Problem 4

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1. Merge Sort

$$T(n) = 2T(n/2) + \Theta(n)$$
$$\Theta(n^{log_2 2}) = \Theta(n)$$
$$\Theta(n) = \Theta(n)$$
$$By Master Theorem : \Theta(n * lg(n))$$

2. Binary Search

$$T(n) = T(n/2) + \Theta(1)$$
$$\Theta(n^{log_2 1}) = \Theta(1)$$
$$\Theta(1) = \Theta(1)$$
$$By Master Theorem : \Theta(lg(n))$$

3. Karatsuba Multiplication of polynomials

$$T(n) = 3T(n/2) + \Theta(n)$$
$$\Theta(n^{log_2 3}) > \Theta(n)$$
$$By Master Theorem : \Theta(n^{log_2 3})$$