

# Programming, Probability, and the Modern Mathematics Classroom

## Exercises — Part 3

Manan Shah  
Mathematician-At-Large

June 4, 2013

Please make sure to have read the blog post with the same topic name on the Math Misery website, otherwise this will be out of context.

### Some reminders

- Have students to comment the code, line by line.
- Let students tweak, modify, and otherwise alter the code.
- Don't worry about programming formalities.
- Have fun, relax, and learn.

### The Python dictionary object

Here I'll show how the Python dictionary is used and give a small example of it in operation via the function `makerandomword`. There is far more that can be done beyond what is given here. I encourage instructors to deviate a little bit from numbers and have students work with strings and dictionaries together. A little programming and literacy won't hurt.

```
>>> dictionary = {}
>>> dictionary
{}
>>> dictionary["hello"] = "greeting"
>>> dictionary
{'hello': 'greeting'}
>>> dictionary[5] = "five"
>>> dictionary
{'hello': 'greeting', 5: 'five'}
>>> dictionary["five"] = 5
>>> dictionary
{'five': 5, 'hello': 'greeting', 5: 'five'}
>>> ##notice that there is no "order"
>>> dictionary["five"]
5
>>> dictionary[5]
```

```

'five'
>>> dictionary["five"] = "number"
>>> dictionary
{'five': 'number', 'hello': 'greeting', 5: 'five'}
>>> ## one unique "key" per entry allowed
>>> dictionary["six"] = "number"
>>> dictionary
{'six': 'number', 'five': 'number', 'hello': 'greeting', 5: 'five'}
>>> ## multiple keys can have the same value, however. "five" and "six" are keys
>>> ## "number" is a value
>>> dictionary["how are you?"]
Traceback (most recent call last):
  File "<pyshell#18>", line 1, in <module>
    dictionary["how are you?"]
KeyError: 'how are you?'
>>> ## "how are you?" was not in the dictionary
>>> dictionary["how are you?"] = "another greeting"
>>> dictionary["how are you"]
Traceback (most recent call last):
  File "<pyshell#21>", line 1, in <module>
    dictionary["how are you"]
KeyError: 'how are you'
>>> ## the lookup has to be exact
>>> ## using a dictionary as a counter for unknown events
>>> import random
>>> letters = list("abcdefghijklmnopqrstuvwxyz")
>>> letters
['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j', 'k', 'l', 'm', 'n', 'o', 'p', 'q', 'r', 's', 't',
'u', 'v', 'w', 'x', 'y', 'z']
>>> def makerandomword(listofletters, wordlength):
    word = ""
    numberofletters = len(listofletters)
    for i in range(wordlength):
        randomindex = random.randint(0,numberofletters-1)
        word = word + listofletters[randomindex]
    return word

>>> makerandomword(letters,3)
'thb'
>>> makerandomword(letters,12)
'dtroxujkvacw'
>>> wordcounterdictionary = {}
>>> for i in range(100):
    vowellyword = makerandomword(list("aeiou"),2)
    if vowellyword in wordcounterdictionary:
        wordcounterdictionary[vowellyword] += 1
    else:
        wordcounterdictionary[vowellyword] = 1

```

```
>>> for word in sorted(wordcounterdictionary):
    print("I saw the vowel word: " + word + " " + str(wordcounterdictionary[word]) + " times.")
```

```
I saw the vowel word: aa 5 times.
I saw the vowel word: ae 3 times.
I saw the vowel word: ai 4 times.
I saw the vowel word: ao 1 times.
I saw the vowel word: au 6 times.
I saw the vowel word: ea 10 times.
I saw the vowel word: ee 5 times.
I saw the vowel word: ei 3 times.
I saw the vowel word: eo 1 times.
I saw the vowel word: eu 3 times.
I saw the vowel word: ia 5 times.
I saw the vowel word: ie 1 times.
I saw the vowel word: ii 3 times.
I saw the vowel word: io 9 times.
I saw the vowel word: iu 4 times.
I saw the vowel word: oa 5 times.
I saw the vowel word: oe 4 times.
I saw the vowel word: oi 5 times.
I saw the vowel word: oo 6 times.
I saw the vowel word: ou 4 times.
I saw the vowel word: ua 5 times.
I saw the vowel word: ue 3 times.
I saw the vowel word: ui 2 times.
I saw the vowel word: uu 3 times.
```

Notice that ‘uo’ never occurred and hence was never logged into the dictionary as a key!

## Summary

In this part, we went over the Python dictionary object through a series of examples. We also suggest that instructors let students explore the other methods that are available on dictionary objects — like using `pop` to remove items from the dictionary, `update` to update the dictionary from another dictionary, etc.

Here are some other exercises:

- Obtain a text document and have students count the instances of each letter that occurs. Which letter occurs most frequently? Which occurs least frequently?
  - If students were to develop a word game where each letter is assigned point values, how many points would they assign to each letter to keep the game “balanced”?
- Obtain a text document and have students count the instances of all the unique words that occur. Why word occurs most frequently?

If you need help, have questions, or would like to set up a workshop at your school get in touch with me at [help@mathmisery.com](mailto:help@mathmisery.com).