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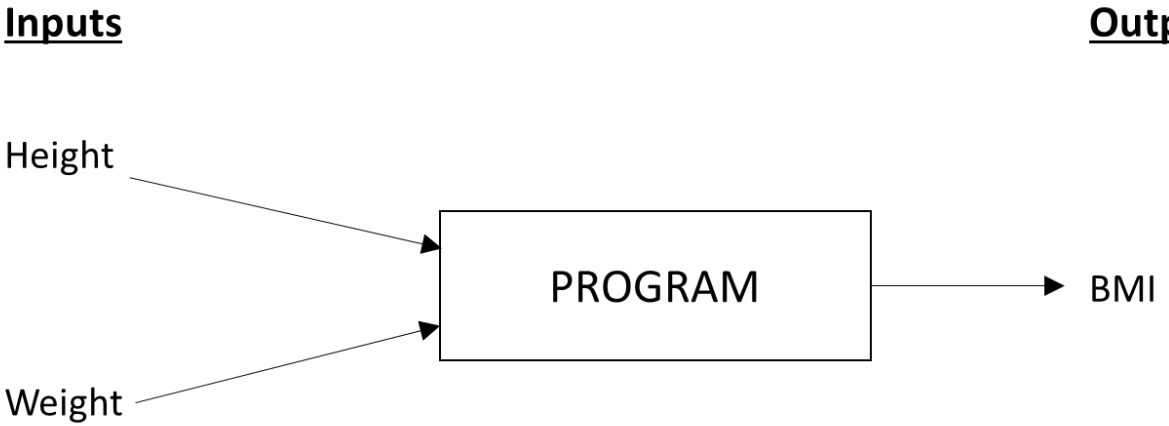
Chapter 1
A General Introduction to Programming

Overview

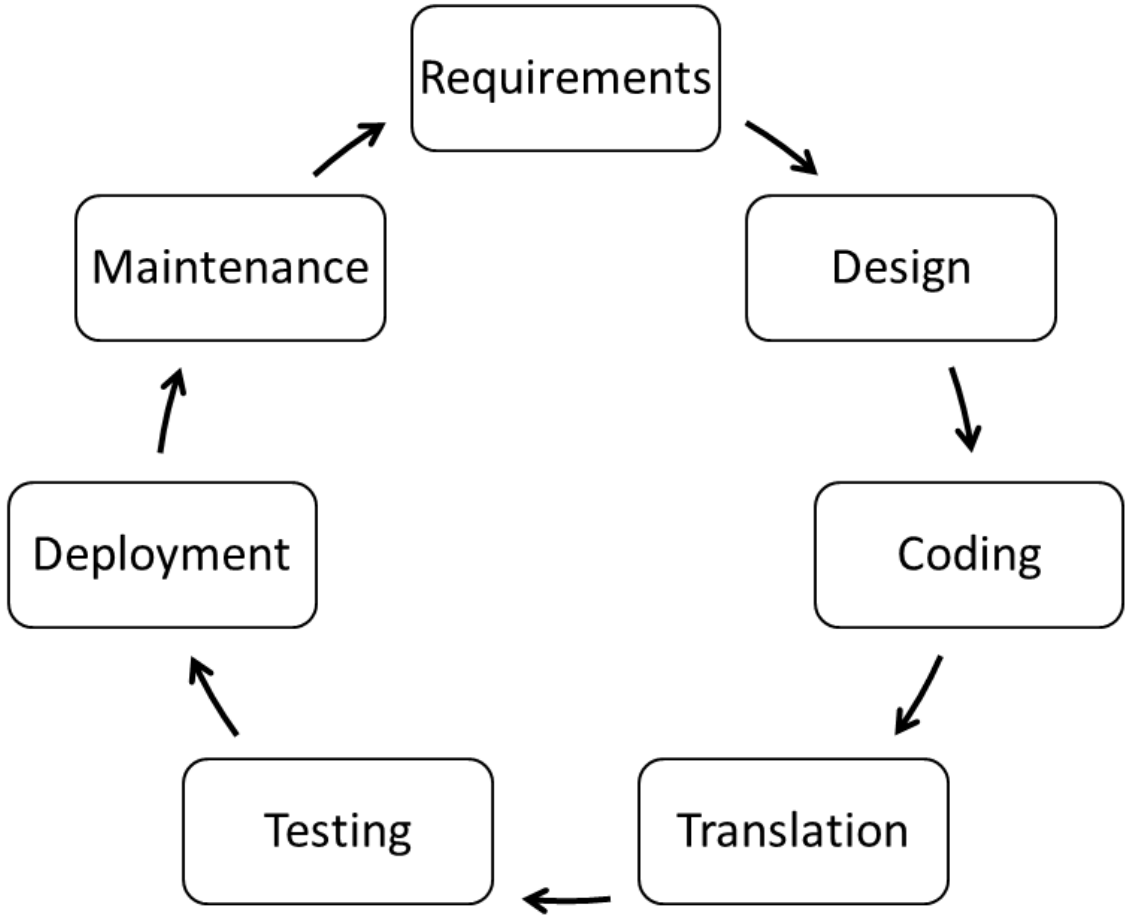
- The programming process
- OO programming: a sneak preview
- Programming errors
- Principles of software testing
- Software maintenance
- Principles of structured programming

The programming process

- A program (aka application) is a set of instructions to solve a particular problem
- Programming is the activity of writing a program
- Example: BMI



The programming process



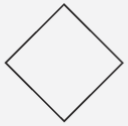
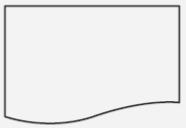
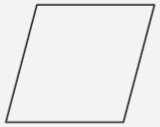
The programming process

- Algorithm is a procedure needed to solve the problem
- Can be designed using pseudo-code or flowcharts
  - Pseudo code: structured English without strict grammar rules
  - Flowchart: represents the algorithm in a visual diagram

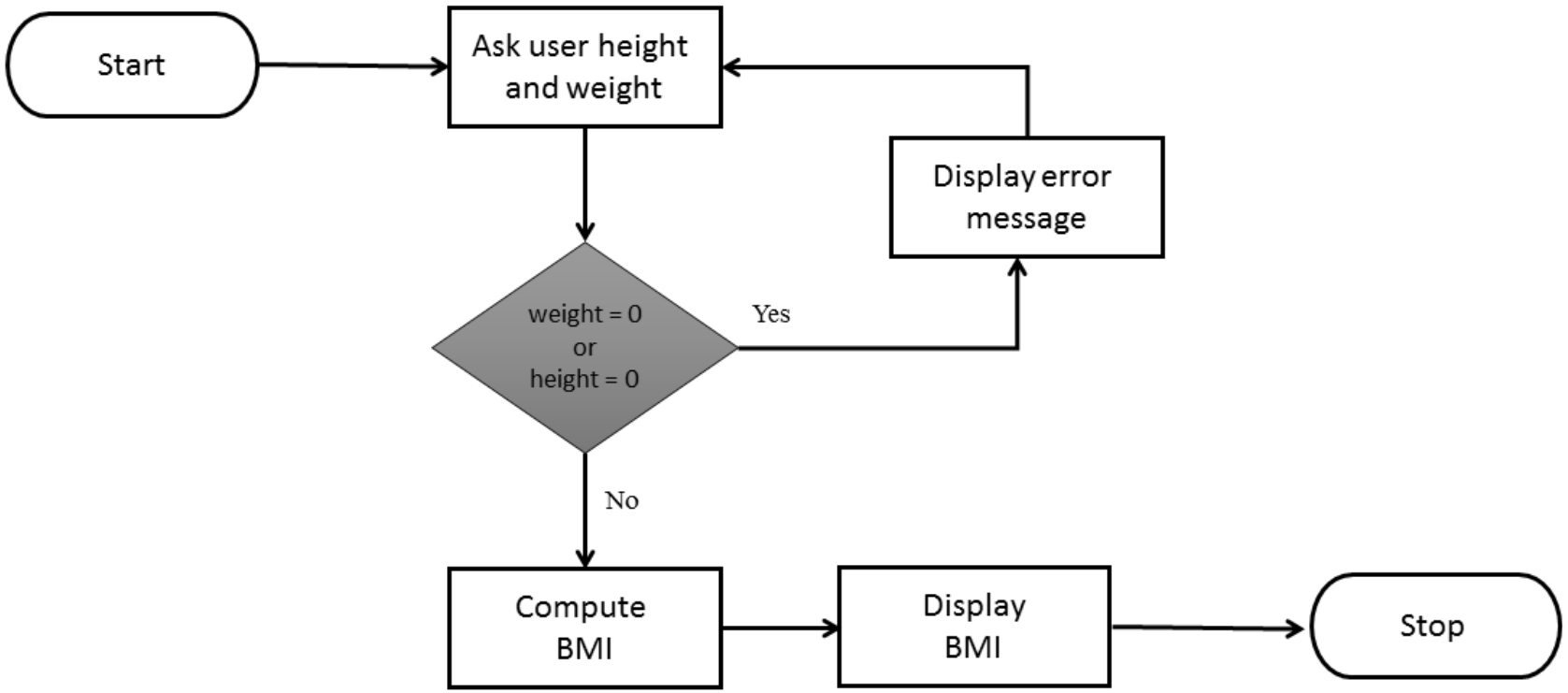
The programming process

```
ask user: height
ask user: weight
if height = 0 or weight = 0:
error: "Incorrect input values"
return to beginning (ask height and weight)
end if
x = weight / (height * height)
message: "Your BMI is ",x
```

The programming proces

FLOWCHART SYMBOL	MEANING
	A terminator shows the start and stopping points of the program.
	An arrow shows the direction of the process flow.
	A rectangle represents a process step or activity.
	A diamond indicates a decision point in the process.
	This symbol represents a document or report.
	This rhombus represents data used as inputs/outputs to/from a process.
	This cylinder represents a database.

The programming process



Object Oriented Programming: A Sneak Preview

```
public class BMICalculator {
  private double weight, height, BMI;

  public BMICalculator( double weight, double height ){
    this.weight = weight;
    this.height = height;
  }

  public void calculate(){
    BMI = weight / (height*height);
  }

  public boolean isOverweight(){
    return (BMI > 25);
  }
```

Programming Errors

- Also referred to as a bug (debugging)
- Debugging steps
  - Detect that there is an error
  - Locate the error
  - Solve the error
- Types of bugs
  - Syntax/Compilation errors
  - Runtime errors
  - Logic/Semantic errors

Programming Errors

```
public void calculate(){
   BMI = weight / (height*height),
}
```

Syntactic/Compilation Error!

Programming Errors

```
public void calculate(){
    BMI = weight / (height*height);
  }
```

- Runtime error if 0 entered for height!

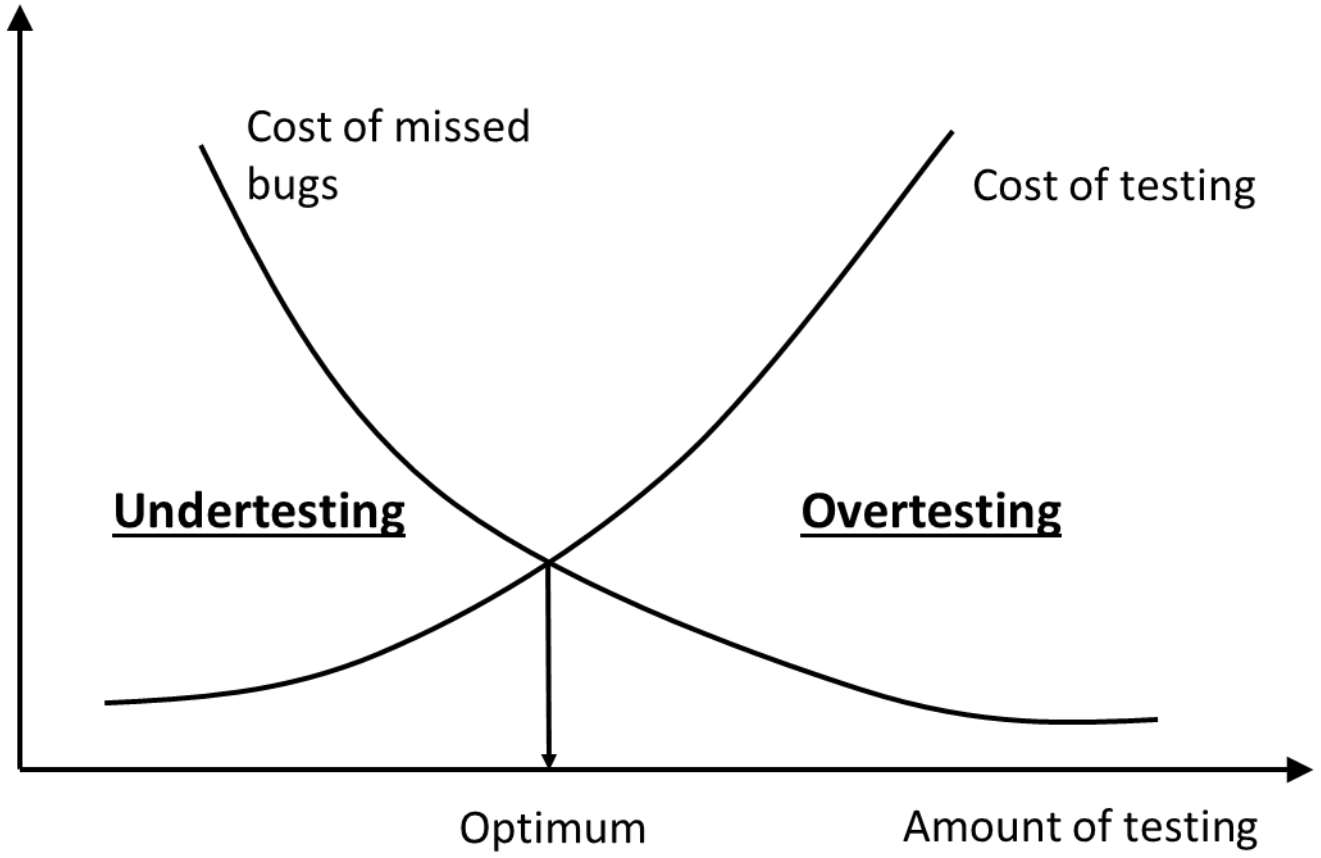
Programming errors

```
public void calculate(){
    BMI = (weight*weight) / height;
 }
```

Logic/Semantic error!

Principles of Software Testing

- Verification versus Validation



Principles of Software Testing

- Desk check the program manually
- Static testing
  - Inspect and review the code
  - Detailed walk-throughs
- Dynamic testing
  - Execute with selected test cases
- White box strategy
  - Test cases selected based upon code inspection
- Black box strategy
  - Test cases selected not based upon code inspection
- Alpha versus beta testing

Software maintenance

- Adjusting the program after it was taken into production
- Adaptive maintenance
  - Modify program to accommodate changes in the environment
  - E.g., new Windows release
- Perfective maintenance
  - Support new or changed user requirements
  - E.g. enter height in feet units and weight in pound units
- Corrective maintenance
  - Fix runtime errors (emergency fixes vs. routine debugging)
- Preventive maintenance
  - Prevent future errors
  - E.g. Y2K, Euro

Principles of Structured Programming

- Stepwise refinement
- Documentation
- Meaningful names

Conclusion

- The programming process
- OO programming: a sneak preview
- Programming errors
- Principles of software testing
- Software maintenance
- Principles of structured programming