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CSE 122: HW 3
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Homework 3

1.

line	Cost	# of Times
1	C_1	n - 6
2	C_2	n - 7

$T(n) = n(C_1 + C_2) - 6C_6 - 7C_2$

Big-O: O(n)

2.

line	Cost	# of Times
1	C_1	1
2	C_2	1
3	C_3	1

$T(n) = C_1 + C_2 + C_3$

Big-O: O(1)

3.

line	Cost	# of Times
1	C_1	n
2	C_2	n - 1
3	C_3	$\frac{n(n+1)}{2} - 1$
4	C_4	$\frac{n(n+1)}{2} - n$
5	C_5	n - 1

$T(n) = ½n^2(C_3 + C_4)+n(C_1 + C_2 + ½C_3 - ½C_4 + C_5) - C_2 - C_3 - C_5$

Big-O: $O(n^2)$

4.

line	Cost	# of Times
1	C_1	n + 1
2	C_2	$\frac{(n+1)(n+2)}{2} - 1$
3	C_3	$\frac{n(n+1)(n+2)}{6}$
4	C_4	$\frac{n(n^2+6n+5)}{2}$

$T(n) = 1/6*n^3(C_3 + C_4)+n^2(½C_2 + ½C_3 + C_4)+n(C_1 + ½C_2 + 1/3*C_3 + 5/6*C_4) + C_1 + ½C_2$

Big-O: $O(n^3)$

Work:

Lines 1 and 2 were calculated using the same methods from questions 1 – 3.

Lines three and four were calculated via the use of a table I had set up below:

i value	j for	k for	k body
1	2	2	1
2	3	2 + 3	1 + 2
3	4	2 + 3 + 4	1 + 2 + 3
…	…	…	…
n	n + 1	2 + 3 + … + n + (n + 1)	1 + 2 + … + n

Line 3 can be converted into the form $\sum_{i=1}^{n} \frac{i(i+1)}{2}$. This was then converted, using Wolfram alpha, to the form $\frac{n(n+1)(n+2)}{6}$.

Line 4 can be converted into the form $\sum_{i=2}^{n+1} \frac{i(i+1)}{2} - 1$. This was then converted, using Wolfram alpha, to the form $\frac{n(n^2+6n+5)}{6}$.

5. If $f(n) = O(g(n))$, then in $\log(n) = O(n^{\in})$ $f(n)$ is equal to $\log(n)$ and $g(n)$ is equal to $n^{\in}$.

$$\lim_{n\to\infty+} \frac{\log(n)}{n^{\in}} \to \lim_{n\to\infty+} \frac{\frac{1}{n}}{n^{\in} * \log(n)} (using\ l'Hospital's) = \lim_{n\to\infty+} \frac{1}{n * n^{\in} * \log(n)} = \frac{1}{\infty * \infty * \infty} = 0$$

Permutations:

begin lucky run

run	n	time
1	250	0.0008
2	250	0.0012
3	250	0.0006
4	250	0.0007
5	250	0.0008
6	250	0.0006
7	250	0.0005
8	250	0.0005
9	250	0.0005
10	250	0.0007

avg for n = 250 for lucky is 0.0007 seconds

run	n	time
1	500	0.0020
2	500	0.0030
3	500	0.0026
4	500	0.0022
5	500	0.0031
6	500	0.0024
7	500	0.0023
8	500	0.0022
9	500	0.0022
10	500	0.0021

avg for n = 500 for lucky is 0.0024 seconds

run n time
1 1000 0.0116
2 1000 0.0106
3 1000 0.0102
4 1000 0.0090
5 1000 0.0087
6 1000 0.0102
7 1000 0.0102
8 1000 0.0147
9 1000 0.0092
10 1000 0.0089
avg for n = 1000 for lucky is 0.0103 seconds
run n time
1 2000 0.0493
2 2000 0.0433
3 2000 0.0413
4 2000 0.0539
5 2000 0.0520
6 2000 0.0428
7 2000 0.0375
8 2000 0.0471
9 2000 0.0407
10 2000 0.0506
avg for n = 2000 for lucky is 0.0459 seconds

begin used run
run n time
1 2500 0.0003
2 2500 0.0003
3 2500 0.0003
4 2500 0.0002
5 2500 0.0003
6 2500 0.0003
7 2500 0.0003
8 2500 0.0003
9 2500 0.0003
10 2500 0.0003
avg for n = 2500 for used is 0.0003 seconds
run n time
1 5000 0.0006
2 5000 0.0007
3 5000 0.0006
4 5000 0.0010
5 5000 0.0010

6 5000 0.0006
7 5000 0.0008
8 5000 0.0007
9 5000 0.0006
10 5000 0.0006
avg for n = 5000 for used is 0.0007 seconds
run n time
1 10000 0.0016
2 10000 0.0015
3 10000 0.0013
4 10000 0.0020
5 10000 0.0015
6 10000 0.0013
7 10000 0.0017
8 10000 0.0012
9 10000 0.0016
10 10000 0.0014
avg for n = 10000 for used is 0.0015 seconds
run n time
1 20000 0.0045
2 20000 0.0025
3 20000 0.0027
4 20000 0.0031
5 20000 0.0029
6 20000 0.0027
7 20000 0.0034
8 20000 0.0030
9 20000 0.0027
10 20000 0.0030
avg for n = 20000 for used is 0.0031 seconds
run n time
1 40000 0.0068
2 40000 0.0070
3 40000 0.0082
4 40000 0.0071
5 40000 0.0060
6 40000 0.0067
7 40000 0.0070
8 40000 0.0056
9 40000 0.0061
10 40000 0.0063
avg for n = 40000 for used is 0.0067 seconds
run n time
1 80000 0.0159

2 80000 0.0202
3 80000 0.0129
4 80000 0.0150
5 80000 0.0132
6 80000 0.0183
7 80000 0.0184
8 80000 0.0147
9 80000 0.0137
10 80000 0.0165
avg for n = 80000 for used is 0.0159 seconds

begin knuth run
run n time
1 1000 0.0000
2 1000 0.0000
3 1000 0.0000
4 1000 0.0000
5 1000 0.0000
6 1000 0.0000
7 1000 0.0000
8 1000 0.0000
9 1000 0.0000
10 1000 0.0000
avg for n = 1000 for knuth is 0.0000 seconds
run n time
1 2000 0.0000
2 2000 0.0000
3 2000 0.0000
4 2000 0.0000
5 2000 0.0000
6 2000 0.0000
7 2000 0.0000
8 2000 0.0000
9 2000 0.0000
10 2000 0.0000
avg for n = 2000 for knuth is 0.0000 seconds
run n time
1 4000 0.0001
2 4000 0.0001
3 4000 0.0001
4 4000 0.0001
5 4000 0.0001
6 4000 0.0001
7 4000 0.0001

8 4000 0.0001
9 4000 0.0001
10 4000 0.0001
avg for n = 4000 for knuth is 0.0001 seconds
run n time
1 8000 0.0001
2 8000 0.0001
3 8000 0.0002
4 8000 0.0002
5 8000 0.0002
6 8000 0.0002
7 8000 0.0002
8 8000 0.0002
9 8000 0.0002
10 8000 0.0002
avg for n = 8000 for knuth is 0.0001 seconds
run n time
1 16000 0.0003
2 16000 0.0003
3 16000 0.0003
4 16000 0.0003
5 16000 0.0003
6 16000 0.0003
7 16000 0.0003
8 16000 0.0003
9 16000 0.0003
10 16000 0.0003
avg for n = 16000 for knuth is 0.0003 seconds
run n time
1 32000 0.0006
2 32000 0.0006
3 32000 0.0006
4 32000 0.0006
5 32000 0.0006
6 32000 0.0006
7 32000 0.0006
8 32000 0.0006
9 32000 0.0006
10 32000 0.0006
avg for n = 32000 for knuth is 0.0006 seconds
run n time
1 64000 0.0013
2 64000 0.0012
3 64000 0.0012

4 64000 0.0012
5 64000 0.0012
6 64000 0.0012
7 64000 0.0012
8 64000 0.0017
9 64000 0.0015
10 64000 0.0012
avg for n = 64000 for knuth is 0.0013 seconds