CS 216 Week 1
Handout

Outline:
1. Definitions of Big-O, Big-Ω, and Big-Θ with examples
2. Common order classes with examples
3. Big-O Math
4. Python example explanation
5. Python code examples with asymptotic explanations

Python Code Example:

```
def bestAlignment (U, V, c, g):
    print "Best Alignment: ", U, V, c, g
    if len(U) == 0 or len(V) == 0:
        while len(U) < len(V): U = U + GAP
        while len(V) < len(U): V = V + GAP
        return U, V
    else:
        # try with no gap
        (U0, V0) = bestAlignment (U[1:], V[1:], c, g)
        scoreNoGap = goodnessScore (U0, V0, c, g)
        if U[0] == V[0]: scoreNoGap += c

        # try inserting a gap in U (no match for V[0])
        (U1, V1) = bestAlignment (U, V[1:], c, g)
        scoreGapU = goodnessScore (U1, V1, c, g) – g

        # try inserting a gap in V (no match for U[0])
        (U2, V2) = bestAlignment (U[1:], V, c, g)
        scoreGapV = goodnessScore (U2, V2, c, g) – g

        if scoreNoGap >= scoreGapU and scoreNoGap >= scoreGapV:
            return U[0] + U0, V[0] + V0
        elif scoreGapU >= scoreGapV:
            return GAP + U1, V[0] + V1
        else:
            return U[0] + U2, GAP + V2
```

More Examples:

1.
```
def range_print(n):
    for i in range(n):
        print i
```

2.
```
def letter_print_no_z(word):
    for i in word:
        if i==z:
            break
        else:
            print i
```

3.
```python
def bubblesort(X):
    for i in range(len(X)-1,0,1):
        for j in range(i):
            if X[j]<X[j+1]:
                X[j], X[j+1] = X[j+1], X[j] #tuple assignment
    return X
```

4.
```python
def pretty_print(X):
    for i in matrix:
        for j in i:
            print j
    print "\n"
```

5.
```python
for i in "alphabet":
    print i
```

6.
```python
def sum_product(lst):
    sum=0
    prod=0
    for i in lst
        sum+=i
    for i in lst
        prod*=y
    return sum, prod
```

More Problems

Prove: $2^n \in O(n^n)$

True or False

a. $\sqrt{n^5} \in O(n^2)$

b. $\lg(n^3) \in O(n \lg n)$

c. $\sqrt{n} \lg \sqrt{n} \in O(n)$

d. $\frac{2}{n} + \frac{4}{n^2} \in \Theta(\frac{1}{n})$

e. $n \log_{10} n \in \Theta(n \log_2 n)$

f. $\log_2 \sqrt{n} \in \Theta(\log n)$

g. $\min(700, n^2) \in \Theta(1)$