1. Assume that we are comparing implementations of insertion sort and merge sort on the same machine. For inputs of size k, insertion sort runs in 16k² steps, while merge sort runs in 64k\*lg(k) steps. For which values of k does insertion sort beat merge sort?

	CS350 Indiv Assign 6
1.	insution: O(n2) - 16K2
	marge: 0(n 10g n) -> 64 k lg/(K)
	16 K2 = 64 K log/2 (K)
	K2 = 4 K loga (K)
	K= 4 log/2 (K)
	K= log((K")
	2 K = K4
	K=1
	For all valve larger than I, marge sort will run more efficiently.

2. Prove that 50n + 100n is in  $O(n^2)$ .

2.	50n + 100n is not in n2
	Take n=10,000
	n²= 100, 000, 000
(1)	50n + 100n = 500,000 + 1,000,000 = 1,500,000
	If we drop the constats, we get 2n or just O(n).

3. Prove that  $50 n^2 - 10n + 10$  is in  $O(n^2)$ .

3.	50 n2 -10n +10
	If we drop all constats and non-highest-order polynomials,
	we are left with n2. Thus, this is n2.

Violations of academic honesty represent a serious breach of discipline and may be considered grounds for disciplinary action, including dismissal from the University. The University requires that all assignments submitted to faculty members by students be the work of the individual student submitting the work. An exception would be group projects assigned by the instructor. (Source: SEMO website)

## 4. Is $3^{n+1} = O(3^n)$ ? please write down your answers with detailed steps.

4.	3 <sup>n+1</sup> = 3 <sup>n</sup>
	For big O, we drop all constats so we have
	3" = 3"

## 5. Write Java functions to implement Big-O notations below.

```
[2] O(n\log n) [3] O(\sqrt[3]{n}) [4] O(\sqrt{n}) [5] O(n^3)
[1] O(\log n)
public static void main(String[] args) {
    int n = 1000;
    // log n
    for (int i = 0; i < n; i *= 2) {
    // n log n
    for (int i = 0; i < n; i++) {
      for (int j = n; j > 0; j /= 2) {
      }
    }
    // cube root
    for (int i = 0; i < Math.pow(n, 1/3); i++) {
    }
    // sqrt
    for (int i = 0; i < Math.sqrt(n); i++) {</pre>
    }
    // cubed
    for (int i = 0; i < n; i++) {
      for (int j = 0; j < n; j++) {
        for (int k = 0; k < n; k++) {
        }
      }
    }
  }
```

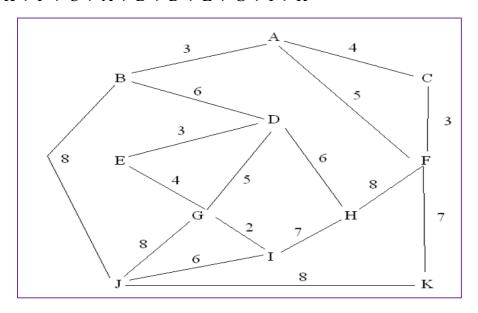
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2

1. Consider the graph in Figure 1 below. Unless otherwise indicated, always visit adjacent nodes in alphabetical order. (20% points, 10% each)

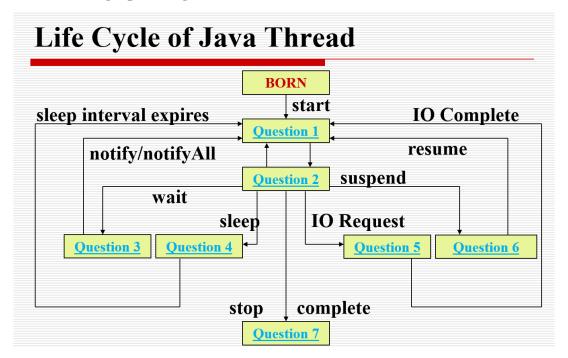
- 2. DFS algorithm traverses all nodes starting at node D
  - $D \rightarrow E \rightarrow G \rightarrow J \rightarrow B \rightarrow A \rightarrow C \rightarrow F \rightarrow K \rightarrow H \rightarrow I$
- 3. BFS algorithm traverses all nodes starting at node G

$$J -> K -> F -> C -> A -> B -> D -> E -> G -> I -> H$$



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## 2. Consider the graph in Figure 1 below. Please fill in Questions 1-7.



- 1. READY
- 2. RUNNING
- 3. WAITING
- 4. SLEEPING
- 5. BLOCKED
- 6. SUSPENDED
- 7. DEAD