CSE 3101, Summer 2013

Tutorial 1

May 8, 2013

1. For the following functions $f(), g()$, $f(n) = O(g(n))$ or $g(n) = O(f(n))$ but not both. Determine which is true.

   (a) $f(n) = n^2 + 3n + 4$, $g(n) = n^3$.

   (b) $f(n) = 4n \log n + n$, $g(n) = (n^2 - n)/2$.

2. Prove that $9999n + 635 = O(2^n)$.

3. Analyze the running time of the following algorithm.

```
POWER(y, z)
1  // return y^z where y ∈ R, z ∈ N
2  x ← 1
3  while z > 0
4  do if odd(z)
5        then x ← x * y
6     z ← ⌊z/2⌋
7     y ← y^2
8  return x
```

4. Analyze the running time of the following program for matrix multiplication.

```
MatMult(Y, Z, n)
1  // multiply n x n matrices Y, Z
2  for i ← 1 to n
3  do for j ← 1 to n
4     do X[i, j] ← 0
5        for k ← 1 to n
6        do X[i, j] ← X[i, j] + Y[i, k] * Z[k, j]
7  return x
```

5. (2 points) Which is bigger asymptotically, n or $(\lg n)^{\lg n}$? Justify your answer.

6. (3 points) For what constants a is the following true?

$$2^n + 3^{\frac{n}{2}} = O(a^n)$$