CSE 332: Data Structures and Parallelism

Exercises (Asymptotics)

Directions: *Submit your solutions on* **Canvas**. *You may use either a txt file or a pdf file.*

EX01. Is Your Program Running? Better Catch It! (20 points)

For each of the following, determine a *tight* asymptotic worst-case runtime in terms of n. (You may use Big-Oh or Big-Theta here, we just want the bound to be tight.) **Give a short description of** *how you turned the code into* **your answer.** That is, we're interested in how the for loops become summations. At this point in the course, we *do not* care how you turn the summations into closed forms–feel free to use online tools to help with this. Although if you do convert summations into closed form you may find some of the formulas in Weiss 1.2 to be useful. You do not necessarily need to write out the summation for all of these, but for some, I think it will be hard to have a sufficient description without one. Note that we are not asking you to prove these - you do not need to use the definition of Big-Oh (or Big-Theta) for this.

(a) [5 Points]

```
1  int sum = 0;
2  for (int i = 0; i < n; i++) {
3      for (int j = 0; j < n; j++) {
4          sum++;
5      }
6  }
```

(c) [5 Points]

```
1  int sum = 0;
2  for (int i = 0; i < n; i++) {
3      for (int j = 0; j < i; j++) {
4          sum++;
5      }
6  }
```

(b) [5 Points]

```
1  int sum = 0;
2  for (int i = 0; i < n; i++) {
3      for (int j = 0; j < n * n; j++) {
4          sum++;
5      }
6  }
```

(d) [5 Points]

```
1  int sum = 0;
2  for (int i = 0; i < n; i++) {
3      for (int j = 0; j < i * i; j++) {
4          for (int k = 0; k < j; k++) {
5              sum++;
6          }
7      }
8  }
```