Kerry Ojakian's CSI 33 Class
Class Assignment #3

Do the following *WITHOUT a calculator!*

1. Evaluate $\log_2(1)$
2. Evaluate $\log_2(2^{27})$
3. Evaluate $\log_2(64)$
4. $\log_2(200)$ is between which two integers?

Do the following *WITHOUT a calculator!*

5. If a computer is capable of performing **one billion** operations per second, how long would it take to execute an algorithm that requires 15 billion operations?

6. If a computer is capable of performing **one million** operations per second, how long would it take to execute an algorithm that requires 15 billion operations?

7. If a computer is capable of performing 1000 operations per second, how long would it take to execute an algorithm that requires $5n$ operations for an input of $n = 10000$ elements? And what if $n = 100$?

8. If a computer is capable of performing one million operations per second, how long would it take to execute an algorithm that requires n^2 operations for an input of $n = 1000$ elements? And if $n = 3000$?

Do the following *WITH a calculator!*

9. If a computer is capable of performing 1200 operations per second, how long would it take to execute an algorithm that requires 15 million operations?

10. If a computer is capable of performing one million operations per second, how long would it take to execute an algorithm that requires $5n^3$ operations for an input of $n = 25$ elements?

11. If a computer is capable of performing one million operations per second, how long would it take to execute an algorithm that requires 2^n operations for an input of $n = 25$ elements?

How many lines of code are executed in each program (give the constant value or a value in terms of n).

12.
```
for i in range(10):
    print(i)
    print('***')
```

13.
```
for i in range(n):
    print(i+10)
```

14.
```
count = 0
for i in range(5n):
    count = count * 10
```

15.
```
i = n
while i > -n:
    print(i)
    i = i - 1
```

16.
```
count = 0
for i in range(n):
    for j in range(n):
        count = count + i + j
```

17.
```
while (n > 1):
    n = n // 2
```

18. Give a Theta analysis for each of the above programs (i.e. put each into some class like $\Theta(n), \Theta(n^2), \ldots$)

Recall that for functions $f(n)$ and $g(n)$, $f(n)$ is $O(g(n))$ if there exist constants C and n_0 such that $f(n) \leq g(n)$ for all $n \geq n_0$. For each of the following cases, show that $f(n)$ is $O(g(n))$ by finding an appropriate C and n_0.

19. $f(n) = 10n$ and $g(n) = 2n$

20. $f(n) = 178n$ and $g(n) = n$

21. $f(n) = n + 100$ and $g(n) = n$

22. $f(n) = 4n^2$ and $g(n) = n^4$

23. $f(n) = 100n^2$ and $g(n) = 10^n$