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CS 2134 HW 1

1a) O(n)

1b) O(n2)

1c) O(n3)

1d) O(n2)

1e) O(n3)

1f) O(n)

1g) O(n2 log(n))

1h) O(n!)

1i) O(n!)

2a) O(1)

2b) O(n)

2c) O(n2)

2d) O(n2)

2e) O(n3)

2f) O(n)

2g) O(n2)

2h) O(n3)

2i) O(log(n))

2j) O(n log(n))

2k) O(log(n))

3) 1. n3

2. n2

3.n1.5

4.n log2 n

5. n log n

6. n and n/2 is same

7. √ n

4) 213 / 211 = 4

1. 4 \* 0.05 s = 0.2 s
2. 42 \* 0.05 s = 0.8 s
3. 44 \* 0.05 s = 12.8 s

5) O(n2) because every time n is increased by 2, the time is increase by 4 or 22

6) 3n2 + 2n log n + 6n + 19 ≤ 4n2 for all n ≥ 13 therefore by the definition of the Big O notation, 3n2 + 2n log n + 6n + 19 = O (n2)

7)

|  |  |  |  |
| --- | --- | --- | --- |
| N | maxSubSum1 O(n^3) | maxSubSum2 O(n^2) | maxSubSum4 O(n) |
| 128 | 0.001069 | 4.6e-05 | 3e-06 |
| 256 | 0.007678 | 0.000171 | 3e-06 |
| 512 | 0.060455 | 0.000565 | 3e-06 |
| 1024 | 0.488088 | 0.002048 | 6e-06 |
| 2048 | 3.91782 | 0.008078 | 1.5e-05 |
| 4096 | 31.379741 | 0.035846 | 2.2e-05 |

8)

|  |  |  |  |
| --- | --- | --- | --- |
| N | maxSubSum1 O(n^3) | maxSubSum2 O(n^2) | maxSubSum4 O(n) |
| 256 | 0.008552 | 0.000184 | 0.000006 |
| 512 | 0.068416 | 0.000736 | 0.000012 |
| 1024 | 0.547328 | 0.002944 | 0.000024 |
| 2048 | 4.378624 | 0.011776 | 0.000048 |
| 4096 | 35.028992 | 0.047104 | 0.000096 |

9)

218 / 27 = 211

For first algorithm O(n3), it will take (211)3 \* 0.001069 = 9.18 \* 106 seconds to compute n = 218.

For second algorithm O(n2), it will take (211)2 \* 4.6e-05 = 192.94 seconds to compute n = 218.

For fourth algorithm O(n), it will take 211 \* 3e-06 = 0.006144 seconds to compute n = 218.

10)

For first algorithm O(n3), it will take 15 weeks, 1 day and 6 hours.

For second algorithm O(n2), it will take 3 minutes and 12.94 seconds.

For third algorithm O(n), it will take 0.006144 seconds.

11)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| N | B | C | D | E |
| 256 | 1e-06 | 0.000145 | 7.9e-05 | 0.035087 |
| 512 | 3e-06 | 0.000555 | 0.000292 | 0.272358 |
| 1024 | 2e-06 | 0.002118 | 0.001087 | 2.152884 |
| 2048 | 5e-06 | 0.008525 | 0.004226 | 17.419535 |
| 4096 | 1e-05 | 0.033426 | 0.017208 | 139.633662 |

12) True

13) True