Midterm 2 Version 2 Solution

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April 4, 2020

Question 1

a.

$$\begin{aligned} 100 \div 3 &= 33, \text{ Remainder } \mathbf{1} \\ 33 \div 3 &= 11, \text{ Remainder } \mathbf{0} \\ 11 \div 3 &= 3, \text{ Remainder } \mathbf{2} \\ 3 \div 3 &= 1, \text{ Remainder } \mathbf{0} \\ 1 \div 3 &= 0, \text{ Remainder } \mathbf{1} \end{aligned}$$

It follows from above that the ternary representation of 100 is $(10201)_3$.

b. The largest number expressible by an n-digit binary representation is

$$\sum_{i=0}^{n-1} 2^i \tag{1}$$

Correct Solution:

$$\sum_{i=0}^{n-1} 2^i = \frac{1 - 2^{n-1+1}}{1-2} = 2^n - 1 \tag{1}$$

Notes:

- Noticed professor simplified solution using geometric series
- Geometric series with finite sum

$$\sum_{i=0}^{n} r^k = \frac{1 - r^{n+1}}{1-r}, \text{ where } |r| > 1 \tag{2}$$

c.

$f(n) \in \mathcal{O}(n)$	True	$g(n) \in \Omega(n)$	False	$f(n) \in \Omega(g(n))$	True
$f(n) \in \Theta(g(n))$	False	$g(n) \in \Theta(\log_3 n)$	False	$f(n) + g(n) \in \Theta(f(n))$	True

Notes:

- Learned $\sqrt{n}$ rises faster than $\log n$.
- Learned if $g(n) \in \Theta(f(n))$ is true then $f(n) + g(n) \in \Theta(f(n))$ is true.

Question 2

Question 3

Question 4