while and do-while Statements

Outline

- Introduction
- while Loop
- do-while Loop

- Introduction

- *Loops* in Java are similar to those in other high-level languages
- Java has three types of loop statements:
  - The **`while`**
  - The **`do-while`**
  - The **`for`**
- The code that is repeated in a loop is called the *body* of the loop
- Each repetition of the loop body is called an *iteration* of the loop

- while loop

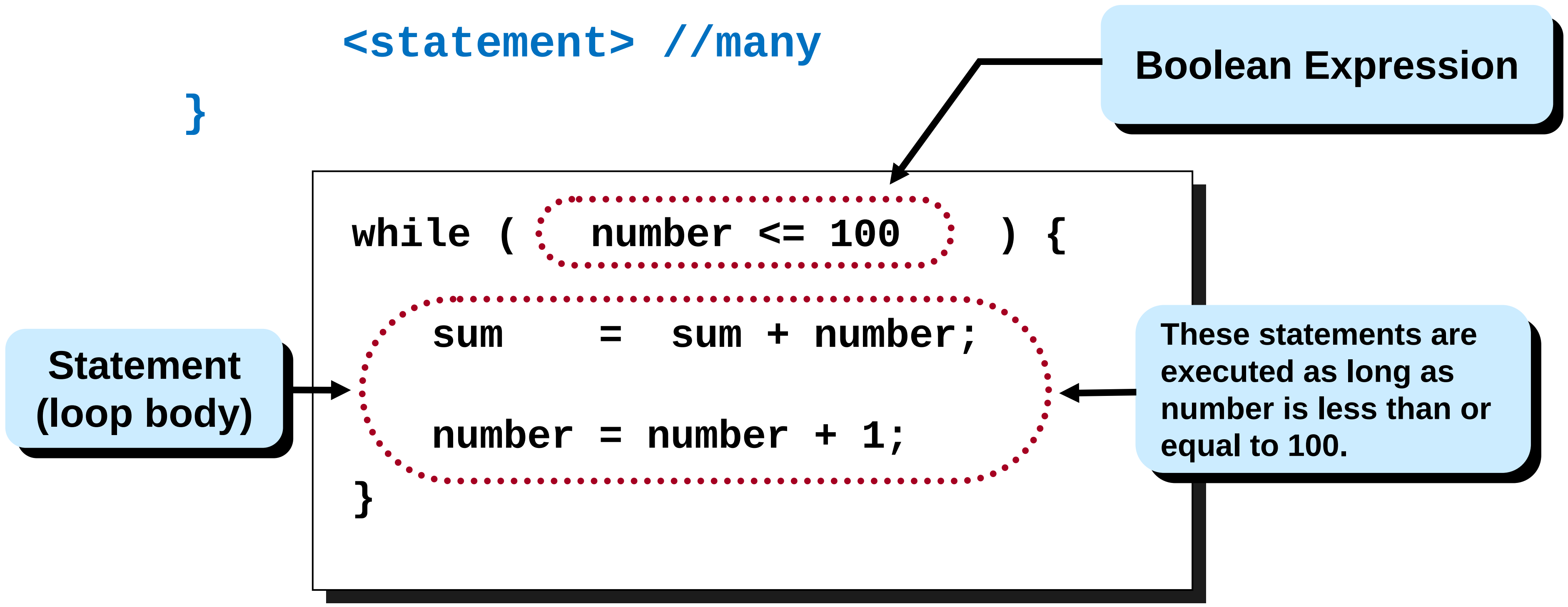
- A `while` statement is used to repeat a portion of code (i.e., the loop body) based on the evaluation of a Boolean expression
    - The Boolean expression is checked *before* the loop body is executed
        - When false, the loop body is not executed at all
    - Before the execution of each following iteration of the loop body, the Boolean expression is checked again
        - If true, the loop body is executed again
        - If false, the loop statement ends
    - The loop body can consist of a single statement, or multiple statements enclosed in a pair of braces (`{ }`)

-- while Loop Syntax

```
while ( <boolean expression> )
      <statement> //only one statement
```

OR

```
while ( <boolean expression> ) {
      <statement> //many
}
```

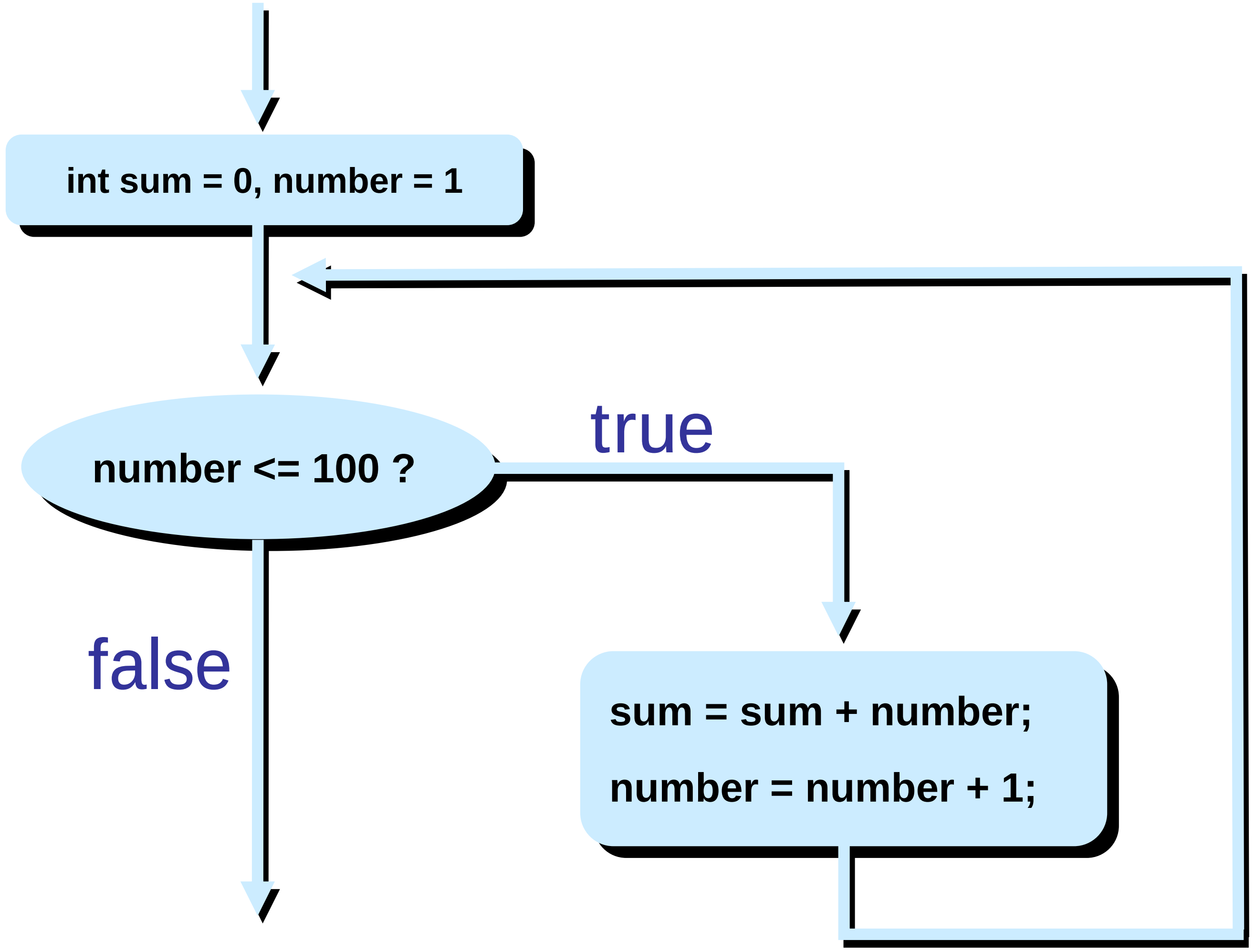


```
while (  number <= 100  ) {
    sum    =  sum + number;

    number = number + 1;
}
```

Boolean Expression
Statement (loop body)
These statements are executed as long as number is less than or equal to 100.

-- while Loop Control flow



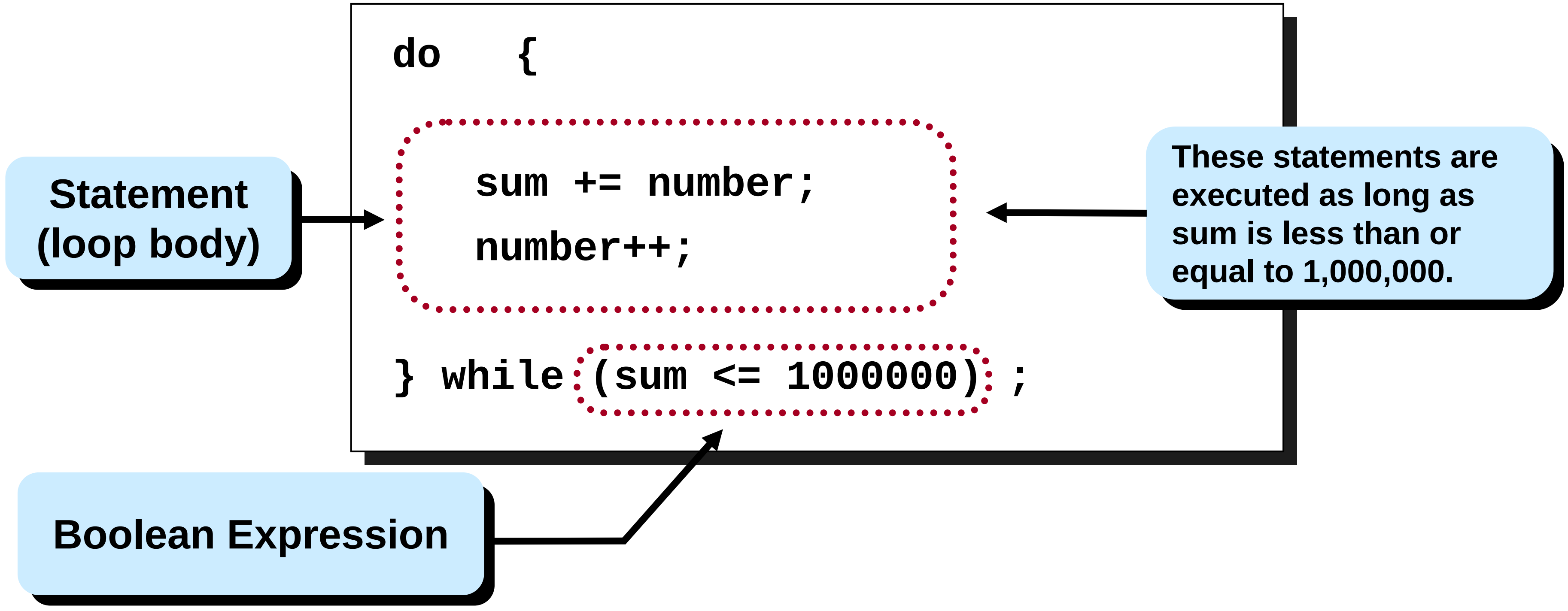
-`do-while` Loop

- A `do-while` statement is used to execute a portion of code (i.e., the loop body), and then repeat it based on the evaluation of a Boolean expression
  - The loop body is executed at least once
    - The Boolean expression is checked *after* the loop body is executed
  - The Boolean expression is checked after each iteration of the loop body
    - If true, the loop body is executed again
    - If false, the loop statement ends
    - Don't forget to put a semicolon after the Boolean expression
  - Like the while statement, the loop body can consist of a single statement, or multiple statements enclosed in a pair of braces (`{ }`)

-- do-while Loop Syntax

```
do {
      <statement>

} while (<boolean expression>);
```



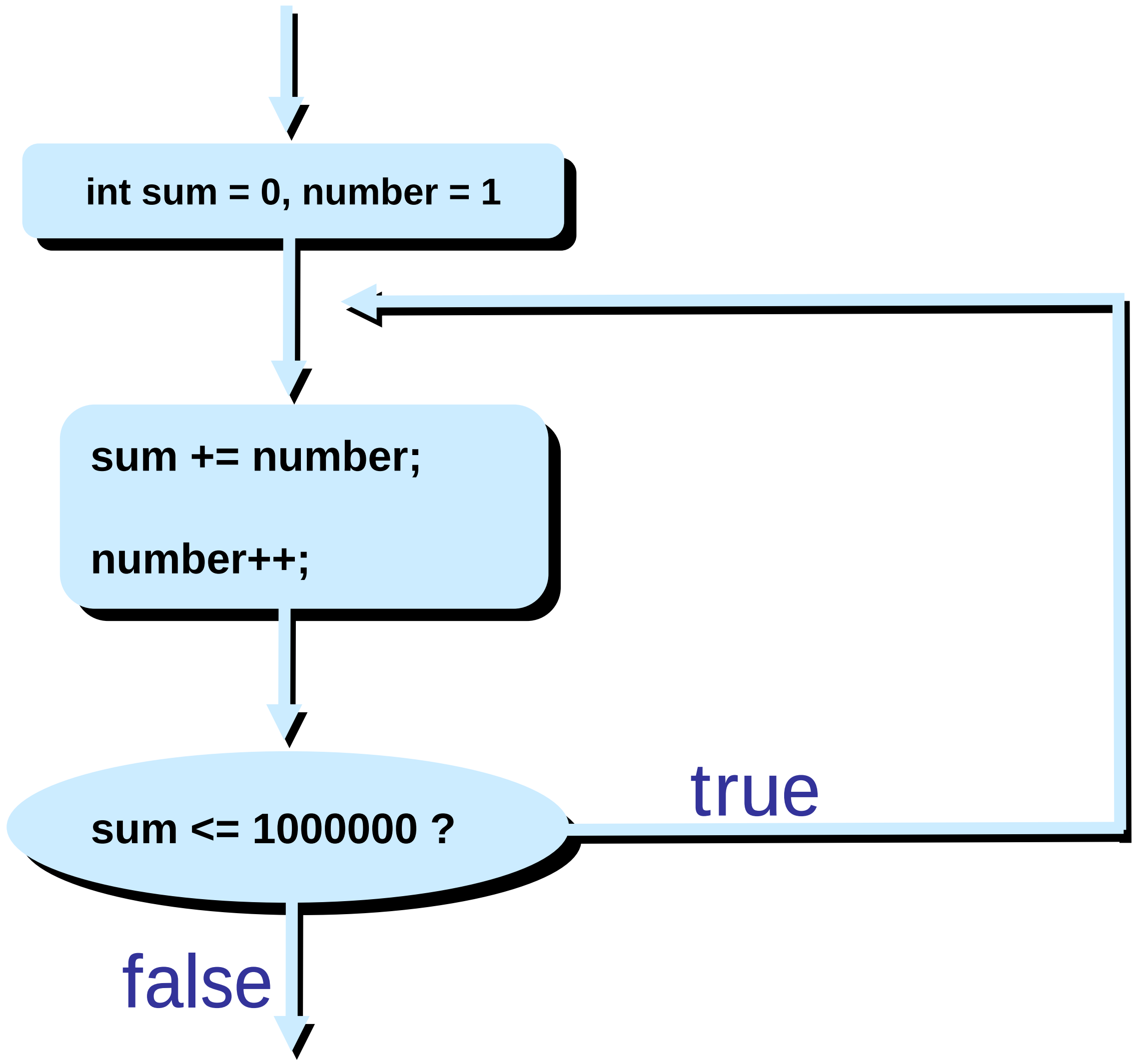
```
do   {

   sum += number;
   number++;

} while (sum <= 1000000) ;
```

Statement (loop body)
These statements are executed as long as sum is less than or equal to 1,000,000.
Boolean Expression

-- do-while Loop Control Flow



THE END

Examples

Questions

1. Write a Java program which computes the sum of all the odd numbers between 0 and 100.

2. Write a Java program which reads 20 numbers using a scanner and computes their average.

3. Write a Java program which reads unknown number of integers using a scanner and counts the number of odd numbers and the number of even numbers. Assume the input integers are all positive. Use a negative number as a sentinel.

Solution using while loop

Q1 Solution

Write a Java program which computes the sum of all the odd numbers between 0 and 100.

```
int n =1;
int sum = 0;
while (n < 100) {
  sum += n;
  n = n + 2;
}
System.out.println("The sum is " + sum);
```

Q2 Solution

Write a Java program which reads 20 numbers using a scanner and computes their average.

```
Scanner kb = new Scanner(System.in);
int cnt = 0;
double x;
double sum = 0;
While (cnt < 20) {
  x = kb.nextDouble();
  sum += x;
  cnt++;
}
System.out.println("The Average is " + sum/cnt);
```

Q3 Solution

Write a Java program which reads unknown number of integers using a scanner and counts the number of odd numbers and the count of even numbers. Assume the input integers are all positive. Use any negative number as a sentinel.

```
Scanner kb = new Scanner(System.in);
int even_cnt = 0;
int odd_cnt = 0;
double x = kb.nextInt();
while (x > 0) {
  if ( mod(x,2) == 0)
     even_cnt++;
  else
     odd_cnt++;
  x = kb.nextInt();
}
System.out.println("Even numbers are = " + even_count);
System.out.println("Odd numbers are = " + odd_count);
```

Solution using do-while loop

Q1 Solution

Write a Java program which computes the sum of all the odd numbers between 0 and 100.

```
int n = 1;
int sum = 0;
do {
   sum += n;
   n = n + 2;
   } While ( n < 100)
System.out.println("The sum is " + sum);
```

Q2 Solution

Write a Java program which reads 20 numbers using a scanner and computes their average.

```
Scanner kb = new Scanner(System.in);
int cnt = 0;
double x;
double sum = 0;
do {
  System.out.println(“Enter a number”);
  x = kb.nextDouble();
  sum += x;
  cnt++;
} while (cnt < 20);
System.out.println(“The Average is “ + sum/cnt);
```

Q3 Solution

Write a Java program which reads unknown number of integers using a scanner and counts the number of odd numbers and the count of even numbers. Assume the input integers are all positive. Use any negative number as a sentinel.

```
Scanner kb = new Scanner(System.in);
int even_cnt = 0;
int odd_cnt = 0;
double x = kb.nextInt();
if (x > 0) {
    do {
    if ( mod(x,2) == 0)
           even_cnt++;
    else
           odd_cnt++;
           x = kb.nextInt();
    } while ( x > 0)
}
System.out.println("Even numbers are = " + even_count);
System.out.println("Odd numbers are = " + odd_count);
```

Additional Slides

while Loop Pitfall - 1

1

```
int product = 0;

while ( product < 500000 ) {
    product = product * 5;
}
```

2

```
int count = 1;

while ( count != 10 ) {
    count = count + 2;
}
```

Infinite Loops

Both loops will not terminate because the boolean expressions will never become false.

while Loop Pitfall - 2

1

```
double count = 0.0;

while ( count != 1.0 ) {
    count = count + 1.0/3.0;
}
```

2

```
double count = 0.0;

while ( count <= 1.0 ) {
    count = count + 1.0/3.0;
}
```

Using Real Numbers

Loop 2 terminates, but Loop 1 does not because only an approximation of a real number can be stored in a computer memory.

while Loop Pitfall - 3

- Goal: Execute the loop body 10 times.

1 ✗
```
count = 1;
while (count < 10) {
    . . .
    count++;
}
```

2 ✓
```
count = 1;
while (count <= 10) {
    . . .
    count++;
}
```

3 ✗
```
count = 0;
while (count <= 10) {
    . . .
    count++;
}
```

4 ✓
```
count = 0;
while (count < 10) {
    . . .
    count++;
}
```

1 and 3 exhibit off-by-one error.

Checklist for Repetition Control

1. Watch out for the off-by-one error (OBOE).
2. Make sure the loop body contains a statement that will eventually cause the loop to terminate.
3. Make sure the loop repeats exactly the correct number of times.