ICCS200: Assignment 1

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Recitation: Your recitation section
The date

2: Hello, Definition

1) $\lim_{x \to \infty} \frac{f(n)}{g(n)} = \frac{n}{nlogn}$

$\lim_{x \to \infty} \frac{n}{nlogn} = 0$

since $0 < \infty$

Therefore from definition f(n) = n is O(nlogn)

2) Let A and B be a real number

$\lim_{x \to \infty} d(n)/f(n) = A$

$\lim_{x \to \infty} e(n)/g(n) = B$

$\lim_{x \to \infty} e(n)/g(n).d(n)/f(n) = A.B$

since A and B are real number therefore $A.B < \infty$

Therefore $\lim_{x \to \infty} e(n)/g(n).d(n)/f(n) < \infty$

3) We loop n time from 0 to n-1, the total number of loops= $1000.k.n(n-1)/2$

$O(n^2)$

4) If h(n) = O(n^4) it is $< \infty$

$\lim_{x \to \infty} 16n^2 + 11n^4 + 0.1n^5/n^4 = \infty$

$O(n^4)$ is not Big-Oh of h(n)

3: How Long Does This Take?

(a) For programA, prod = prod.C takes k constant

Z	
n	k
$\frac{n}{2}$	k
.	k
.	k
1	k

$= \log_2 n + 1$

$= \Theta(\log_2 n)$

(b) For programB, prod = prod.C takes k constant

Z	
1	k
3	k
.	k
.	k
3^n	k

$= \log_3 n$

$= \Theta(\log_3 n)$

4: Halving Sum

(2) Cost to allocate $Y = \frac{z}{2}.k_1$

Cost to read each value = $z.k_2$

Cost to add values= $\frac{z}{2}.k_2$

Cost to add values to array Y = $\frac{z}{2}.k_2$

Cost to assign Y to Z = C

Total cost for one iteration = $2z.k_2 + \frac{z}{2}.k_1 + C$

(3) Let A= $2z.k_2 + \frac{z}{2}.k_1$

Z	
$n = 2^p$	$A.(2^p) + C$
$n = (2^{p-1})$	$A.(2^{p-1}) + C$
.	.
.	.
$n = (2)$	$A.(2) + C$

$= (A.(2^p) + C) + (A.(2^{p-1}) + C) + ... + (A.(2) + C)$

$= A.2(2^p) + p.C$

since $n = 2^p$

$= A.2(n-1) + (\log_2 n).C$

$= 2.(\frac{k_1}{2} + 2.k_2).(n-1) + (\log_2 n).C$

5: Random Permutation

(1)

int[ ] perm = new int[n]; $->$ $\Theta(n)$

Random rng = new Random(); $->$ $O(1)$

for (int i=0;i<n;i++) perm[i] $=i+1;->O(1)$

for (int i=0;i<n;i++) {

int t = rng.nextInt(i+1); $->$ $O(1).n$

if (i!=t) { swp(perm, t, i); } $->$ $O(1)$

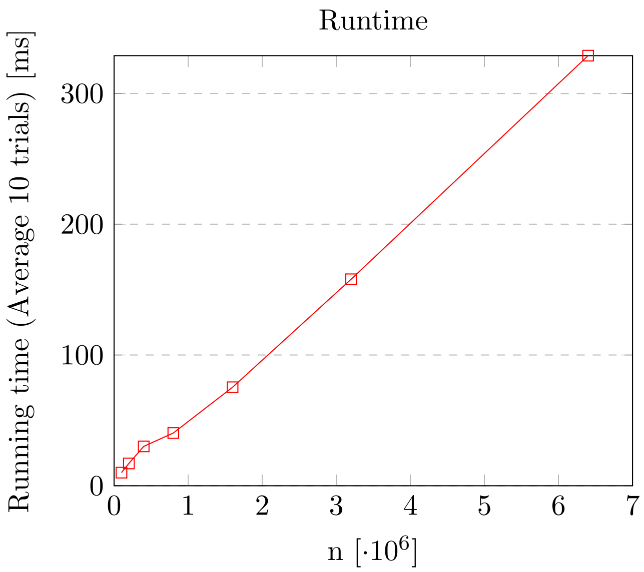
}

return perm; $->$ $O(1)$

Therefore Running time of mkPerm = $\Theta(n)$

(2)

n	Running time(Average of 10 trials)
100,000	10.0357148
200,000	17.0696323
400,000	30.0938004
800,000	40.3386635
1,600,000	75.3559396
3,200,000	157.8987411
6,400,000	328.9085858



(3)
The graph/data supports the analysis in part 2.