# Homework 1: Asymptotic Analysis

1. For each of the following program fragments, give the running time (Big-Oh will suffice) and justify your answers. (2 points each)

1.1.
```
sum = 0;
for (i = 0; i < n; i++)
    For (j = 0; j < n; j++)
        sum++;
```

1.2.
```
sum = 0
for(i = 0; i < n; i++)
    for( j = 0; j < n * n; j++)
        sum++;
```

1.3.
```
sum = 0;
for(i = 0; i < n; i++)
    for(j = 0; j < i; j++)
        sum++;
```

1.4.
```
sum = 0;
for(i = 0; i < n; i++)
    for(j = 0; j < i * i; j++)
        for( k = 0; k < j; k++)
            sum++;
```

1.5.
```
sum = 0;
for(i = 1; i <= n; i*=2)
    for(j = 1; j <= i; j++)
        sum++;
```

2. For each pair of functions given below determine if i) one is in Big-Oh of the other but not vise versa; ii) each is in Big-Oh of the other; and iii) none is in Big-Oh of the other: (2 points each)

2.1. $\log(\log n)$ vs. $\log^2 n$

2.2. $2^n$ vs. $3^n$

2.3. $500 + 10n$ vs. $20n$

2.4. $\sin(n)\, n$ vs. $n$

3. Prove the following theorem: (7 points)
If T(n) = O(f(n)) and f(n) = O(g(n)), then T(n) = O(g(n)).