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Hw #1

written part:

1.

(a) $T(n) = 12n - 204$ $\boxed{O(n)}$

(b) $T(n) = \frac{3}{2}n^2 + \frac{5}{2}n + 0.24$ $\boxed{O(n^2)}$

(c) $T(n) = 2n^3 + 2n + 2n \cdot \log(n)$ $\boxed{O(n^3)}$

(d) $T(n) = 10n^2 + 0.002n + 82$ $\boxed{O(n^2)}$

(e) $T(n) = (2n^2 + 4\log(n)) \cdot 10n$ $\boxed{O(n^3)}$

(f) $T(n) = 34\log(n^3) + \frac{2}{3}n$ $\boxed{O(n)}$

(g) $T(n) = \frac{4n \cdot \log(n)\,[3n \cdot \log(n) + 2n^2]}{n}$ $\boxed{O(n^2 \log^2(n))}$

(h) $T(n) = \binom{n}{2}$ $\frac{n(n-1)}{2}$ $\boxed{O(n^2)}$

(i) $T(n) = \binom{n}{3}$ $\boxed{O(n^3)}$

2.

(a) $O(1)$

(b) $O(n)$

(c) $O(n^2)$

(d) $O(n^2)$

(e) $O(n^3)$

(f) $O(n)$

(g) $O(n^2)$

(h) $O(n^3)$

(i) $O(\log(n))$

(j) $O(n \cdot \log(n))$

(k) $O(\log(n))$

3. ordered from fastest to slowest

$n^3, n^2, n^{1.5}, n \cdot \log^2(n), n \cdot \log(n), n, n/2, \sqrt{n}$

all the functions grow at different rates but all going towards infinity.

4.

(a) $\left(\frac{2^{13}}{2^{11}}\right)^1 * 0.05 = \boxed{0.2}$

(b) $\left(\frac{2^{13}}{2^{11}}\right)^2 * 0.05 = \boxed{0.8}$

(c) $\left(\frac{2^{13}}{2^{11}}\right)^4 * 0.05 = \boxed{12.8}$

5. $\left(\frac{2^{12}}{2^7}\right)^1 * 0.002094 = 0.067008$ ✗

$\left(\frac{2^{12}}{2^7}\right)^2 * 0.002094 = 2.1442 \approx 2.128$ ✓

so, the running time is $\boxed{O(n^2)}$

6. $3n^2 + 2n \cdot \log(n) + 6n + 19 = O(n^2)$

using the standard definition, let $c = 50$,

$3n^2 + 2n \cdot \log(n) + 6n + 19 \leq 50n^2$

for all values of $n > 100$

(7)

| n | maxsubsum1 $O(n^3)$ | maxsubsum2 $O(n^2)$ | maxsubsum4 $O(n)$ |
|---|---|---|---|
| 128 | 0.118000 | 0.004000 | 0.000010 |
| 256 | 0.796000 | 0.031000 | 0.001000 |
| 512 | 6.280000 | 0.065000 | 0.001000 |
| 1024 | 50.8000 | 0.259000 | 0.001000 |
| 2048 | 402.12500 | 1.008000 | 0.002000 |
| 4096 | 3225.5630 | 4.116000 | 0.003000 |

(8)

| n | maxsubsum1 $O(n^3)$ | matsubsum2 $O(n^2)$ | maxsubsum4 $O(n)$ |
|---|---|---|---|
| 256 | 0.9440 | 0.0160 | 0.00020 |
| 512 | 7.5520 | 0.0640 | 0.0004 |
| 1024 | 60.4160 | 0.2560 | 0.0008 |
| 2048 | 483.3280 | 1.0240 | 0.0016 |
| 4096 | 3866.624 | 4.0960 | 0.0032 |

(9) for maxsubsum1 $O(n^3)$:

$n = 2^{18}$, $k = 3$, $n_0 = 128$, $t_0 = 0.1180$

approx time $= \left(\frac{n_1}{n_0}\right)^k \cdot t_0 = \left(\frac{2^{18}}{128}\right)^3 \cdot 0.1180 \approx \boxed{10136122.82}$

for matsubsum2 $O(n^2)$:

approx time $= \left(\frac{n_1}{n_0}\right)^k \cdot t_0 = \left(\frac{2^{18}}{128}\right)^2 \cdot 0.00400 \approx \boxed{6777.21}$

for maxsum4 $O(n)$:

approx time $= \left(\frac{n_1}{n_0}\right)^k \cdot t_0 = \left(\frac{2^{18}}{128}\right)^1 \cdot 0.000001$

$\approx \boxed{0.002048}$

10. for maxsubsum 1 ($n^3$):
32 years, 6 weeks, 1 day, 20 hrs, 43 min
6 seconds
for maxsubsum 2 ($n^2$):
4 hours, 39 min, 37 sec
for maxsubsum 4 ($n$):
0.002 seconds

11.

| n | b | c | d | e |
|---|---|---|---|---|
| 256 | 0.000 | 0.000 | 0.0000 | 0.0370 |
| 512 | 0,000 | 0.0010 | 0.0000 | 0.2940 |
| 1024 | 0.000 | 0.00200 | 0.0020 | 2.3630 |
| 2048 | 0.000 | 0.00900 | 0.0050 | 18.1020 |
| 4096 | 0.000 | 0.03500 | 0.0190 | 145.468 |

12. (True) I understand if I dont submit a .pdf file for written portion of the assignment, I will recieve no credit for the written part

13. (True) I understand that if I dont submit code that compiles I will recieve no credit for programming part.