Lab 4 - Big-O

CS 251, Fall 2024

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Exam 1

If you are taking the exam in your lab section, **take the exam on a lab computer, not your personal laptop**. You can sign into a lab computer with your NetID and password.

Access the exam through Blackboard. In the sidebar, there is a section labeled “Exams”. You should see Mastery Exam 1 in this section.

Complete the exam before working on the lab worksheet. If you finish early, please be quiet and respectful of your peers who are still taking the exam. Big-O is not tested on Exam 1.

Learning Goals

By the end of this lab, you’ll:

- Understand how variations in code structure affect asymptotic performance (big-O)

Starter Code

N/A

Tasks

As usual, you can work on the tasks in any order. We strongly encourage collaboration in labs. Work with your peers (once they’re done with the exam), and ask your TAs questions!

For each of these 5 functions, what is the most accurate big-O of the runtime of the function, in terms of N? **Why?** Explain the derivation, don’t just write down the big-O and call it done!

(1)

```
int f(int N) {
  int sum = 0;
```

```
  for (int i = 1; i <= N + 2; i++) {
    sum++;
  }
  for (int j = 1; j <= N * 2; j++) {
    sum++;
  }
  return sum;
}
```

(2)

```
// pow(a, b) computes a^b; round(x) rounds to the nearest integer
void f(int N) {
  int m = (int) ((15 + round(3.2 / 2)) *
                 ((int) (10 / 5.5) / 2.5) * pow(2, 5));
  for (int i = 0;  i < m; i++) {
    cout << i << endl;
  }
}
```

(3)

```
void f(int N) {
  int allowed = 1000;
  for (int i = 0; i < N; i++) {
    if (i % 1000 == 0) {
      allowed--;
    }
    if (allowed == 0) {
      break;
    }
    cout << "Hi!" << endl;
  }
}
```

(4)

```
int f(int N) {
```

```
  int sum = 0;
  for (int i = 1; i <= N; i *= 2) {
      sum ++;
  }
  return sum;
}
```

(5)

```
int f(int N) {
  int sum = 0;
  for (int i = 1; i <= N - 5; i++) {
      for (int j = 1; j <= N - 5; j += 2) {
          sum++;
      }
  }
  return sum;
}
```

Deliverables

To record your attendance at the lab, show a TA your group's answers and explanations. You will be asked questions about your work!

TAs will discuss solutions in the last 15 minutes of the lab. If you aren't interested in solutions, feel free to leave early once you've been checked off.

Oral Activity 1 Timeslot

If you haven't already, make sure to sign up for an oral activity timeslot! (https://docs.google.com/forms/d/e/1FAIpQLSeNYwjKoN7VNZM5K5no7Nq5k6HTU9x8w_32gatPJN41XQE6oQ/viewform)