GDI2 -1 - Algorithmen

Insertion Sort I

(a)

1	2	3	4	5	6
5	2	4	6	1	3

(b)

1	2	3	4	5	6
2	5	4	6	1	3

(c)

1	2	3	4	5	6
2	4	5	6	1	3

(d)

1	2	3	4	5	6
2	4	5	6	1	3

(e)

1	2	3	4	5	6
1	2	4	5	6	3

(f)

1	2	3	4	5	6
1	2	3	4	5	6
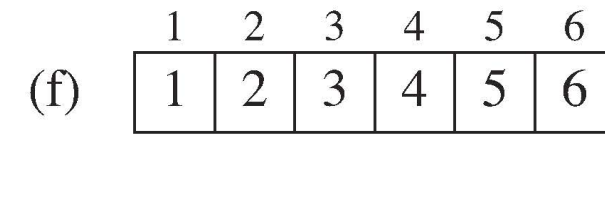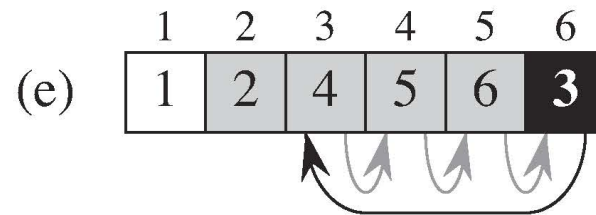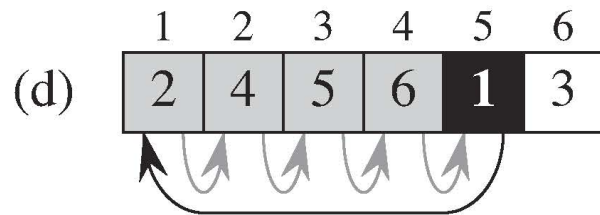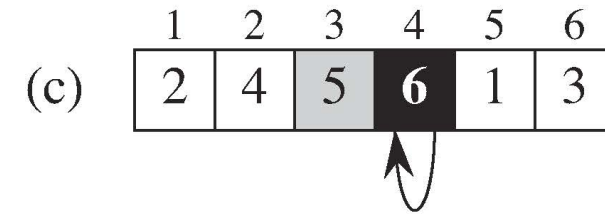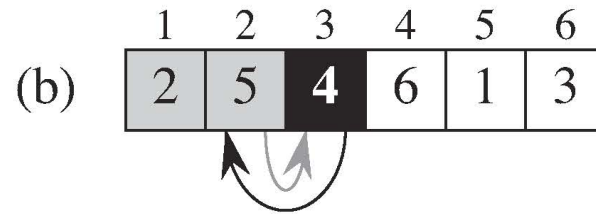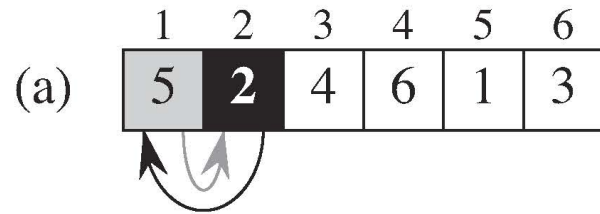
Insertion Sort II

INSERTION-SORT(A)

```
1   for j = 2 to A.length
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
```

Insertion Sort Analyse I

INSERTION-SORT(A)	cost
1 **for** $j = 2$ **to** $A.length$	c_1
2 $key = A[j]$	c_2
3 **//** Insert $A[j]$ into the sorted	
sequence $A[1 .. j - 1]$.	0
4 $i = j - 1$	c_4
5 **while** $i > 0$ and $A[i] > key$	c_5
6 $A[i + 1] = A[i]$	c_6
7 $i = i - 1$	c_7
8 $A[i + 1] = key$	c_8

Insertion Sort Analyse II

INSERTION-SORT(A)	cost	times
1 **for** $j = 2$ **to** $A.length$	c_1	n
2 $key = A[j]$	c_2	$n - 1$
3 **//** Insert $A[j]$ into the sorted		
sequence $A[1 .. j - 1]$.	0	$n - 1$
4 $i = j - 1$	c_4	$n - 1$
5 **while** $i > 0$ and $A[i] > key$	c_5	$\sum_{j=2}^{n} t_j$
6 $A[i + 1] = A[i]$	c_6	$\sum_{j=2}^{n} (t_j - 1)$
7 $i = i - 1$	c_7	$\sum_{j=2}^{n} (t_j - 1)$
8 $A[i + 1] = key$	c_8	$n - 1$

Insertion Sort Analyse III

$$T(n) = c_1 n + c_2(n-1) + c_4(n-1) + c_5 \sum_{j=2}^{n} t_j + c_6 \sum_{j=2}^{n}(t_j - 1)$$

$$+ c_7 \sum_{j=2}^{n}(t_j - 1) + c_8(n-1) \; .$$

Insertion Sort Analyse Best Case

$$T(n) = c_1 n + c_2(n-1) + c_4(n-1) + c_5 \sum_{j=2}^{n} t_j + c_6 \sum_{j=2}^{n} (t_j - 1)$$

$$+ c_7 \sum_{j=2}^{n} (t_j - 1) + c_8(n-1) .$$

$$t_j = 1$$

$$T(n) = c_1 n + c_2(n-1) + c_4(n-1) + c_5(n-1) + c_8(n-1)$$

$$= (c_1 + c_2 + c_4 + c_5 + c_8)n - (c_2 + c_4 + c_5 + c_8) .$$

Insertion Sort Analyse Worst Case

$$T(n) \;=\; c_1 n + c_2(n-1) + c_4(n-1) + c_5 \sum_{j=2}^{n} t_j + c_6 \sum_{j=2}^{n} (t_j - 1)$$

$$+ c_7 \sum_{j=2}^{n} (t_j - 1) + c_8(n-1) \; .$$

$$t_j = j \qquad \sum_{j=2}^{n} j = \frac{n(n+1)}{2} - 1 \qquad \sum_{j=2}^{n} (j-1) = \frac{n(n-1)}{2}$$

$$T(n) = c_1 n + c_2(n-1) + c_4(n-1) + c_5 \sum_{j=2}^{n} t_j + c_6 \sum_{j=2}^{n} (t_j - 1)$$

$$+ c_7 \sum_{j=2}^{n} (t_j - 1) + c_8(n-1) \ .$$

$$t_j = j \qquad \sum_{j=2}^{n} j = \frac{n(n+1)}{2} - 1 \qquad \sum_{j=2}^{n} (j-1) = \frac{n(n-1)}{2}$$

$$T(n) = c_1 n + c_2(n-1) + c_4(n-1) + c_5 \left(\frac{n(n+1)}{2} - 1 \right)$$

$$+ c_6 \left(\frac{n(n-1)}{2} \right) + c_7 \left(\frac{n(n-1)}{2} \right) + c_8(n-1)$$

$$= \left(\frac{c_5}{2} + \frac{c_6}{2} + \frac{c_7}{2} \right) n^2 + \left(c_1 + c_2 + c_4 + \frac{c_5}{2} - \frac{c_6}{2} - \frac{c_7}{2} + c_8 \right) n$$

$$- (c_2 + c_4 + c_5 + c_8) \ .$$