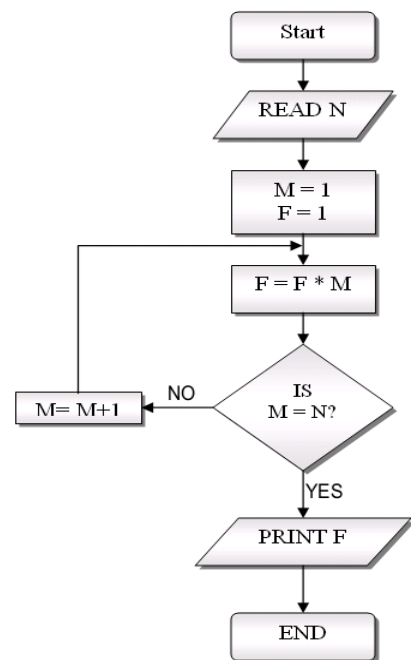


Objectives:

- stepwise refinement / workflow
- variable types and expressions; literals

Up next: Read course notes; MP1 out soon; Sign up for Quiz 01!

2. Describe an algorithm using a flowchart that calculates $N!$ i.e. $1 \times 2 \times 3 \times \dots \times N$. A proposed solution is included below.



i) What is the purpose of the three variables, N,M,F

N: _____ M: _____ F: _____

Which variable is unchanged by the loop? (A "Loop Invariant")

ii) Will the algorithm terminate for all values of N? If no, provide a counter-example: N = _____

iii) Create a new algorithm that only uses two variables - Draw your flowchart above and check your neighbor's answer.

1. Java as a high-level language: What happens 'under the covers' in the following code? How often do we read 'score' ? _____, write to score? _____

How many bytes are used to hold the value of score?

```

int score=0;
score = score + 1;
if(score>0) ...
  
```

3. Wooden toy abstraction demo:

4. Identify the following types from the literals:

-10 = int

0. = double

true = _____

4000000000L = _____

11f = _____

'c' = _____

Identify and fix these common mistakes:

- `int passed = score > 80;`
- `float x=0, y=1.5;`
- `boolean pleaseQuit; while(!pleaseQuit) { ... }`
- `double score = 8 / 10;`
- `double average = count / total; // count, total are of type int`

5. You hold 12 playing cards of the same suite in your hand. Write down the steps required to sort them in numerical order. Check your neighbor's algorithm for clarity and correctness. Together, can you think of an alternative sort algorithm?

6. Your startup, 'YouTube Inc' has N online videos. Describe a **two-pass** algorithm to print the # views of the most popular video and also the number of videos that achieved at least 5% of that viewing popularity.

Why do you need two passes through the data?

Use 'viewed[0]' to mean the # views of the first online video, 'viewed[i]' for the number of views of the i^{th} online video.

7. Identify two examples of each of the following: local variables, operators, expressions, statements, literal values in this code:

```
public class TrueLove {
    public static void main(String[] args) {
        boolean love = false;
        int petal = 0;
        while ( Math.random() <= 1. - 0.01 * petal ) {
            love = ! love;
            petal ++;
            if( love ) System.out.println( "Loves me" );
            else System.out.println( "Loves me not" );
        }
        System.out.println(petal + " petals picked");
    }
}
```

8. While talking to the nice people in the student ACM office at Siebel you accidentally signed up for the ACM-credit card and now you're behind on the payments. The ACM mob will not look for you until your arrears are greater than \$12000. Currently you owe \$1000 and the compound interest rate is 20% per month (this rate also increases by 5% per month). How many complete months remain before they knock on your door? Write some pseudo-code or Java code to determine when you should go into hiding.

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```

6. Test your Java knowledge:

T / F? A Java variable must always be declared with a type.

T / F? You cannot change the type of a variable.

T / F? Variable names often use camelCase.

T / F? A variable has a type, value, name and memory location(s).

T / F? A variable must be declared before it is assigned or read.

Write a single line of code to illustrate each of the following:

Variable Initialization:

Variable Declaration:

Variable Assignment:

Fix the following incorrect statements:

A variable of type 'char' holds one or more characters.

A character is 8 bits.

There are two Java integer representations.

There is one floating-point type: double.

A boolean variable has three states: 'true' 'false' 'unknown'.

Variable Memory Requirements

Name two Java types that use 8 bytes of storage:

Name two Java types that use 4 bytes of storage:

Name two Java types that use 2 bytes of storage:

3. Identify two examples of each of the following: local variables, operators, expressions, statements, literal values in this code:

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        }
        System.out.println(petal + " petals picked");
    }
}
```

```
public class Example
{
    public static void main(String[] args)
    {
        int x, y, z;
        char selectionLetter;
        double temperature = 98.6;
        x = 2;
        selectionLetter = 'c';
        x = x + 3;
        y = x * 2;
        z = (x + y)/2;

        boolean isCompletedYet;
        isCompletedYet = false;
        x = 5;
        x = 0;
        int w = (2 * x) + (3 * y) + (y * z * 4);
        isCompletedYet = true;
        temperature = 44.5 + temperature;
    }
}
```

At this point: x=____; y=____; z=____;
selectionLetter=____; temperature=____;

At this point: x=____; y=____; w=____;
isCompletedYet=____; temperature=____;

"On 4 June 1996, the maiden flight of the Ariane 5 launcher ended in a failure. Only about 40 seconds after initiation of the flight sequence, at an altitude of about 3700 m, the launcher veered off its flight path, broke up and exploded.

The failure of the Ariane 501 was caused by the complete loss of guidance and attitude information 37 seconds after start of the main engine ignition sequence (30 seconds after lift-off). This loss of information was due to specification and design errors in the software of the inertial reference system.

The internal ... software exception was caused during execution of a data conversion from 64-bit floating point to 16-bit signed integer value. The floating point number which was converted had a value greater than what could be represented by a 16-bit signed integer."