Introduction to Algorithms: 6.006
Massachusetts Institute of Technology February 14, 2017
Professors Constantinos Daskalakis, Piotr Indyk, and Steve Smith Problem Set 1

Problem Set 1

All parts are due Tuesday, February 28 at 11:59PM.

Name: Faaya Abate Fulas

Collaborators: Name1, Name2

Part A

Problem 1-1. Submit this to gradescope.

(a) Group 1:

$f_1(n) = O(n)$
$f_2(n) = O(\log(\log(n)))$
$f_3(n) = O(n\log(n))$
$f_4(n) = O(\log(n))$
$f_5(n) = n\log(\sqrt{n}) = 0.5n\log(n) = O(n\log(n))$

Since $f_2(n)$ reduces the size of the problem by its square root, its order of growth is slower than $f_4(n)$ which reduces it by half each time. Therefore, the arrangement of the functions in increasing order of growth is $f_2, f_4, f_1, (f_3 = f_5)$

(b) Group2:

$f_1 = O(n^{6.006}\log(n))$
$f_2 = n^2\log(n^{6.006}) = 6.006n^2\log(n) = O(n\log(n)) = O(n^2\log(n))$
$f_3 = O(n^3)$
$f_4 = O(n^2\log(n))$
$f_5 = O(n^3\log(n))$

Arrangement:$(f_2 = f_4), f_3, f_5, f_1$

Problem 1-2. Submit this to gradescope. I used the Master Theorem method to solve all the recurrences below.

(a) $T(n) = \theta(n) since n^{\log_b a} = \theta(n) and f(n) = \theta(1)$

(b) $T(n) = \theta(n \lg(n)) since n^{\log_b a} = \theta(n) and f(n) = \theta(n)$

(c) $T(n) = \theta(n^{\log(3)}) since n^{\log_b a} = \theta(n^{\lg 3}) and f(n) = \theta(n)$

(d) $T(n) = \theta(\log(n)) since n^{\log_b a} = \theta(1) and f(n) = \theta(\log(n))$

(e) $T(n) = \theta(n^2) since n^{\log_b a} = \theta(n) and f(n^2) = \theta(n^2)$

(f) $T(n) = \theta(n^{\lg(7)}) since n^{\log_b a} = \theta(n^{\lg 7}) and f(n) = \theta(n^2)$

Problem 1-3. Submit this to gradescope.

Problem 1-4. Submit this to gradescope.

Part B

Problem 1-5.

(a) *Submit your implementation on alg.csail.mit.edu*