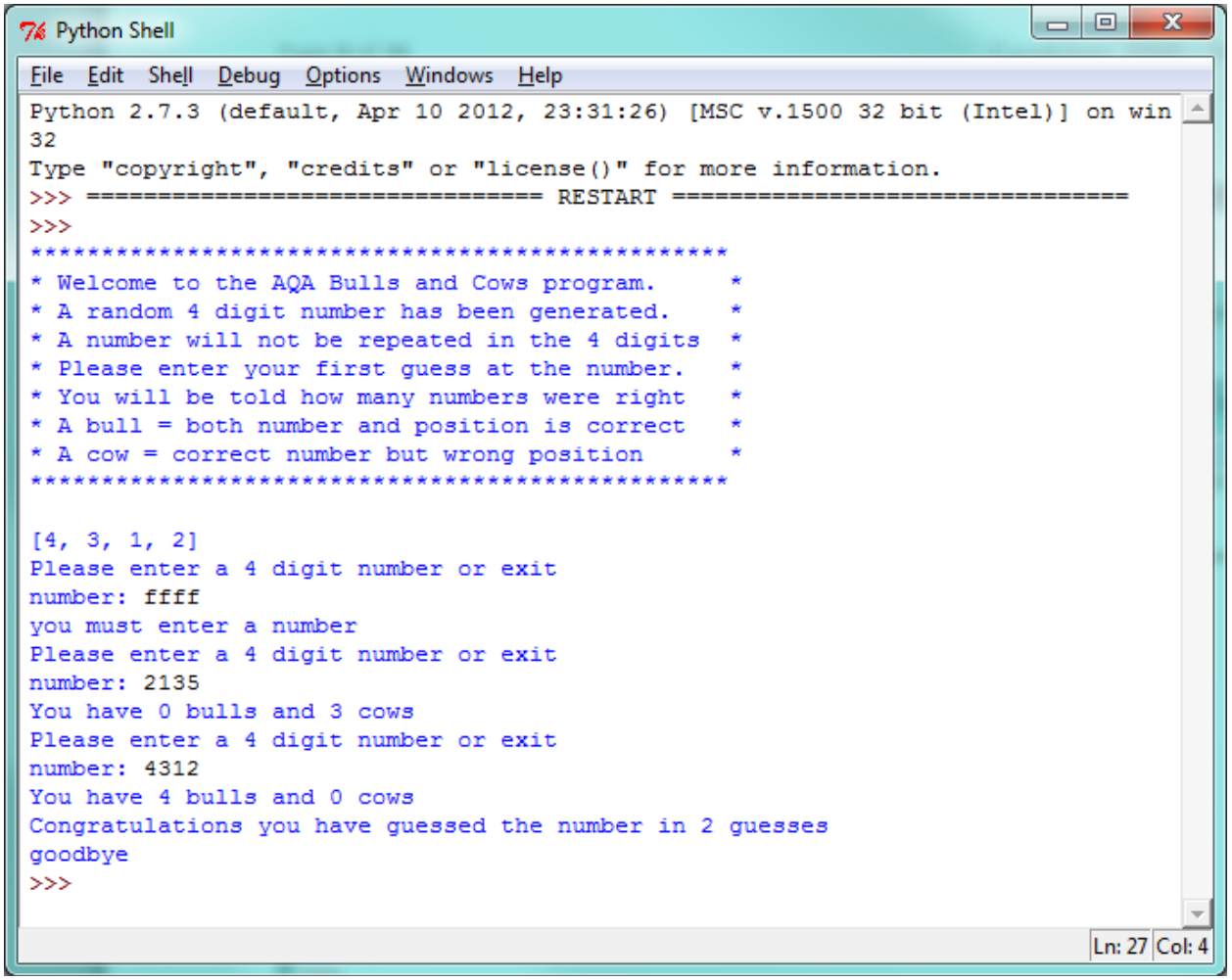
**Figure 6b.**




```
while user_input != "exit":
    print("Please enter a 4 digit number or exit")
    user_input = raw_input("number: ").lower()
```

Corrected code

**Figure 7.**


Python Shell
File Edit Shell Debug Options Windows Help
Python 2.7.3 (default, Apr 10 2012, 23:31:26) [MSC v.1500 32 bit (Intel)] on win
32
Type "copyright", "credits" or "license()" for more information.
>>> ========== RESTART ==========
>>>
**********
* Welcome to the AQA Bulls and Cows program. *
* A random 4 digit number has been generated. *
* A number will not be repeated in the 4 digits *
* Please enter your first guess at the number. *
* You will be told how many numbers were right *
* A bull = both number and position is correct *
* A cow = correct number but wrong position *
**********
[4, 3, 1, 2]
Please enter a 4 digit number or exit
number: ffff
you must enter a number
Please enter a 4 digit number or exit
number: 2135
You have 0 bulls and 3 cows
Please enter a 4 digit number or exit
number: 4312
You have 4 bulls and 0 cows
Congratulations you have guessed the number in 2 guesses
goodbye
>>>
Ln: 27 Col: 4