

Homework #2

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For all questions, choose the **best** answer.

1. Which of the below statements are true?

- I. $n = O(\sqrt{n})$
- II. $n = \theta(n \lg n)$
- III. $n = \Omega(n)$
- IV. $n = \Omega(\lg n)$
- V. $n = \theta(n^2)$

- a) I only
- b) II and V
- c) III only
- ✓d) III and IV
- e) IV and V

2. Using the Merge Sort algorithm from the book on the below array of numbers, which of the below statements are true? Assume index starts at 1.

A = [3, 2, 3, 7, 8, 11, 6]

- I. The first recursive step has 3, 2, 3 as the left sub-array and 7, 8, 11, 6 as the right sub-array.
- II. After the base cases are reached, the sub-arrays produced are: [2, 3], [3, 7], [8, 11], and [6]
- III. The sub-arrays produced right before the outputted array are: [2, 3, 3] and [6, 7, 8, 11]

- a) I only
- b) I and III
- ✓c) II only
- d) III only
- e) I and II

For questions 3 and 4, find the runtime. Use any approach you like.

3. $T(n) = 100T\left(\frac{n}{2}\right) + n^2 \log^5 n$

- a) $\theta(n^{6.64} \log^6 n)$
- b) $\theta(n^{6.64} \log \log n)$
- ✓c) $\theta(n^{6.64})$
- d) $\theta(n^2 \log^5 n)$
- e) $\theta(n^2)$

4. $T(n) = 4T\left(\frac{n}{5}\right) + n \log^3 n$

- a) $\theta(n^{86} \log^4 n)$
- b) $\theta(n^{86} \log \log n)$
- c) $O(n)$
- d) $\theta(n^{86})$
- ✓e) $\theta(n \log^3 n)$

5. If you wanted to multiply two 4x4 matrices using Strassen's algorithm for matrix multiplication, how many recursive calls would be made?

- ✓a) 49
- b) 50
- c) 56
- d) 64
- e) 60