Assessment and Rubric
Introduction to Programming in Python – Comprehensive Quiz
Instructor: Mohammad Taha Khan

Note: This document has been developed by Mohammad Taha Khan and is derived from the contents of MIT OCW course 6.00 Introduction to Computer Science and Programming.

Q1. For the following statements, select if it true or false along with a reason [10 points]

(a) String literals in Python can be represented using only single quotes (’ ’).
(b) In Python programming language function parameters are passed by reference.
(c) The join() method, applied to the following list ['a','b','c','d'] will result in an output of type string.
(d) The dictionary (dict) data type in Python is immutable.
(e) The difference() operation on takes in a single argument of type string.

Q2. (a) What output will the following code produce? [5 points]

    colors = ['Red', 'Green', 'Blue', 'Yellow', 'Pink']
    for i in range(0,len(colors), 2):
        print (i, colors[i])

(b). Rewrite the code which produces the same output using while loop. [5 points]

Q3. Write a function in freq(dict) python that takes in a dictionary as an argument of integer values and prints out a frequency represented by the asterisks (*) corresponding to each key. You can assume the keys in the dictionary will always be of type string. An example dictionary and the output has been provided below for your reference [7 points]

    animals = {'cat': 20, 'dog':10, 'cow': 5}
    freq(animals)

    OUTPUT:
    cat|***************
    dog|********
    cow|*****

Q4. The following function defined below in a recursive implementation of quick sort. Answer the questions below

    def quick_sort(l)
    if len(l) <= 1:
        return l
    else:
        return quick_sort([e for e in l[1:] if e <= l[0]]) + [l[0]] +
        quick_sort([e for e in l[1:] if e > l[0]])

(a) Which line(s) in the code correspond to the base case of the recursive sort? [3 points]

(b) Derive the average and worst-case complexity in Big O notation for this algorithm. [7 points]
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Q1.
Topic: Variables and data containers

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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| (a) | +1 point for stating False  
|     | +1 point for mentioning any one of the following reasons:  
|     |     - Double quotes can also be used to define strings  
|     |     - Python does not differentiate between string and character type |
| (b) | +1 point for stating True  
|     | +1 demonstrates understanding of underlying language implementation characteristics |
| (c) | +1 point for stating True  
|     | +1 point for describing the result of a join method, which concatenates a list of strings into a single string |
| (d) | +1 point for stating False  
|     | +1 point for mentioning that dictionaries are mutable data containers and their values can be updated without changing their identity |
| (e) | +1 point for stating False  
|     | +1 point for stating that the difference operation takes two arguments of type set. |

Q2. “for” and “while” loops.

(a) **+5** correct output as shown below

```
0 Red
2 Blue
4 Pink
```

Score breakdown (use for partial credit):

- +1: prints both numbers and colors e.g. (0 Red)
- +1: numbers and colors in correct order, the color proceeds the number
- +1: new line on each iteration
- +2: understanding of the implementation of range function and prints increments of two in the list

(b) **+5** correct output as shown below

```python
colors = ['Red', 'Green', 'Blue', 'Yellow', 'Pink']
i = 0

while i < len(colors):  
    print(i, colors[i])
```
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i+= 2

Score breakdown (use for partial credit):
- +1: initialization of a count variable used for indexing
- +2: correct use of while loop syntax, ensuring the : terminator (-1 if terminator missing)
- +1: correct print function used, with both count variable and indexed colors list
- +1: the count variable is incremented by two within the while loop

Q3. Functions in Python
+7: Correct code

```python
def freq(dict):
    for x, y in dict.items():
        print(x + '|' + '*'*y)
```

Score breakdown (use for partial credit):
- +3: Correct function declaration without any syntax errors (-1 if : terminator is missing)
- +1: for or while loop implemented within function for iteration
- +2: explicit use of items() to split the keys and values of the dictionary
- +1: Use of the print function with
- +1: Use of multiply (*) operator to print asterisks in correct amount (values).

Q4. Recursion and big O complexity

(a) +3: mentions lines 2 and 3 as the base case, or explicitly states the if clause of the conditional

Score breakdown (use for partial credit):
- +2: mentions line 2 only which is the line with the conditional
- +1: mentions line 1 which is only the return statement

(b) Average case complexity:
- +2.5: $O(N \log_2 N)$
- +1: shows proper working for derivation

Worst case complexity:
- +2.5: $O(N^2)$
- +1: shows proper working for derivation

Rubric for partially correct answers:
- +2: $O(\log_2 N)$ in average case complexity
- +2: $O(N)$ in worst case complexity
- +2: Incorrect complexity but correct general approach in derivation working.

(c) +3: Yes, due to the nature of partitions more unbalanced the partitions of the list will take longer.

Score breakdown (use for partial credit):
- +1: Yes, credit awarded only if and different complexities derived in part (b)
- +2: Some understanding of the order of elements in list (unbalanced partitions)