(Insertion sort)

(3, 44, 38, 5, 47, 15, 36, 26, 27, 2, 46, 4, 19, 50, 48, 43
     33, 34, 25, 1)

1) (3, 44, 38, 5, 47, 15, 36, 26, 27, 2, 46, 4,
      19, 50, 48, 43, 33, 25, 1)

2) (3, 38, 44, 5, 47, 15, 36, 26, 27, 2, 46, 4,
      19, 50, 48, 43, 33, 25, 1)

3) (3, 5, 38, 44, 47, 15, 36, 26, 27, 2, 46, 4,
      19, 50, 48, 43, 33, 25, 1)

4) (3, 5, 38, 44, 47, 15, 36, 26, 27, 2, 46, 4,
      19, 50, 48, 43, 33, 25, 1)

5) (3, 5, 15, 38, 44, 47, 36, 26, 27, 2, 46, 4,
      19, 50, 48, 43, 33, 25, 1)

6) (3, 5, 15, 36, 38, 44, 47, 26, 27, 2, 46, 4,
      19, 50, 48, 43, 33, 25, 1)

7) (3, 5, 15, 26, 36, 38, 44, 47, 27, 2, 46, 4,
      19, 50, 48, 43, 33, 25, 1)

8) (3, 5, 15, 26, 27, 36, 38, 44, 47, 2, 46, 4
      19, 50, 48, 43, 33, 25, 1)

9) (2, 3, 5, 15, 26, 27, 36, 38, 44, 47, 46, 4
      19, 50, 48, 43, 33, 25, 1)

10) (2, 3, 5, 15, 26, 27, 36, 38, 44, 46, 47, 4,
      19, 50, 48, 43, 33, 25, 1)

11) (2, 3, 4, 5, 15, 26, 27, 36, 38, 44, 46, 47,
19, $50, 48, 43, 33, 25, 1)

12) (2, 3, 4, 5, 15, 19, 26, 27, 36, 38, 44, 46, 47,
$50, 48, 43, 33, 25, 1)

13) (2, 3, 4, 5, 15, 19, 26, 27, 36, 38, 44, 46, 47,
$50, 48, 43, 33, 25, 1)

14) (2, 3, 4, 5, 15, 19, 26, 27, 36, 38, 44, 46, 47,
48, $50, 43, 33, 25, 1)

15) (2, 3, 4, 5, 15, 19, 26, 27, 36, 38, 43, 44, 46,
47, 48, $50, 33, 25, 1)

16) (2, 3, 4, 5, 15, 19, 26, 27, 33, 36, 38, 43,
44, 46, 47, 48, $50, 25, 1)

17) (2, 3, 4, 5, 15, 19, 25, 26, 27, 33, 36, 38, 43,
44, 46, 47, 48, $50, 1)

18) (1, 2, 3, 4, 5, 15, 19, 25, 26, 27, 33, 36,
38, 43, 44, 46, 47, 48, $50)

Sudo code

```
for  J=2  to n                          C1
  {    key = A[J]                        C2
       i = j-1                           C4
  While (i>0) and (A[i] >key)            C5
    {    A[i+1] = A[i]                    C6
          i = i-1 }                       C7
       A[i+1] = key;                      C8
   }
```

J = 1,2,....n

Cost	time complexity
c_1	n
c_2	$(n-1)$
c_4	$(n-1)$
c_5	A
c_6	B
c_7	C
c_8	$(n-1)$

$\Rightarrow$ Best case (arr is sorted)

$$T(n) = \underbrace{(c_1+c_2+c_4+c_5+c_8)}_{L := a} n - \underbrace{(c_2+c_4+c_5+c_8)}_{L := b}$$

$$= an + b$$

$$T(n) = O(n)$$

⇒ worst case

$$T(n) = C_1 n + C_2(n-1) + C_4(n-1) + C_5\left(n \frac{n+1}{2} - 1\right)$$
$$+ C_6\left(\frac{n(n-1)}{2}\right) + C_7\left(\frac{n(n-1)}{2}\right) + C_8(n-1)$$

$$= an^2 + bn + c$$
$$O(n^2)$$

⇒ avg case
$$O(n^2)$$

/ ———————— /