CSCI 305 HW 2

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```
1   for j = 2 to n
2       key = A[j]
3       // Insert A[j] into the sorted
            sequence A[1..j-1]
4       i = j-1
5       while i > 0 and A[i] > key
6           A[i+1] = A[i]
7           i = i -1
8       A[i+1] = key
```

cost	times b.c.	w.c.
C_1	n	n
C_2	$n-1$	$n-1$
C_3	$n-1$	$n-1$
C_4	$n-1$	$n-1$
C_5	n	$\sum_{i=1}^{j-1}$
C_6	0	$\sum_{i=1}^{j-1} i-1$
C_7	0	$\sum_{i=1}^{j-1} i-1$
C_8	$n-1$	$n-1$

1. Walk through the algorithm using the following sequences.

8 2 4 9 3 6	2 3 4 6 8 9	9 8 6 4 3 2
	(terminates)	
1. 2 8 4 9 3 6		1. 8 9 6 4 3 2
2. 2 4 8 9 3 6		2. 8 6 9 4 3 2
3. 2 4 8 3 9 6		3. 6 8 9 4 3 2
4. 2 4 3 8 9 6		4. 6 8 4 9 3 2
5. 2 3 4 8 9 6		5. 6 4 8 9 3 2
6. 2 3 4 8 6 9		6. 4 6 8 9 3 2
7. 2 3 4 6 8 9		7. 4 6 8 3 9 2
		8. 4 6 3 8 9 2
		9. 4 3 6 8 9 2
		10. 3 4 6 8 9 2
		11. 3 4 6 8 2 9
		12. 3 4 6 2 8 9
		13. 3 4 2 6 8 9
		14. 3 2 4 6 8 9
		15. 2 3 4 6 8 9

2. Assign a cost to each line.

$$C_1, C_2, \ldots, C_8$$

3. What is the best case scenario?
   The best case scenario occurs when the array is already fully sorted.

4. What is the worse case scenario?
   The worse case scenario occurs when the array is reverse-sorted.

5. Give the best case runtime.

$$[C_1 \cdot n] + [C_2 \cdot (n-1)] + [C_3 \cdot (n-1)] + [C_4 \cdot (n-1)] + [C_5] \cdot n + [C_6 \cdot 0] + [C_7 \cdot 0] + [C_8 \cdot (n-1)]$$
$$\implies O(n)$$

6. Give the worst case runtime.

$$[C_1 \cdot n] + [C_2 \cdot (n-1)] + [C_3 \cdot (n-1)] + [C_4 \cdot (n-1)] +$$
$$[C_5 \cdot \sum_{i=1}^{j-1} i] + [C_6 \cdot \sum_{i=1}^{j-1} (i-1)] + [C_6 \cdot \sum_{i=1}^{j-1} (i-1)] + [C_8 \cdot (n-1)]$$
$$\implies O(n^2)$$