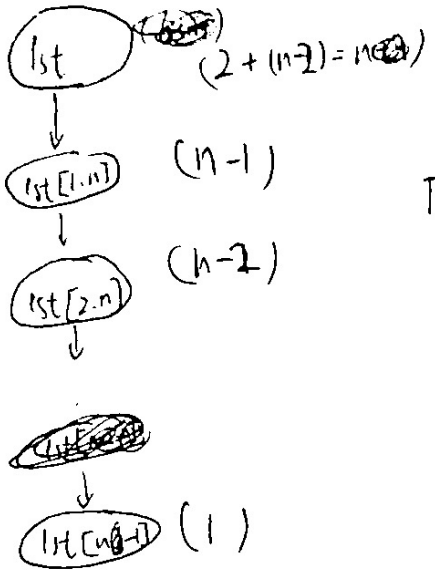
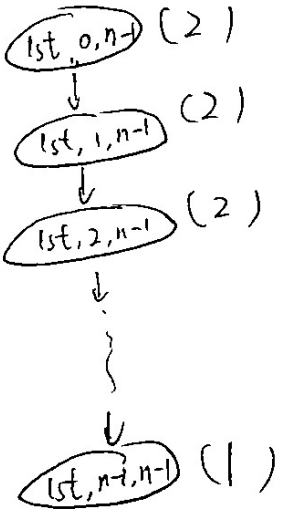
Q1:

Version 1:



$T(n) = n + n-1 + \cdots + 1 = \frac{(n)(n+1)}{2} = \frac{n^2+n}{2} = \theta(n^2)$

Version 2:

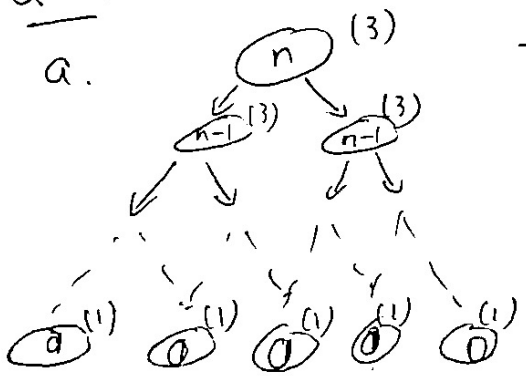


$T(n) = 2 \times (n-1) + 1 = 2n-1 = \theta(n)$

$\theta(n) < \theta(n^2)$. Version 2 is asymptotically faster

Q2:

a.

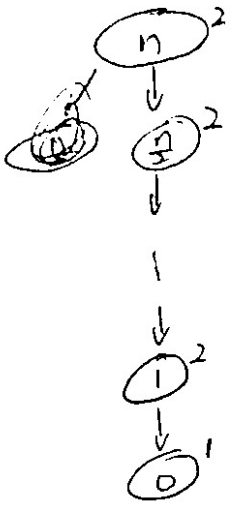


$T(n) = 3 \times (1 + 2 + 4 + 8 + \cdots + 2^{n-1}) + 2^n \times 1$

$= 3 \times (2^n - 1) + 2^n$

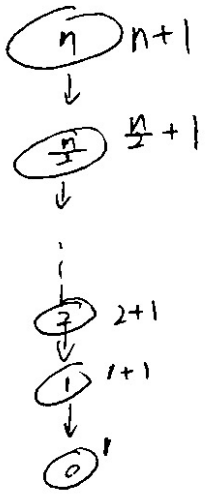
$= 2^{n+2} - 3 = \theta(2^n)$

b.



$T(n) = 2(\log n + 1) + 1 = 2\log n + 3 = \theta(\log n)$

c.



$T(n) = 1 + 1 + 2 + 4 + \cdots + n + \log n + 1$

$= 2n + \log n = \theta(n)$