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- **Pseudocode**
- **Simple Debugging**
- **Iteration (using loops)**
- **Arrays**

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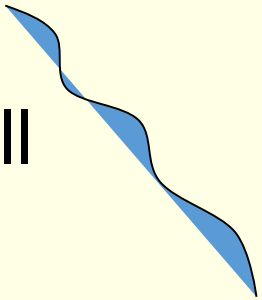
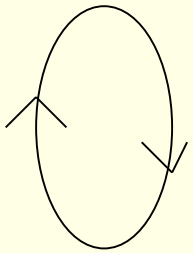
The Software Life Cycle

Waterfall model



1. Requirements
2. Design
3. Implementation
4. Testing
5. Maintenance



Spiral model

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Pseudocode

Used for algorithm design,
i.e. creating a recipe

Example>

Write a program that calculates the mowing time in minutes and seconds for a rectangular block of land whose dimensions are input by the user. The mower mows at 2 square metres / second.

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Level 1 pseudocode

input width and length
area = width x length
time = area / rate
display time

Level 2 pseudocode

input width to nearest metre
input length to nearest metre
area = width x length
time = area / 2 rounded down to nearest second
mins = time / 60
secs = time % 60
display mins and secs

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C# implementation

```
static void Main(string[ ] args)
{
    int width,  length;
    string input;
    Console.WriteLine("Enter width to nearest whole metre >");
    input = Console.ReadLine();
    width = int.Parse( input );
    Console.WriteLine("Enter length to nearest whole metre >");
    input = Console.ReadLine();
    length = int.Parse( input );
    int area = width * length;
    int time = area / 2;
    int mins = time / 60;
    int secs = time % 60;
    Console.WriteLine(“Time  is " + mins + “min “ + secs + “s” );
}
```

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- No accepted protocol as to how to write pseudocode
- No indication of type
- Step-wise (top-down) refinement can selectively clarify and identify possible devolvement to subprogram(s)
- Syntax common to many languages used eg ‘*’, ‘{‘

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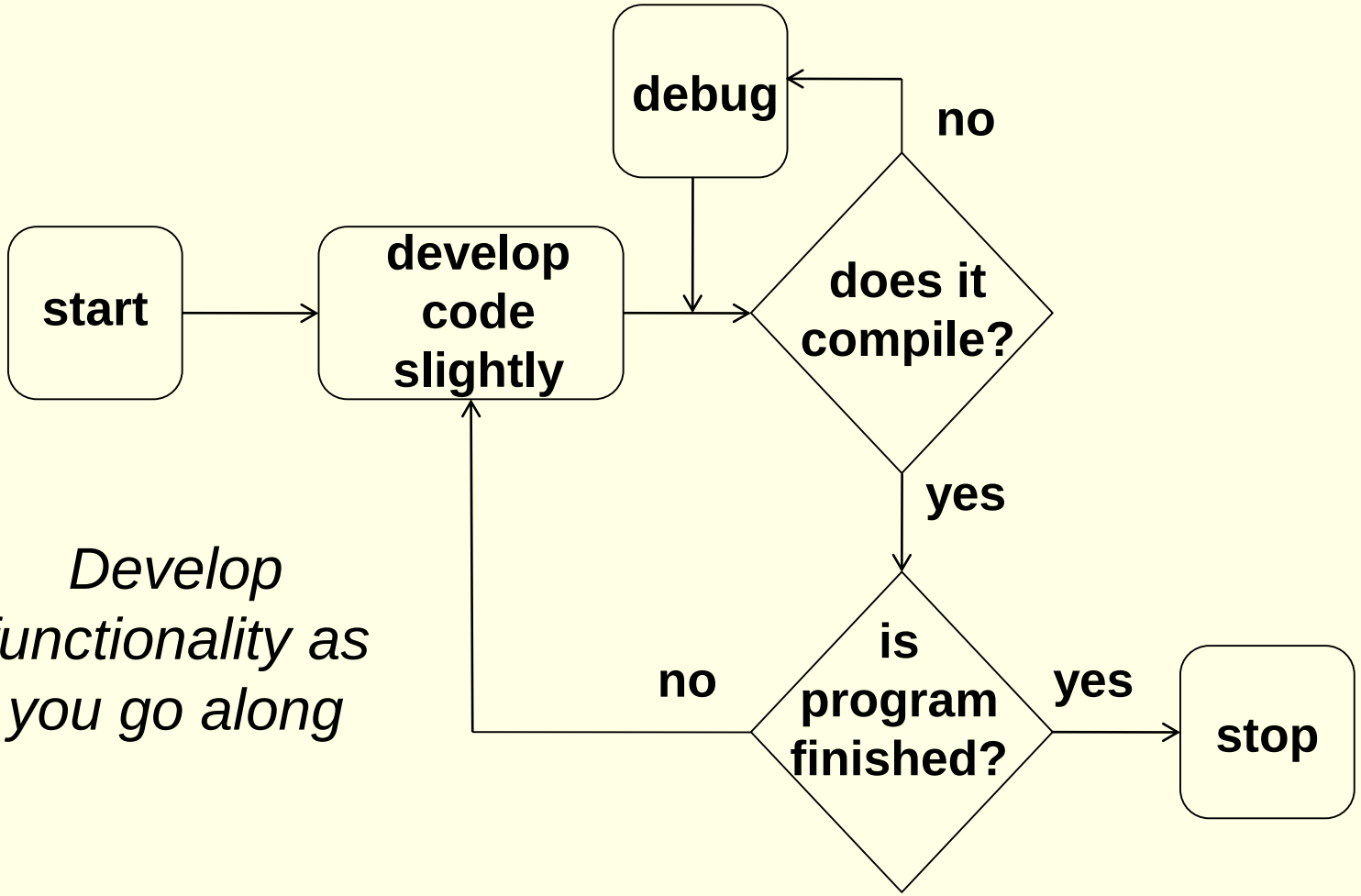
Debugging



Develop functionality as you go along

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Develop functionality as you go along

- Trace statements

  Insert print commands at points to display values

  Console.WriteLine(“val is “ + num);
  Console.WriteLine(“ OK to here”);

- Use the IDE Debugging tool

  Step-through the program line-by-line

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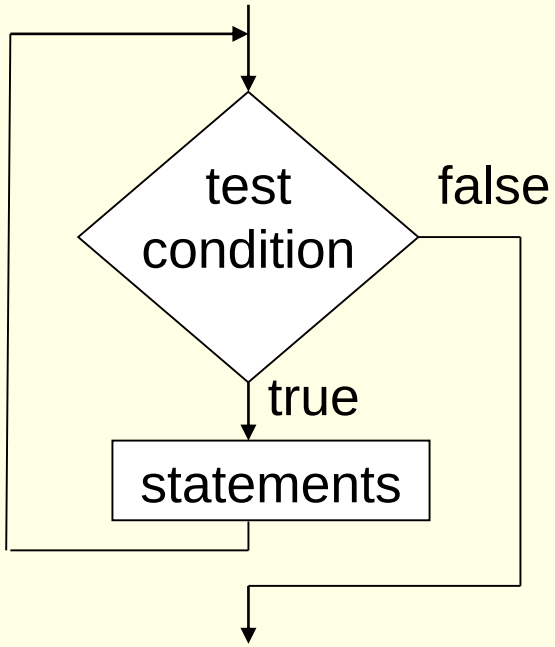
ITERATION

ITERATION: while, do-while, for



The while loop

```
int val = 4;
while ( val < 100 )
{
   val = val + 1;
}
```

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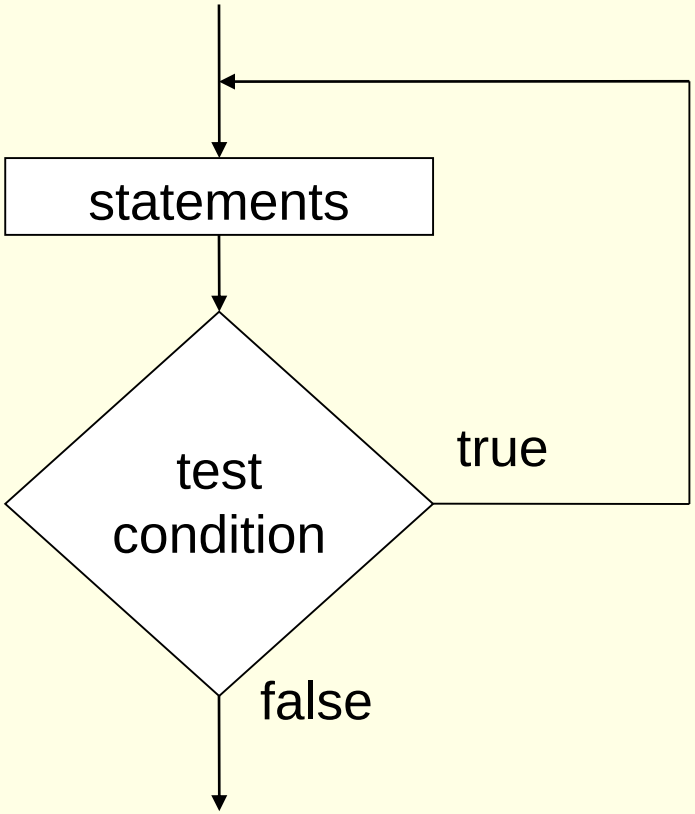
The do-while loop




```
int val = 4;
do
{
   val = val + 1;
} while ( val < 100 );
```

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The for loop

```
for( count=0; condition; count++ )
{
   statements;
}
```

```
double val = 3.4;
for( int num=0; num < 50; num++ )
{
   val = val * 1.5;
}
```

Post - incrementation

num++; *is short-hand for:* **num = num + 1;**

```
int  a, var = 6;
a = var++;      /* var= 7 and a=7 */
```

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Arrays

Primitive types: e.g. **int, double, bool,** etc

```
int val;
val = 6;
```

Can also define a collection of values of the same type; this is an *array*.

```
int[ ] numbers = { 4, 3, 9, 2, 5 };
```

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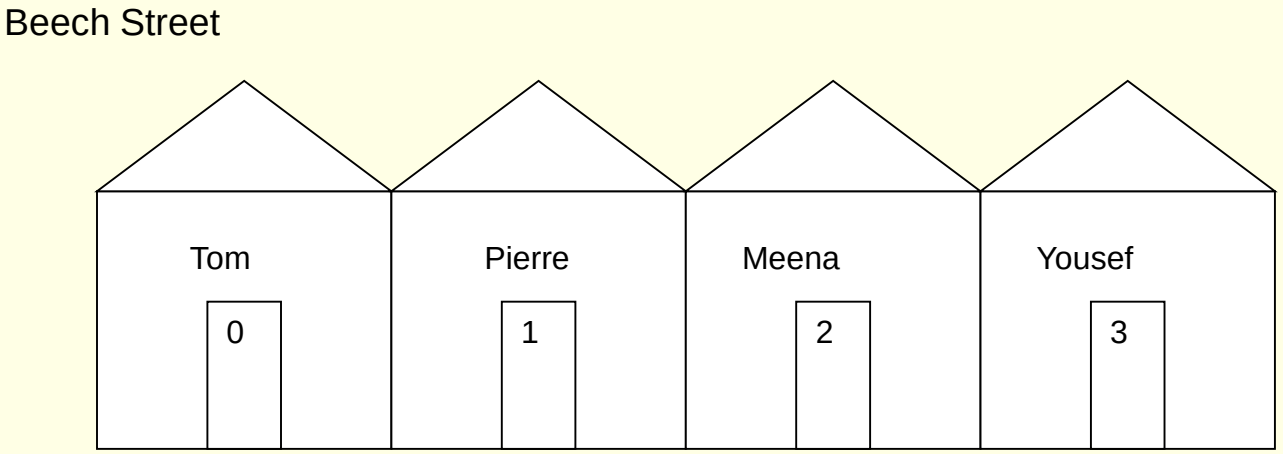
An array is rather like a street of terraced houses



Name of the street = variable name of the array
Consecutive house numbers = elements of the array
Occupant of each house = value stored

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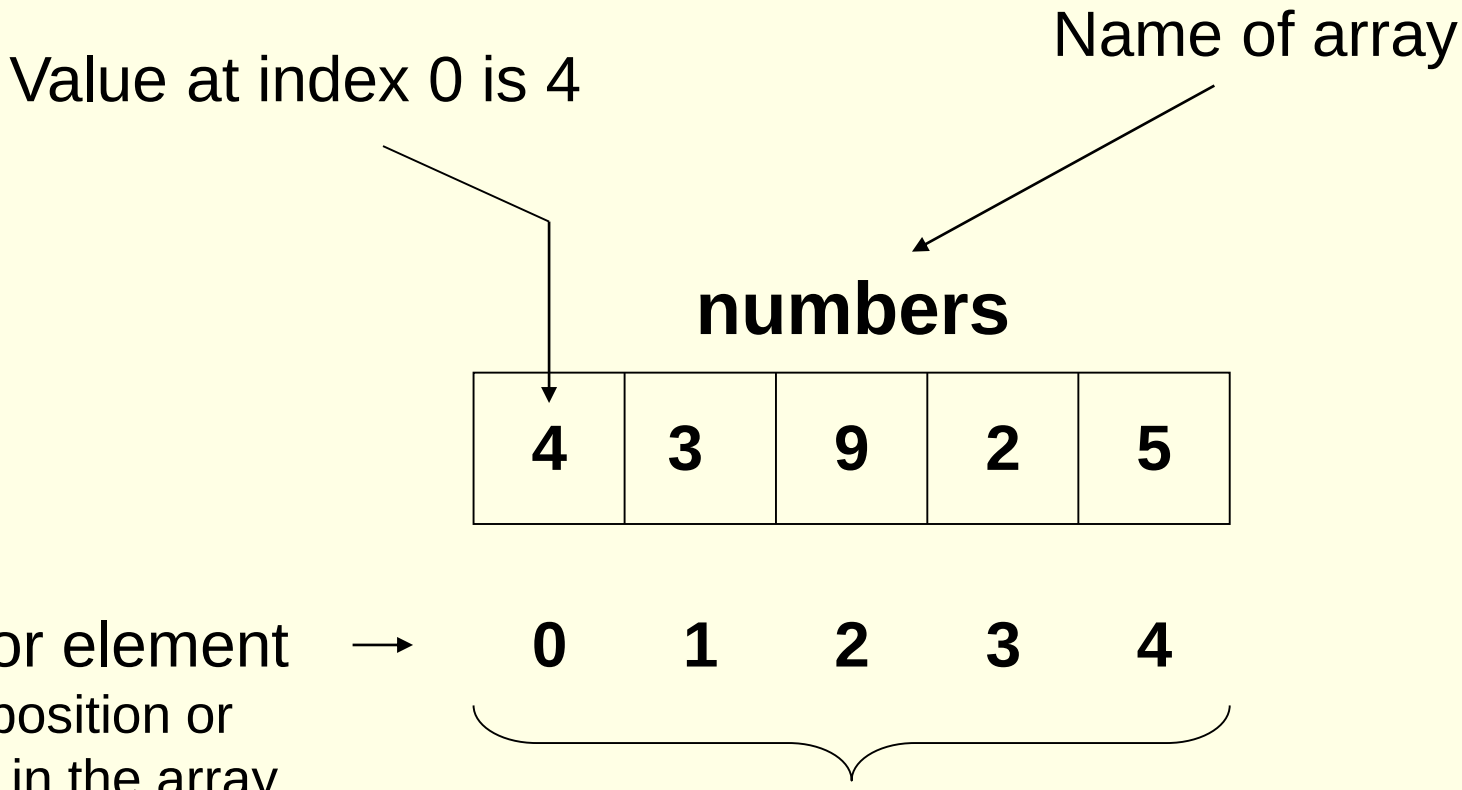

Length of array = 5
Elements 0 – 4

numbers.Length; //returns array length

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```
int  value = numbers[ 3 ];
Console.WriteLine( “Value at index 3 is “ + value );
```

Value at index 3 is 2

Alternatively could use a loop

```
for (int index=0; index < numbers.Length; index++ )
{
   Console.WriteLine( “Value at “+ index +“ is “+numbers[index] );
}
```

Value at 0 is 4
Value at 1 is 3
Value at 2 is 9
Value at 3 is 2
Value at 4 is 5

Variation is to loop through array using **foreach**

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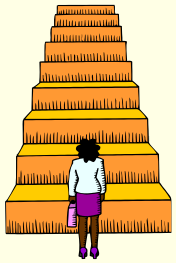
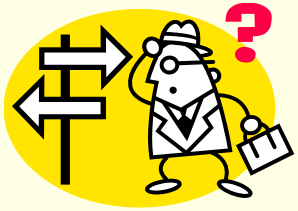
Concluding thought

- Loops are often used to process arrays
- Control structures determine the flow of execution

- sequence



- selection



- repetition

ANY program can be written using **sequential operations**, **if**, and **while** – the other structures are variations to make coding easier