ICCS200: Assignment 1

Vikrom Narula
vikrom.nar@gmail.com

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Exercise 2:

(1)

$f(n) = n \ \ is \ O(n \ \ log \ n) \Rightarrow \lim_{n\to\infty} \frac{n}{n*log\ n} < \infty \Rightarrow \lim_{n\to\infty} \frac{1}{log\ n}$

If we take the limit we will get $\frac{1}{\infty}$ which is zero which is lesser than ∞.

(2)

We know

$\lim_{n\to\infty} \frac{d(n)}{f(n)} < \infty$, $\lim_{n\to\infty} \frac{e(n)}{g(n)} < \infty$

Let say

$\frac{d(n)}{f(n)}$ and $\frac{e(n)}{g(n)}$ are Real number

We know if $Real\ number * Real\ number = Real\ number$

Hence prove because Real number is lesser than ∞.

(3)

We know it cost in loop 1,1k,2k,3k,4k,...,nk (k is 1000)

So we can use geometric formula we will get $\frac{1000n^2+1000n}{2}$ and other are constant so we know this code will take $O(n^2)$.

(4)

$\lim_{n\to\infty} \frac{16n^2+11n^4+0.1n^5}{n^4} < \infty \Rightarrow \lim_{n\to\infty} \frac{16}{n^4} + 11 + 0.1n < \infty$

If we take the limit

$0 + 11 + 0.1 * \infty < \infty$ and $\infty = \infty$ not lesser hence the big O isn't n^4

Exercise 3:

programA

Cost is c+k,0.5c+k,0.25c+k,...,1 which is (log n)

So it's Θ(log n)

ProgramB
Cost is 3 times each iterations and the cost will be the amount of times n can be divided by 3 which is $log_3 n$
So the cost is $\Theta(log_3 n)$

Exercise 4:
(4)
$\frac{k_1 z}{2} + 2zk_2 + C$ {I just look and see the answers}

(3)

Iterations	Cost
$n = 2^k$	$2^k + c$
$0.5n = 2^{k-1}$	$2^{k-1} + c$
$0.25n = 2^{k-2}$	$2^{k-2} + c$
...	...
2^1	c

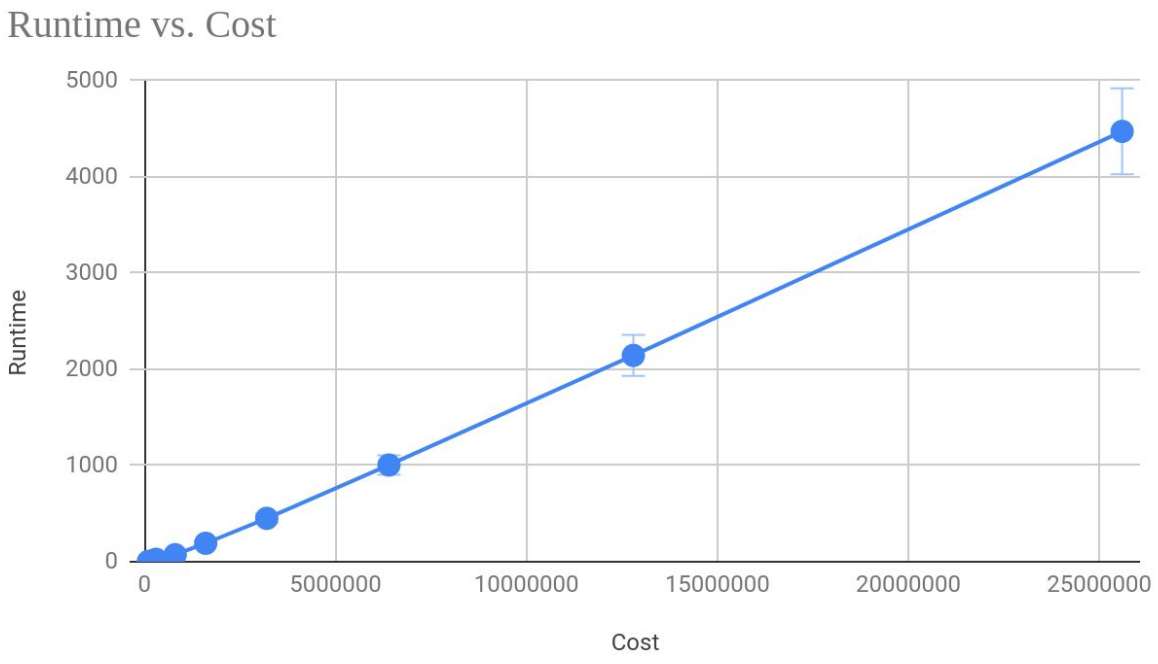
Cost is k times and n-1 times
By the (3) we know z = 2(n-1) cause we repeat half two times
Then we will get
$2(0.5k_1 + 2k_2)(n-1) + C\ log\ n \Rightarrow (k_1 + 4k_2)(n-1) + C\ log\ n$

Exercise 5:
(1)
$O(1) * 3 + \Theta(n) + O(1) + O(n) + O(n) + O(1)$

(2)

Cost(size of input)	Runtime(run 100 times each){ms}
$2^0 * 1000$	2.855508
$2^1 * 1000$	8.054605
$2^2 * 1000$	24.533155
$2^3 * 1000$	72.385585
$2^4 * 1000$	191.015185
$2^5 * 1000$	450.287061
$2^6 * 1000$	1004.507601
$2^8 * 1000$	2143.65359
$2^9 * 1000$	4472.271875

(3)



The cost and runtime increase linearly.