INTRODUCTION TO PROGRAMMING

OVERVIEW AND IMPORTANT CONCEPTS

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Topics

- What is Programming
- Bits and Data
- Procedural Programming
- Algorithm and Examples
- Practice using Blockly

What is Programming

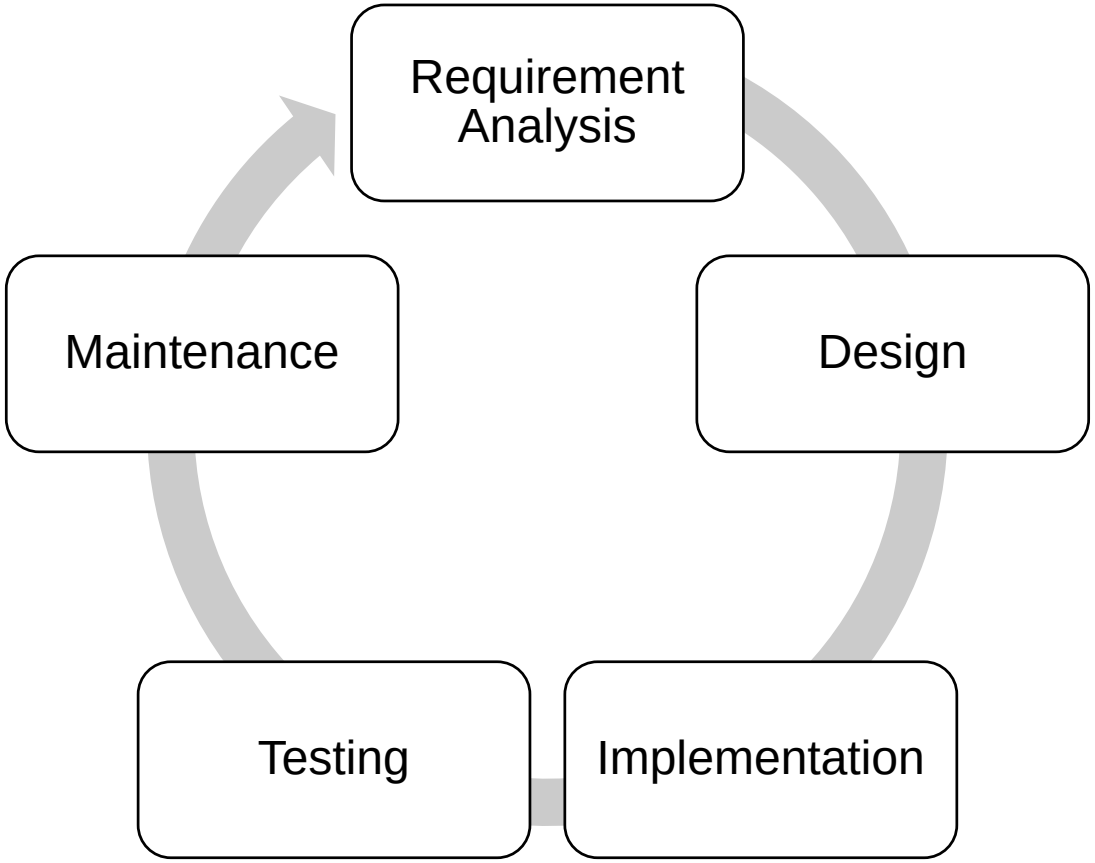
Making computers do what you want them to do by expressing your intentions and instructions clearly in a structured and un-ambiguous way

programming language

Application of Programming

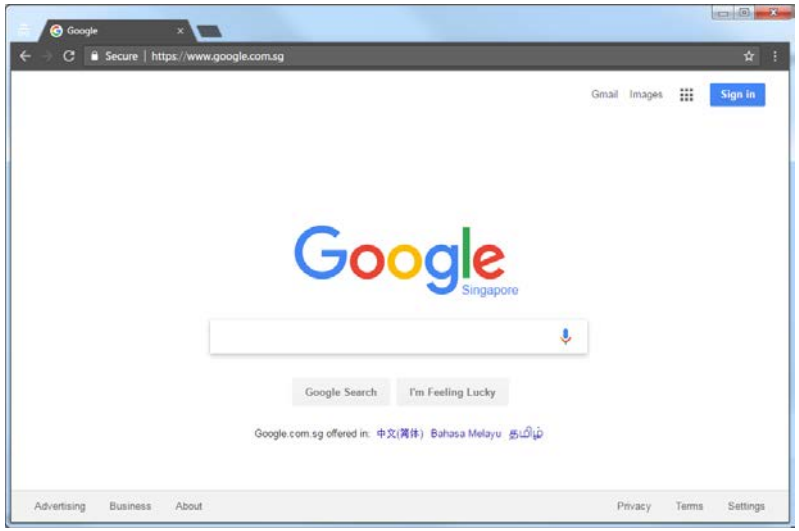
- Almost everything
  - Websites
  - Apps
  - Games
  - Robots
  - Self-driving cars
  - Infrastructures
  - Healthcare
  - Entertainment
  - Arts
  - Movies special effects
  - And many more…

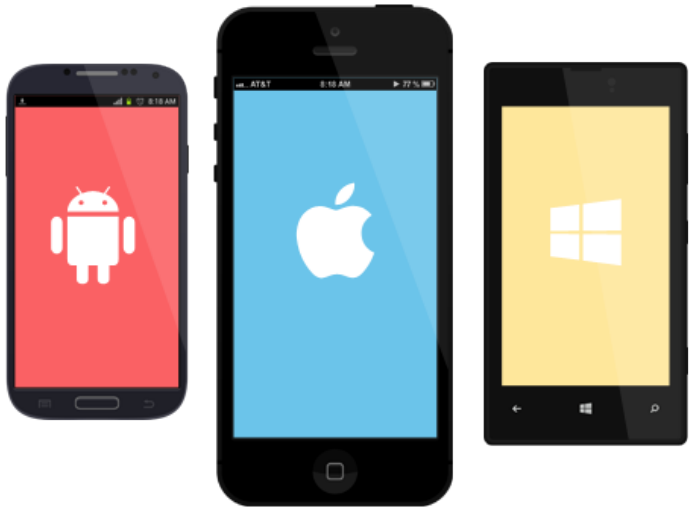
Software Development and Programming

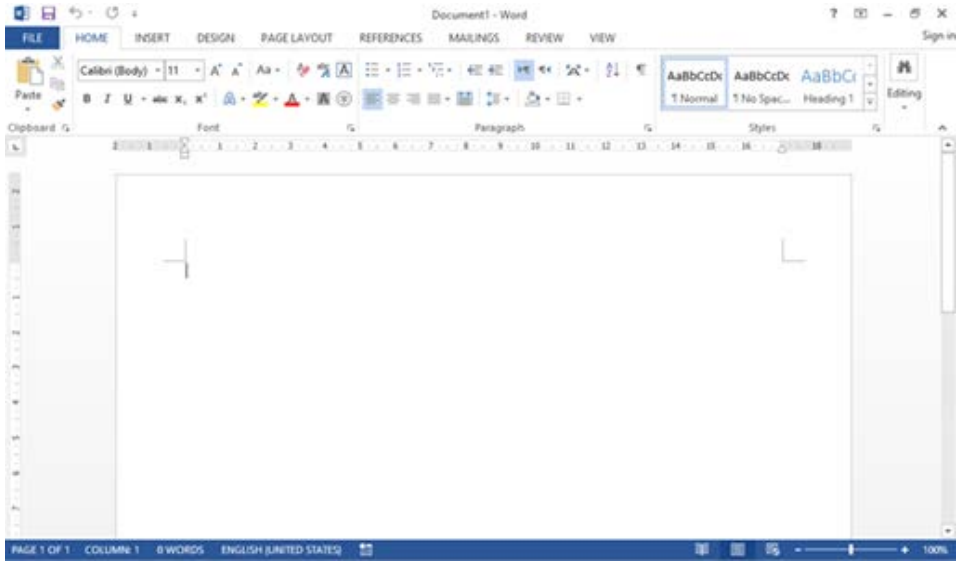


When would programming skill be needed?

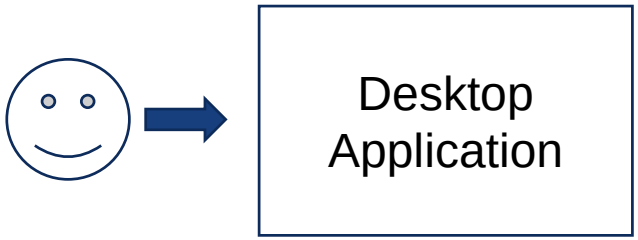
Different Kinds of Software

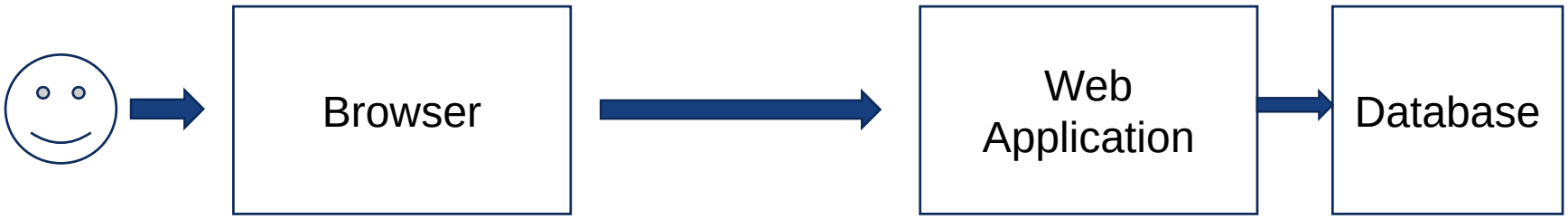


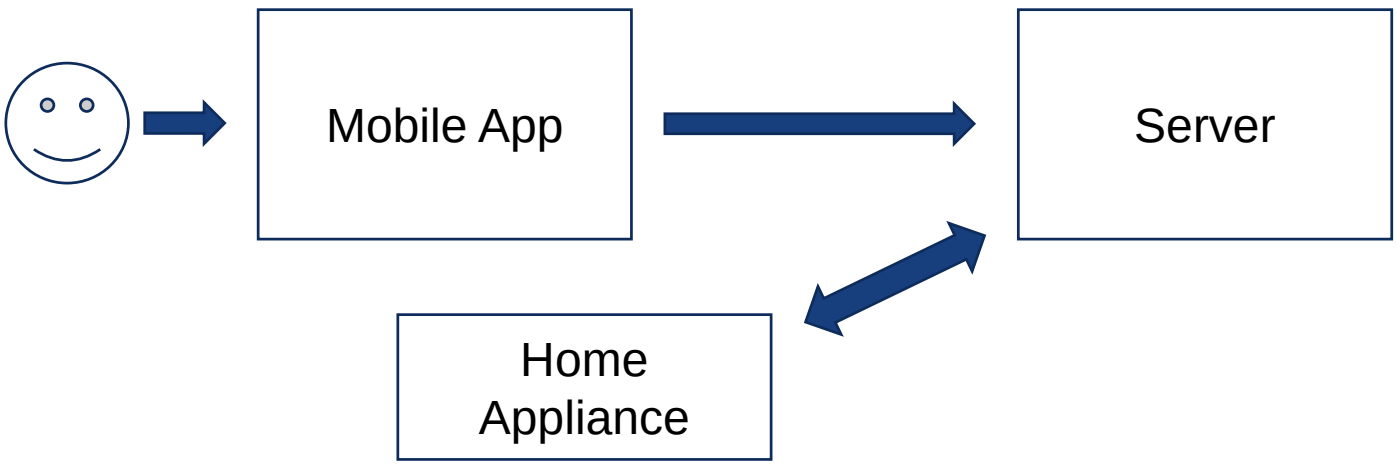




Various architectures (example)







Different kind of programming tasks

- User Interface (UI) Programming
  - How best to interact with the user
  - Concerns: screen design, interaction design, user experience
  - Example: Web Design
- Communication/Network Programming
  - Communication between various kind of software
  - Concerns: Performance, security, protocols
  - Example: WhatsApp
- Logic Programming
  - Processing and calculation of some sort
  - Concerns: performance, accuracy
  - Example: price and discount calculation

Programming Language

- A language system used to instruct computers
  - Each language has their own syntax and rules

4GL Language
High Level Language
Low Level Language
Assembler Language
Machine Language

Higher level = close to how human express themselves

Lower level = closer to the technical implementation of the computer

Programming Language

Assembly Language
(Low Level)

```
mov ax, 0x000D     ; set 320x200 graphics mode
int 0x10           ; bios video services
mov ax, 0x0C07     ; put pixel in white color
xor bx, bx         ; page number 0
mov cx, 200        ; x position 200
mov dx, 100        ; y position 200
l1: int 0x10       ; bios video services
dec dx             ; decrease y position
loop l1            ; decrease x position and repeat
mov ah, 0          ; service 0 - get keystroke
int 0x16           ; bios keyboard services
mov ax, 0x0003     ; 80x25 text mode
int 0x10           ; bios video services
mov ax, 0x4c00     ; terminate program
int 0x21
```

this high-level language
like that just tell you
what i need to search and
what i want .it is not
have produre and just select

```
SELECT NAME, AVG(GRADE)
FROM STUDENT JOIN TERM1_GRADES
ON STUDENT.STUDENT_ID = TERM1_GRADE.STUDENT_ID
WHERE TERM1_GRADES.CLASS = 'ABC'
```

Standard Query
Language / SQL
(High Level)

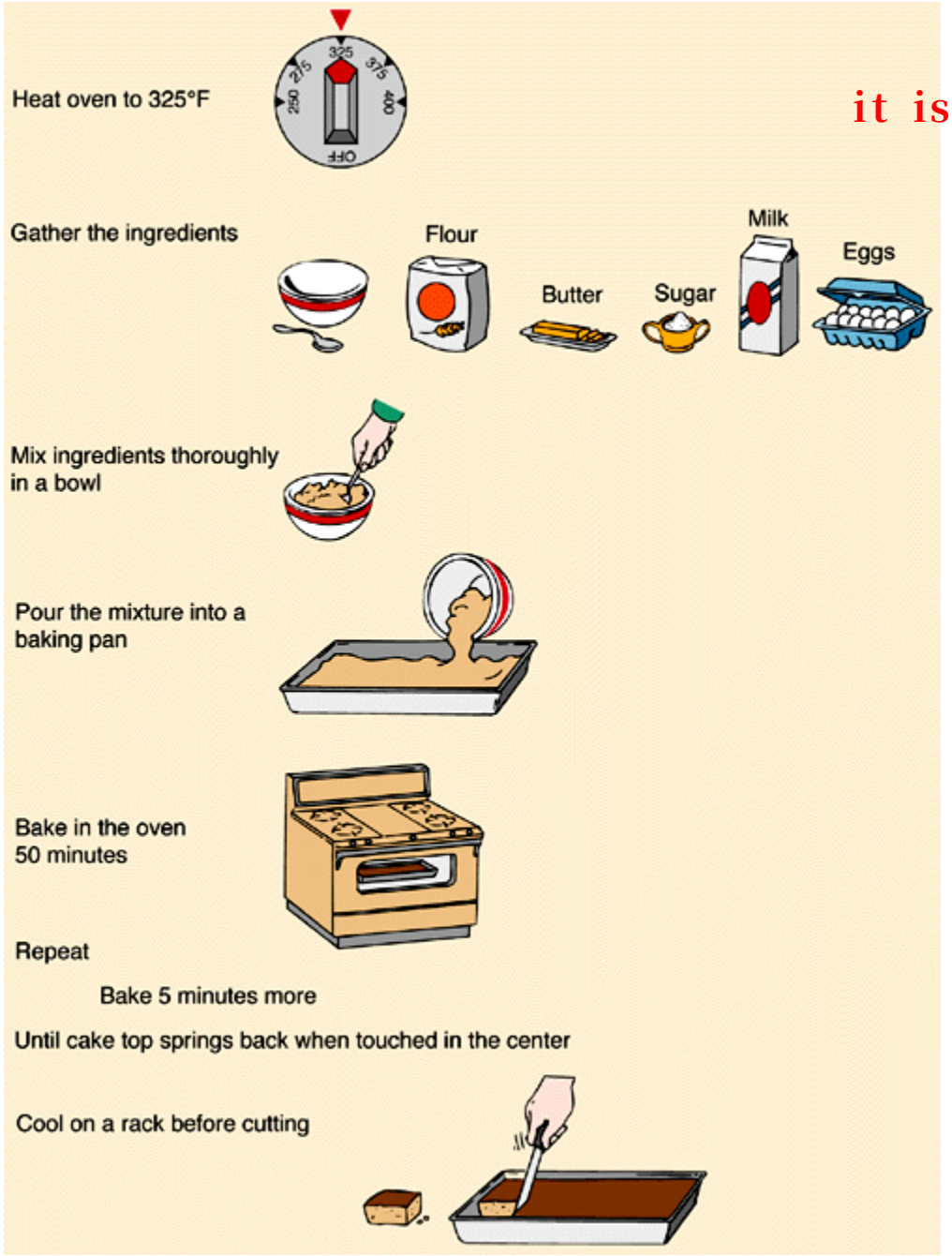
Procedural programming

it tell you what you should do by procedure so it call procedural programming .you need to make step to think what you want to do next

- In many programming languages, you are supposed to write the program as a procedure to do something

al-go-rithm : an ordered set of steps to solve a problem.

- Good algorithm should be:
  - Unambiguous
  - Have a defined set of input
  - Produce a defined set of output
  - Guaranteed to terminate
  - Guaranteed to produce a correct result



it is not ambiguous partly

unambiguous

defined set of input

produce a defined output

always terminate

always produce correct result

Debrief

Programming	writing procedures to achieve an objective
Testing	executing the program to check that the program can achieve the objective
Bug	problem in the program that prevent the program to achieve the objective in some or all situations
Debugging	fixing a bug in your program

Programming Concepts

- Variables
  - Named storage for values
- Data Types
  - Different kind of values
- Expressions
  - Computation done on one or many values
- Conditionals
  - Provide a condition when the instruction should be performed
- Repetitions (loops)
  - Repeat a set of instructions until certain condition is met
- Function/Procedure/Method
  - A named set of instructions with a defined input and output

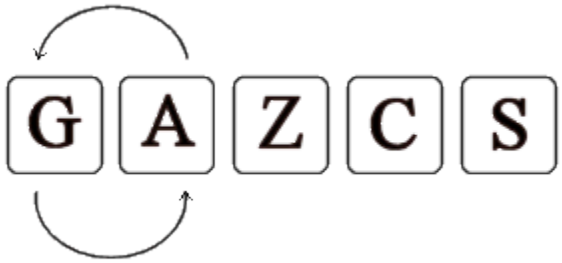
Example – Bubble Sort

Suppose you have a row of children's toy blocks with letters on them. They are in random order and you wish to arrange them in alphabetical order from left to right.

Step 1. Begin with the first block. In this case, the letter G.

Step 2. Look at the block just to the right of it.

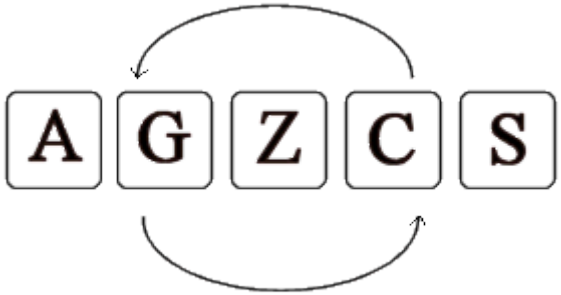
Step 3. If the block to the right should come before the block on the left, swap them so that they are in order

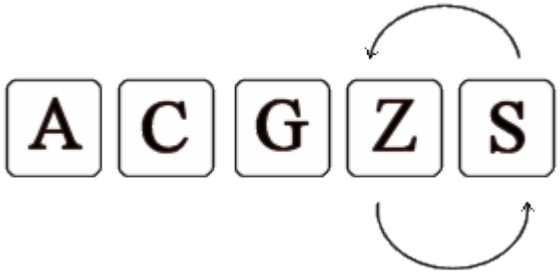


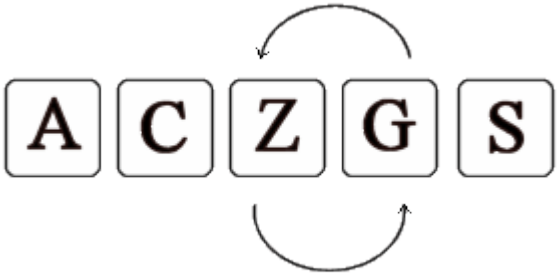
Example – Bubble Sort

Step 4. Compare the next block in line with the first, and repeat step 3. Do this until you run out of blocks.

Step 5. Then begin step one again with the second block (next block of the block used in step 1). Repeat until there is no more next block.



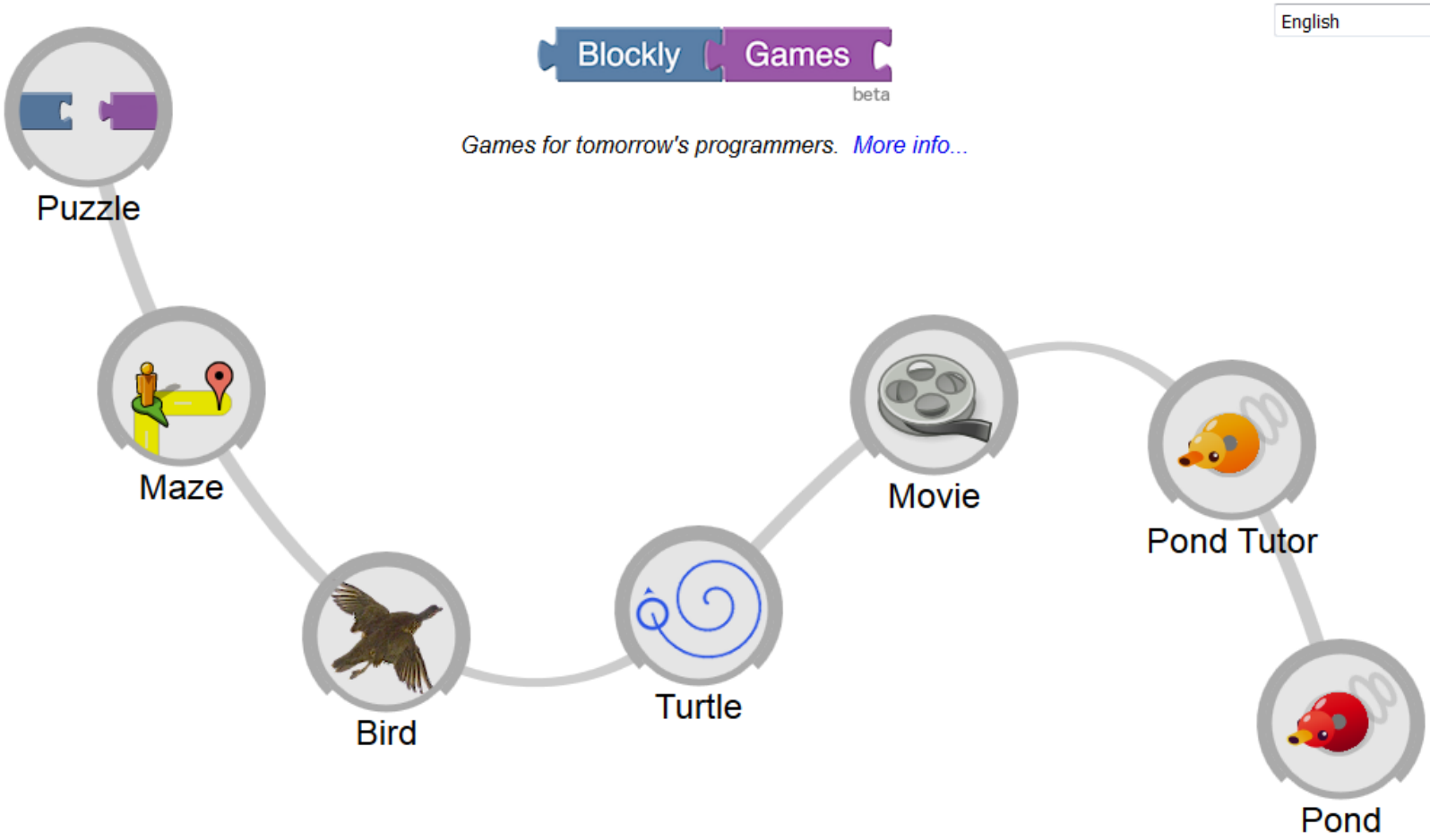




Example – Bubble Sort in C#

```
static void BubbleSort(IComparable[] array)
{
    int i = array.Length - 1;
    while(i > 0)
    {
        int swap = 0;
        for (int j = 0; j < i; j++)
        {
            if (array[j].CompareTo(array[j + 1]) > 0)
            {
                IComparable temp = array[j];
                array[j] = array[j + 1];
                array[j + 1] = temp;
                swap = j;
            }
        }
        i = swap;
    }
}
```

First Step to Programming



Instructions

- Try the different games
- It is OK to get stuck in some level. Discuss with others to compare notes and ideas. It will help to cultivate your programming skills
- You may not be able to come up with general solution to the problem because you are only allowed to use limited number of capabilities.
- Don’t give solution to others unless you’re asked. Giving hint is probably better than direct solution – respect other people’s rights to learn

Suggestion

- Once you're done, copy and paste the JavaScript code to a Word document and keep it for your reference

Expected skills learned

- Maze
  - Path finding
  - Repetition and condition
- Bird
  - Setting up a rule
- Turtle
  - Programmatic drawing
  - State management
- Movie
  - Keyframe animation
  - Variables and expression
- Pond
  - Autonomous agent like robots

Summary

- What is programming?
- How do you program a computer software?
- Where does computer software located?