COMP10001 Foundations of Computing
Semester 2, 2016

Tutorial Questions: Week 7

1. Identify 3 errors in the following code, determine for each whether it is a syntax, run-time or logic error, and provide a replacement line which corrects the error.

```python
def disemvowel(string):
    """Remove all vowels from `string'"""
    vowels = ('a','e','i','o','u')
    answer = string[0]
    for char in string:
        if char is not in vowels:
            answer = char + answer
    print(answer)
```

2. Identify 3 errors in the following code, determine for each whether it is a syntax, run-time or logic error, and provide a replacement line which corrects the error.

```python
def big-ratio(numlist,n):
    """Calculate the ratio of numbers in `numlist'
    which are larger than 'n'"""
    n = greater_n = 0
    for number in numlist:
        if number > n:
            greater_n += 1
            total += 1
    return greater_n/total

nums = [4,5,6]
    min = 4
print("{}% of numbers in {} are greater than {}"\
        .format(100*big_ratio(nums,min),nums,min))
```

3. What does the following code do?

```python
d = {}
for i in range(20):
    try:
        d[i%3].append(i)
    except KeyError:
        d[i%3] = [i]
print(d)
```

4. Rewrite the code from Question 4 using a `defaultdict`

5. What is wrong with the following code? Write test cases that will highlight the problems you identify, as well as two test cases that pass even though there is a problem.

```python
def contains(box, item):
    index = 1
    while index <= len(box):
        if box[index] == item:
```

```
                return True
            index += 1
    return False
```

6. Write a code snippet to produce each of the following exceptions and associated error messages:

- `SyntaxError:  invalid syntax`
- `ZeroDivisionError:  division by zero`
- `KeyError:  1`
- `IndexError:  list index out of range`
- `TypeError:  Can't convert 'int' object to str implicitly`
- `ValueError:  invalid literal for int() with base 10:  'a'`
- `TypeError:  'NoneType' object is not subscriptable`
- `TypeError:  object of type 'int' has no len()`

OPTIONAL EXTENSION QUESTIONS FOR SELF-STUDY

1. The decimal number, $585 = 1001001001_2$ (binary), is palindromic (the same number when read from either the left or the right) as both a decimal (base 10) number and a binary (base 2) number.

   Find the sum of all numbers, less than one million, which are palindromic in both base 10 and base 2.

   Note that the palindromic number, in either base, may not include leading zeros.

   (adapted from Problem 36 of Project Euler)

2. The following iterative sequence is defined for the set of positive integers:

$$n \rightarrow n/2 \quad \text{if } n \text{ is even}$$
$$n \rightarrow 3n + 1 \quad \text{if } n \text{ is odd}$$

   The sequence terminates when it reaches 1.

   For example, starting from $n = 13$, we generate the following sequence:

$$13 \rightarrow 40 \rightarrow 20 \rightarrow 10 \rightarrow 5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$$

   which is of length 10 terms (including the starting value and the final value of 1).

   Which starting number(s), under one million, produce the longest chain? Optimise your solution to run to completion on Grok, making use of redundancy in the calculation.

   (adapted from Problem 14 of Project Euler)