

CSC108H Winter 2024 Worksheet 32 : Run Time Complexity of Functions

In this exercise, you will explore how to read code and figure out how efficient that code is. For each of the following functions, indicate the runtime with respect to the given quantity.

1. L refers to a list. If there are k items in the list, roughly how many iterations are there?

```
sum = 0
for value in L:
    sum = sum + value
```

- (a) 1 (b) 2 (c) 4 (d) $k/2$ **(e) k** (f) k^2

2. L refers to a list. If there are k items in the list, roughly how many iterations are there?

```
sum = 0
for i in range(len(L)):
    sum = sum + L[i]
```

- (a) 1 (b) 2 (c) 4 (d) $k/2$ **(e) k** (f) k^2

3. L refers to a list. If there are k items in the list, roughly how many iterations are there?

```
sum = 0
i = 0
while i < len(L):
    sum = sum + L[i]
    i = i + 1
```

- (a) 1 (b) 2 (c) 4 (d) $k/2$ **(e) k** (f) k^2

4. L refers to a list. If there are k items in the list, roughly how many iterations are there?

```
sum = 0
i = 0
while i < len(L):
    sum = sum + L[i]
    i = i + 2
```

- (a) 1 (b) 2 (c) 4 **(d) $k/2$** (e) k (f) k^2

5. L refers to a list. If there are k items in the list, roughly how many iterations are there?

```
# Precondition: len(L) % 4 == 0
sum = 0
i = 0
while i < len(L):
    sum = sum + L[i]
    i = i + len(L) // 4
```

- (a) 1 (b) 2 **(c) 4** (d) $k/2$ (e) k (f) k^2

6. The first five questions all involve looping over a list. If the length of the list is doubled, some of the loops will take twice as many iterations as before.¹ Which questions contain these loops? Circle all that apply.

- (a) question 1** **(b) question 2** **(c) question 3** **(d) question 4** (e) question 5

7. The first five questions all involve looping over a list. If the length of the list is doubled, some of the loops will take exactly the same number of iterations as before.² Which questions contain these loops? Circle all that apply.

- (a) question 1 (b) question 2 (c) question 3 (d) question 4 **(e) question 5**

¹This is *linear running time*: the running time is proportional to the size of the input.

²This is *constant running time*: the running time does not depend on the size of the input.

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8. `L` refers to a list. If there are k items in the list, roughly how many times is the assignment statement `sum = val1 - val2` executed?

```
sum = 0
for val1 in L:
    for val2 in L:
        sum = val1 - val2
```

- (a) 1 (b) 4 (c) $k/2$ (d) k (e) $10k$ (f) k^2

9. Roughly how many times is the assignment statement `sum = sum + i` executed?

```
sum = 0
for i in range(k * k):
    sum = sum + i
```

- (a) 1 (b) 4 (c) $k/2$ (d) k (e) $10k$ (f) k^2

10. `L` refers to a list. If there are k items in the list, roughly how many times is the assignment statement `sum = sum + i + j` executed?

```
sum = 0
for i in range(10):
    for j in range(len(L)):
        sum = sum + i + j
```

- (a) 1 (b) 4 (c) $k/2$ (d) k (e) $10k$ (f) k^2

11. Which of questions 8, 9, and 10 contain code that has linear running time? Circle all that apply.

- (a) question 8 (b) question 9 (c) question 10

12. *Quadratic* running time is proportional to the square of the size of the input. Which of questions 8, 9, and 10 contain code that has quadratic running time? Circle all that apply.

- (a) question 8 (b) question 9 (c) question 10