1) Bubble Sort Complexity

i) Number of comparison complexity

Comparison of each number:

$$C(n) = (n-1) + (n-2) \ldots + 1$$

Comparison of each number expressed as a formula:

$$C(n) = \frac{(n-1)n}{2}$$

Comparison expanded:

$$C(n) = \frac{n^2-n}{2}$$

Comparison expressed as in Big-O:

$$O(n^2)$$

ii) Average-case number of swaps for bubble sort

Average-case calculation:

$$S(n) = \frac{(n-1)n}{2} \times \frac{1}{2}$$

Average-case for number of swaps:

$$S(n) = \frac{(n-1)n}{4}$$

Average-case for number of swaps in Big-Θ:

$$\Theta(n^2)$$

4) The results of the graphs do match with the calculations as the both the graphs and the calculations are quadratic