Student Name: _____ J#: _____

CSC 323 Algorithm Design and Analysis, Fall 2017

Instructor: Dr. Natarajan Meghanathan

Quiz 2 (September 26, 2017) Max. Points: 25 Max. Time: 15 min.

1) (10 pts) Solve the recurrence relation: M(n) = M(n-1) + 5 for n > 1; M(1) = 2

$M(n) = M(n-1) + 5$ for $n > 1$

$M(n-1) = M(n-2) + 5$

$\Rightarrow M(n) = \{M(n-2) + 5\} + 5 = M(n-2) + (2 * 5)$

$M(n-2) = M(n-3) + 5$

$\Rightarrow M(n) = \{M(n-3) + 5\} + (2 * 5)$

$M(n) = M(n-3) + (3 * 5)$

In general, $M(n) = M(n-i) + (i * 5)$

put $i = n-1$

$n - i = 1$

$M(n) = M(1) + (n-1) * 5$

$= 2 + (n-1) * 5 = 5n - 3$

$M(n) = \Theta(n)$

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2) (15 pts) Solve the recurrence relation: M(n) = M(n/5) + 1 for n > 1; M(1) = 2.

$M(n) = M(n/5) + 1$ for $n > 1$

Let $n = 5^k$

$M(5^k) = M(5^{k-1}) + 1$ for $k > 0$.

$M(5^0) = 2$

$n = 5^k$, $n > 1$, $5^k > 1$, $k > 0$.

$M(5^k) = M(5^{k-1}) + 1$

$M(5^{k-1}) = M(5^{k-2}) + 1$

$M(5^k) = \{M(5^{k-2}) + 1\} + 1$

$M(5^k) = M(5^{k-2}) + 2$

$M(5^k) = \{M(5^{k-3}) + 1\} + 2 = M(5^{k-3}) + 3$

($M(5^{k-2})$)

$M(5^k) = M(5^{k-i}) + i$

Put $i = k$

$M(5^k) = M(5^0) + (k) = 2 + k.$

$M(n) = 2 + \log_5 n = \Theta(\log n)$