

CMCS 341

Homework #1

Assigned Wed. Sept 12

Due (hard copy in class) Wed. Sept 19 / Thur Sept 20

1. (8 points) Prove the following theorem:
If $T(n) = O(f(n))$ and $f(n) = O(g(n))$, then $T(n) = O(g(n))$.
2. (7 points) Prove by mathematical induction that for all non-negative integer n
$$\sum_{i=0}^n i2^i = (n-1)2^{n+1} + 2.$$
3. (2 points each) For each of the following program fragments, give the running time (Big-Oh will suffice) and justify your answers. (2 points each)

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

```
3.2  sum = 0;
      for( i = 0; i < n; i += 2 )
        for( j = 0; j < n; j++ )
          ++sum;
```

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

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

```
3.5  sum = 0;
      for ( i = 1; i < n; i++ )
        for( j = 1; j < i * i; j++ )
          if( j % i == 0 )
            for( k = 0; k < j; k++ ) )
              ++sum;
```