CS 2134
Assignment #1
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Programming part results:
1)
maxSubSum1 took 0.001315 seconds... with n = 2^7
maxSubSum2 took 4.3e-05 seconds... with n = 2^7
maxSubSum4 took 3e-06 seconds... with n = 2^7

maxSubSum1 took 0.011586 seconds... with n = 2^8
maxSubSum2 took 0.000223 seconds... with n = 2^8
maxSubSum4 took 4e-06 seconds... with n = 2^8

maxSubSum1 took 0.089846 seconds... with n = 2^9
maxSubSum2 took 0.000738 seconds... with n = 2^9
maxSubSum4 took 4e-06 seconds... with n = 2^9

maxSubSum1 took 0.612021 seconds... with n = 2^10
maxSubSum2 took 0.003851 seconds... with n = 2^10
maxSubSum4 took 1.1e-05 seconds... with n = 2^10

maxSubSum1 took 4.817963 seconds... with n = 2^11
maxSubSum2 took 0.011758 seconds... with n = 2^11
maxSubSum4 took 2.5e-05 seconds... with n = 2^11

maxSubSum1 took 40.15918 seconds... with n = 2^12
maxSubSum2 took 0.048554 seconds... with n = 2^12
maxSubSum4 took 2.1e-05 seconds... with n = 2^12

2)
2a took 7.68e-07 seconds... with n = 2^8
2b took 0.0034050048 seconds... with n = 2^8
2c took 0.0016635904 seconds... with n = 2^8
2d took 0.623713792 seconds... with n = 2^8

2a took 1.536e-06 seconds... with n = 2^9
2b took 0.0066048 seconds... with n = 2^9
2c took 0.003280384 seconds... with n = 2^9

2d took 1.251518464 seconds... with n = 2^9

2a took 2.4576e-06 seconds... with n = 2^10
2b took 0.0126560256 seconds... with n = 2^10
2c took 0.0065191936 seconds... with n = 2^10
2d took 2.521059328 seconds... with n = 2^10

2a took 6.144e-06 seconds... with n = 2^11
2b took 0.0257785856 seconds... with n = 2^11
2c took 0.012828672 seconds... with n = 2^11
2d took 5.023936512000001 seconds... with n = 2^11

2a took 1.14688e-05 seconds... with n = 2^12
2b took 0.0517341184 seconds... with n = 2^12
2c took 0.0259186688 seconds... with n = 2^12
2d took 10.079637504 seconds... with n = 2^12

Written Portion ----------

1. Write each of the following functions in Big-Oh notation:

a) O(n)
b) O(n^2)
c) O(n^3)
d) O(n^2)
e) O(n^3)
f) O(n)
g) O(n^3 * log(n))
h) O(n)
i) O(n)

2. For each of the following code fragments[4], determine the worst case running time using Big- Oh notation as a function of n.

a) O(n)
b) O(n^2)
c) O(n^2)
d) O(n^3)
e) O(n)
f) O(n^2)
g) O(n^3)
h) O(log(n))
i) O(nlog(n))
j) O(log(n))

3. Suppose a program takes 0.05 seconds to run on input size of 2048. Estimate how long it would run for an input size of 2^{13} if:

a) .2 seconds
b) .8 seconds
c) 12.8 seconds

4. Suppose you had a very complicated code that was difficult to analyze. To get a quick idea of your algorithm's running time you ran your program on different sized inputs. Suppose the following are the timing results for your algorithm. Using the timing results below, indicate the most likely running time in big-Oh notation; choose one from the following list. O(1), O(n), O(n^2), O(n^3), O(n^4).

n time

. 2^7 0.002094

. 2^8 0.00834

. 2^9 0.033412

. 2^10 0.133054

.

. 2^11 0.532501

.

. 2^12 2.12835

O(n^2)

5. Using the definition of Big-Oh, show that $3n^2 + 2n \log(n) + 6n + 19 = O(n^2)$.

$3n^2 + 2n \log(n) + 6n + 19 <= 4n^2$

4n^2 >=16 so for n >16 O(n^2) is appropriate

6.

n	maxSubsequenceSum1 O(n^3)	maxSubsequenceSum2 O(n^2)	maxSubsequenceSum3 O(n^1)
2^7	0.001315	4.3e-05	3e-06

2^8	0.011586	0.000223	4e-06
2^9	0.089846	0.000738	4e-06
2^10	0.612021	0.003851	1.1e-05
2^11	4.817963	0.011758	2.5e-05
2^12	40.15918	0.048554	2.1e-05

7.

n	maxSubsequenceSum1 O(n^3)	maxSubsequenceSum2 O(n^2)	maxSubsequenceSum3 O(n^1)
2^7	0.001315	4.30E-05	3.00E-06
2^8	0.01052	0.000172	0.000006
2^9	0.08416	0.000688	0.000012
2^10	0.67328	0.002752	0.000024
2^11	5.38624	0.011008	0.000048
2^12	43.08992	0.044032	0.000096

8.

n	maxSubsequenceSum1 O(n^3)	maxSubsequenceSum2 O(n^2)	maxSubsequenceSum3 O(n^1)
2^7	0.001315	4.30E-05	3.00E-06
2^18	11295763.99	180.355072	0.006144

T(n) = O(n^x)
T(n) = cn^x
T(kn) =c(kn)^x
T(kn) = cn^x * k^x
Where k is the multiplicative value of the exponent and x is the exponent in the BigO.
So 2^18 = 2^7 * 2^18 * (the big-O exponent)

9.
MSS1: 18 weeks, 4 days, 17 hours, 42 minutes, and 43.99 seconds.
MSS2: 3 minutes, and 0.355072 seconds.
MSS3: 0.006144 seconds.

10.

n	Part a	Part b	Part c	Part d
2^8	7.68e-07	0.0034050048	0.0016635904	0.623713792
2^9	1.536e-06	0.0066048	0.003280384	1.251518464
2^10	2.4576e-06	0.0126560256	0.0065191936	2.521059328
2^11	6.144e-06	0.0257785856	0.012828672	5.023936512
2^12	1.14688e-05	0.0517341184	0.0259186688	10.079637504