Iteration (1A)

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Sigma Notation and Flow Chart (1)
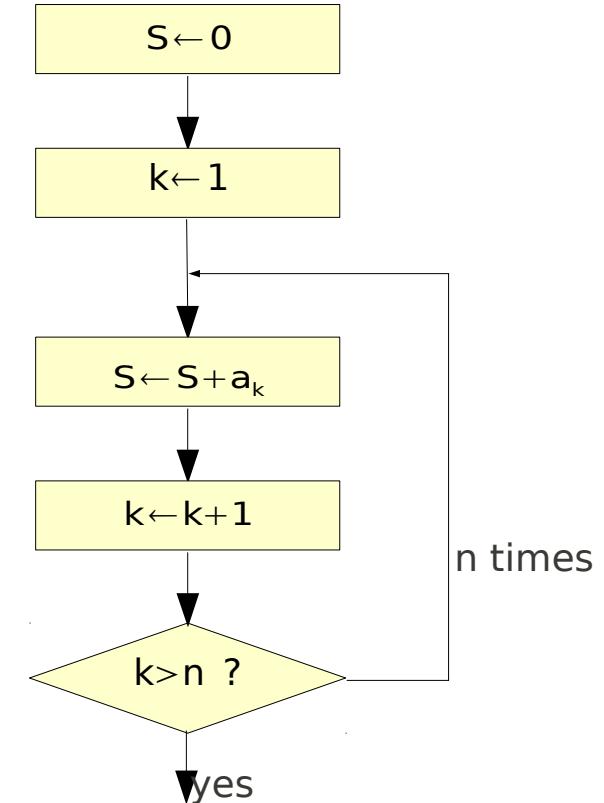
$$S_n = \sum_{k=1}^{n} a_k$$

$$= a_1 + a_2 + a_3 + \quad \cdots \quad + a_n$$

$S \leftarrow 0$

$k \leftarrow 1$

$S \leftarrow S + a_k$

$k \leftarrow k + 1$

n times

$k > n$?

yes

$a_1 = 2,$
$a_2 = 4,$
$a_3 = 6,$
$a_4 = 8,$
$a_5 = 10$

Iteration

3

Sigma Notation and Flow Chart (2)

1st Iteration (S=0, k=1)	2nd Iteration (S=2, k=2)	3rd Iteration (S=6, k=3)	4th Iteration (S=12, k=4)	5th Iteration (S=20, k=5)
$S \leftarrow 0 + a_1$	$S \leftarrow 2 + a_2$	$S \leftarrow 6 + a_3$	$S \leftarrow 12 + a_4$	$S \leftarrow 20 + a_5$
$k \leftarrow 1 + 1$	$k \leftarrow 2 + 1$	$k \leftarrow 3 + 1$	$k \leftarrow 4 + 1$	$k \leftarrow 5 + 1$
$k > 5$? no	$k > 5$? no	$k > 5$? no	$k > 5$? no	$k > 5$? yes

Final result (S=30, k=6)

$a_1 = 2,$
$a_2 = 4,$
$a_3 = 6,$
$a_4 = 8,$
$a_5 = 10$

Sigma Notation and Flow Chart (3)

Chart 1:

$S \leftarrow 0$

$k \leftarrow 1$ $k = 1, 2, 3, 4, 5$

$S \leftarrow S + a_k$

$k \leftarrow k+1$

$k < n$? → yes

$k = 2, 3, 4, 5, 6$

Chart 2:

$S \leftarrow 0$

$k \leftarrow 0$ $k = 1, 2, 3, 4, 5$

$k \leftarrow k+1$

$S \leftarrow S + a_k$

$k \leq n$? → yes

$k = 1, 2, 3, 4, 5$

Chart 3:

$S \leftarrow 0$

$k \leftarrow 1$ $k = 1, 2, 3, 4, 5$

$S \leftarrow S + a_k$ $k \leftarrow k+1$

$k \leq n$? → yes

$k = 1, 2, 3, 4, 5$
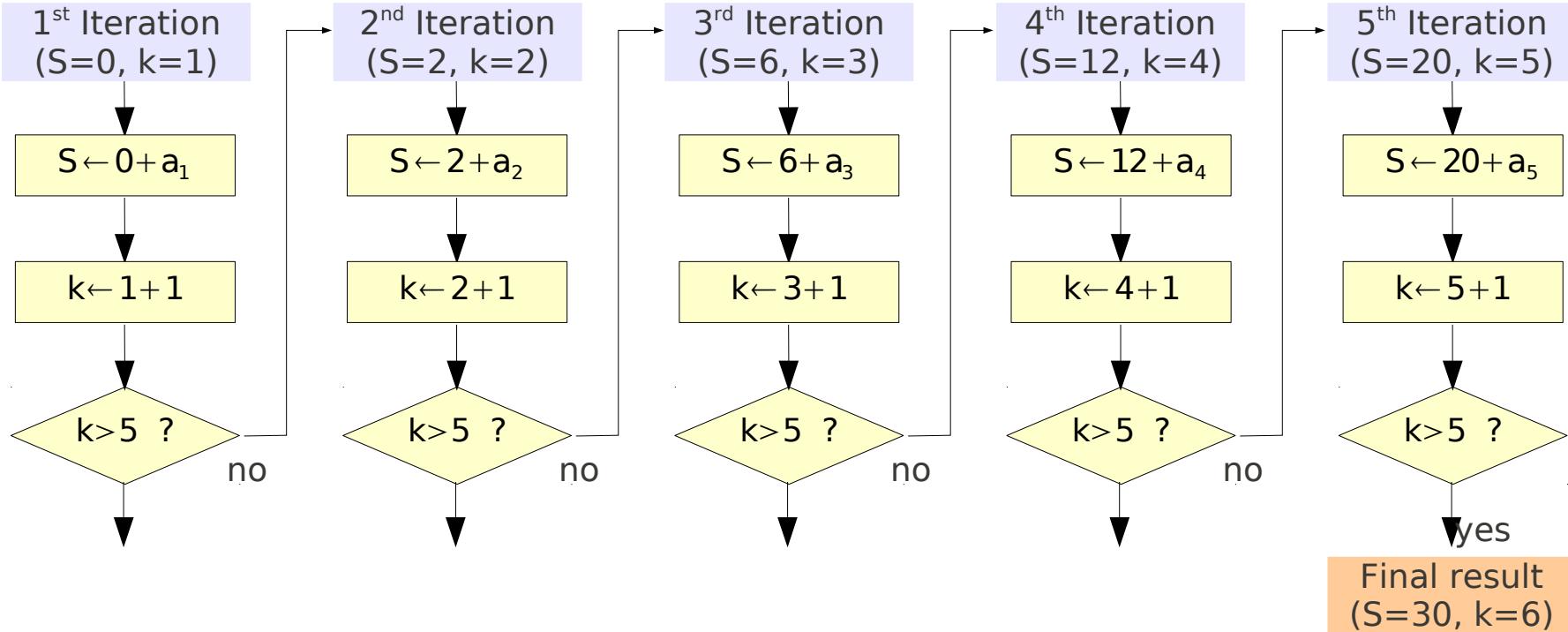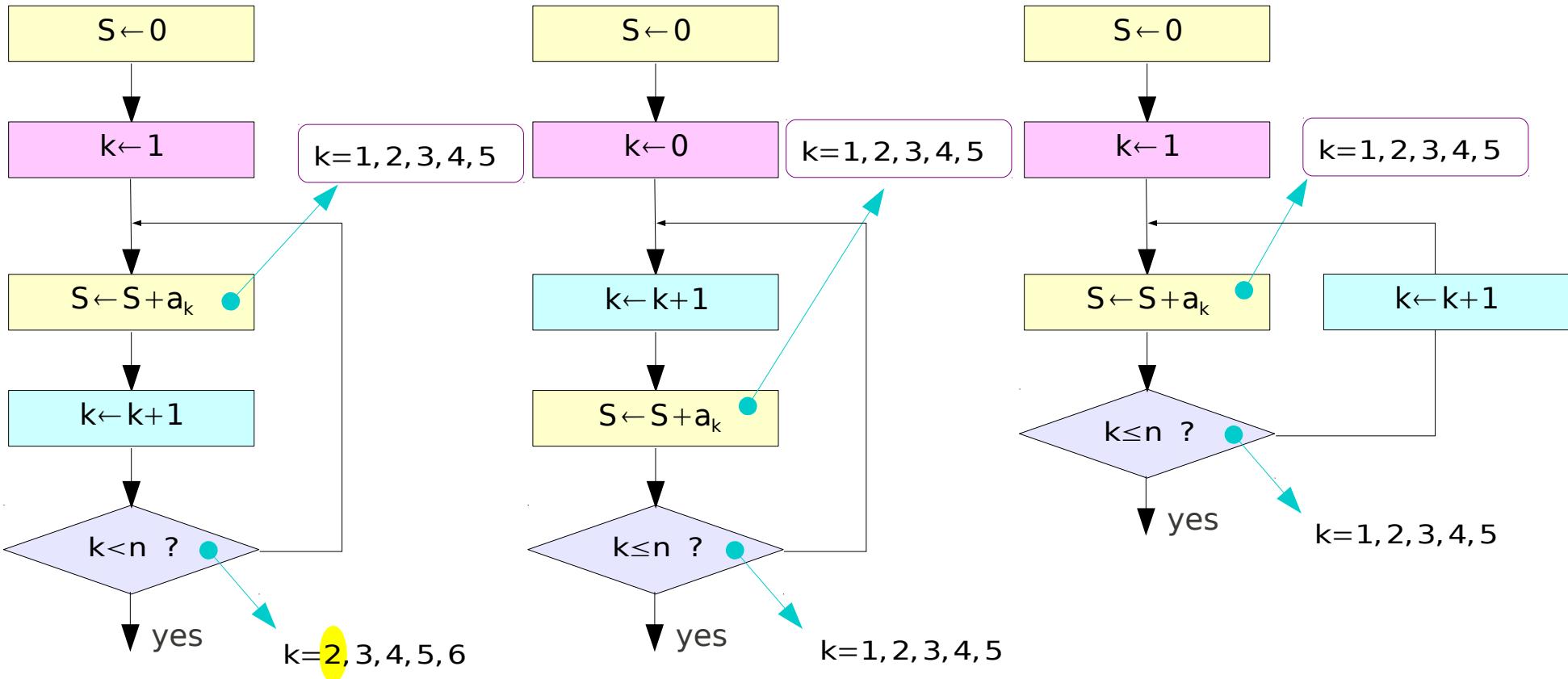
for loop

S = 0;
for (k=0; k<5; k++) {
    S = S + k+1;
}

S = 0;
for (k=1; k<6; k++) {
    S = S + k;
}

S ← 0

k ← 0

k < 5   no

yes

S ← S + k+1

k ← k + 1

Next Statement

fixed

S ← 0

k ← 1

k < 6   no

yes

S ← S + k

k ← k + 1

Next Statement
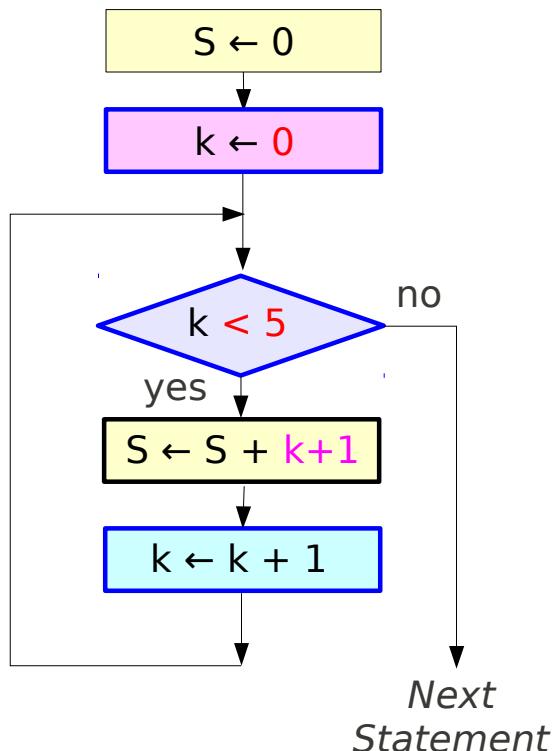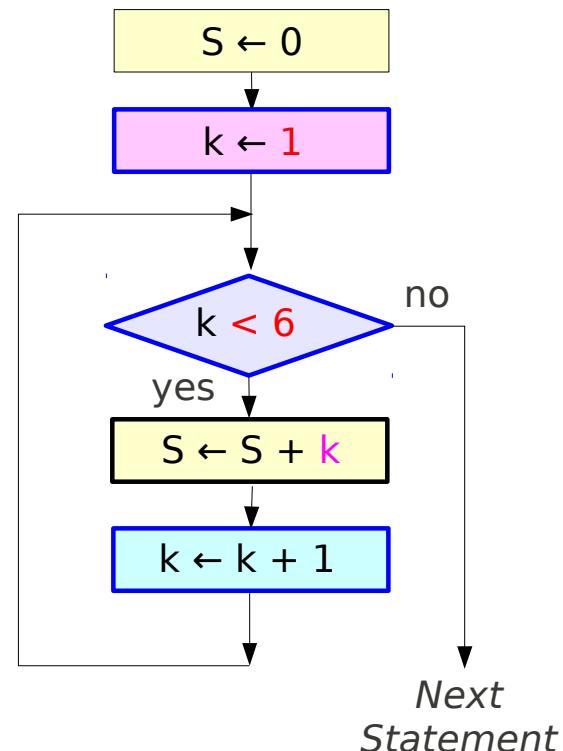
while loop

S = 0; k=0;
  while (k<5) {
      k = k+1;
      S = S+k;
}

S = 0; k=1;
  while (k<6) {
      S = S+k;
   k = k+1;
}
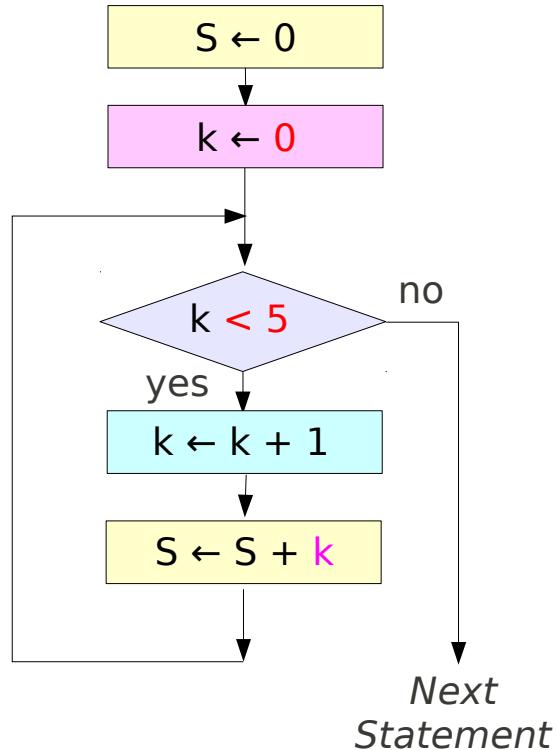

flexible
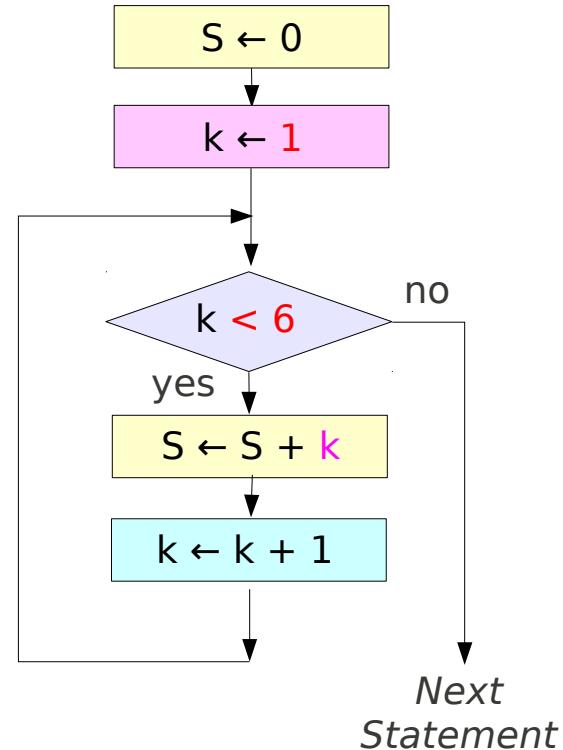
do-while loop

```
S = 0; k=0;
do  {
    k = k+1;
    S = S+k;
} while (k<5);
```

```
S = 0; k=1;
do {
    S = S+k;
    k = k+1;
} while (k<6);
```

S ← 0

k ← 0

k ← k + 1

S ← S + k

k < 5   no

yes

Next
Statement

*flexible,
at least once*

S ← 0

k ← 1

S ← S + k

k ← k + 1

k < 6   no

yes

Next
Statement

Iteration

8
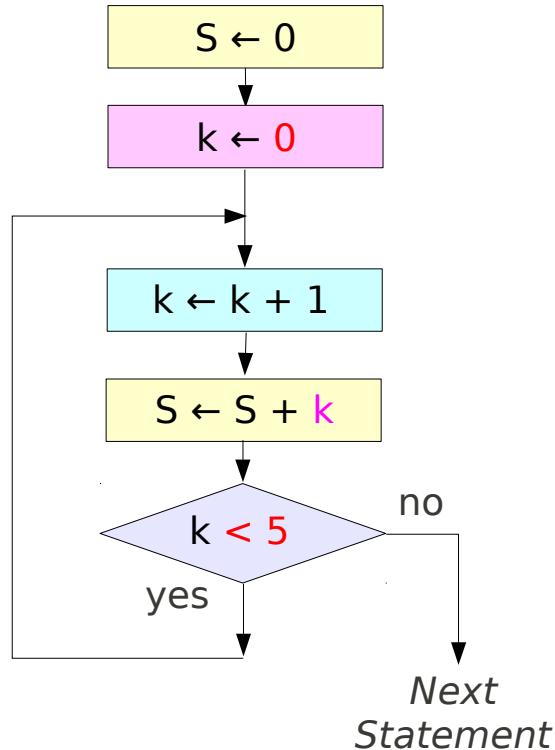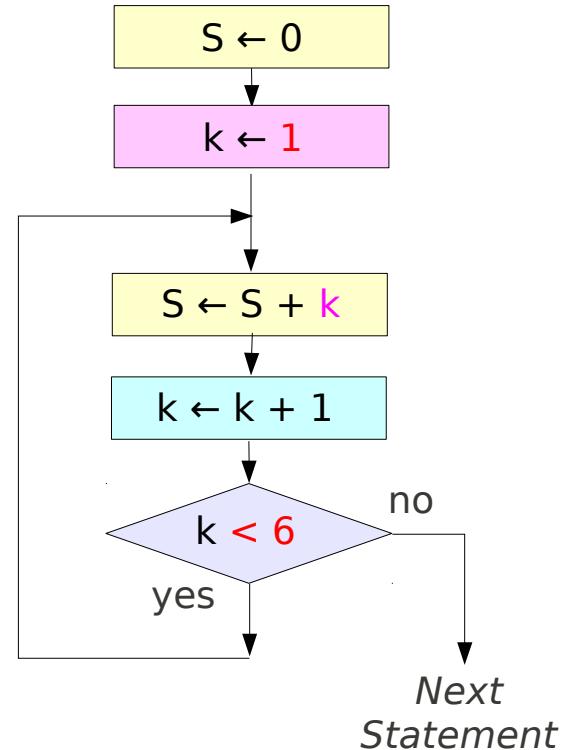
2-d Array

References

[1]   Essential C, Nick Parlante
[2]   Efficient C Programming, Mark A. Weiss
[3]   C A Reference Manual, Samuel P. Harbison & Guy L. Steele Jr.
[4] C Language Express, I. K. Chun