

# Duke Glenn Assignment 2

1a)  $W(n) = 2W(n/3) + 1$

$$\begin{array}{c} n \\ \swarrow \quad \searrow \\ \frac{n}{3} \quad \frac{n}{3} \quad 2 \\ \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ \frac{n}{9} \quad \frac{n}{9} \quad \frac{n}{9} \quad \frac{n}{9} \quad 4 \\ \vdots \end{array} = O(n^{\log_3 2})$$

1g)  $W(n) = W(n-1) + 2$   
 $= O(n)$

1h)  $W(n) = W(n-1) + n^c, c \geq 1$   
 $= O(n^{c+1})$

1b)  $W(n) = 5W(n/4) + n$

$$\begin{array}{c} n \\ \swarrow \quad \searrow \\ 5 \cdot \frac{n}{4} \\ \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ 5^2 \cdot \frac{n}{4^2} \\ \vdots \end{array} = O(n^{\log_4 5})$$

1i)  $W(n) = W(\sqrt{n}) + 1$   
 $= O(\log(\log n))$

1c)  $W(n) = 7W(n/7) + n$

$$\begin{array}{c} n \\ \swarrow \quad \searrow \\ 7 \cdot \frac{n}{7} \\ \swarrow \quad \searrow \\ 7^2 \cdot \frac{n}{7^2} \\ \vdots \end{array} = O(n \log_7 n)$$

1d)  $W(n) = 9W(n/3) + n^2$

$$\begin{array}{c} n^2 \\ \swarrow \quad \searrow \\ \frac{n^2}{3} \cdot 9 \\ \swarrow \quad \searrow \\ \frac{n^2}{3^2} \cdot 9^2 \\ \vdots \end{array} = O(n^2 \log_3 n)$$

1e)  $W(n) = 8W(n/2) + n^3$

$$\begin{array}{c} n^3 \\ \swarrow \quad \searrow \\ 8 \cdot \left(\frac{n}{2}\right)^3 \\ \swarrow \quad \searrow \\ 8^2 \cdot \left(\frac{n}{2^2}\right)^3 \\ \vdots \end{array} = O(n^3 \log_2 n)$$

1f)  $W(n) = 49W(n/25) + n^{3/2} \log n$   
 $= O(n^{3/2} \log n)$

$$2) A = W(n) = 5(W(n/2) + n) = O(n^{\log_2 5})$$

$$B = 2W(n/2) + 1 = O(n^2)$$

$$C = W(n) = 9W(n/3) + O(n^2) = O(n^2 \log_3 n)$$

I would choose C because it's the fastest