

CISC181 Introduction to Computer Science

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Lecture 3 (2) & 4
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Programming Gets Tougher

- Need rules for thinking about more difficult programming problems
- Take your time – think first.
- Make sure you understand what it is you are trying to do before you try to do it.

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Rules

1. Think before you code

- Use some abstract short-hand design
 - Flowcharts/activity diagrams
 - Pseudocode – informal language for writing “algorithms”
 - Set of actions to be executed
 - Specified order for the actions

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More Rules for Thinking

2. Know the tools available to you

- Control structures of the language

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2.4 Control Structures

- Sequential execution
 - Statements executed in order
- Transfer of control
 - Next statement executed *not* next one in sequence
- 3 control structures (Bohm and Jacopini)
 - Sequence structure
 - Programs executed sequentially by default
 - Selection structures
 - **if, if/else, switch**
 - Repetition structures
 - **while, do/while, for**

2.4 Control Structures

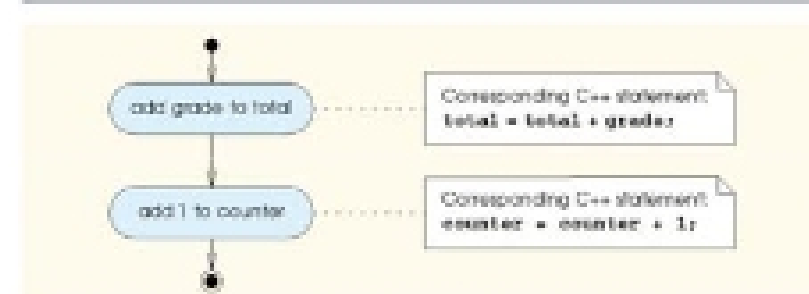


Fig. 2.1 Sequence structure activity diagram.

2.5 if Selection Structure

- Flowchart of pseudocode statement

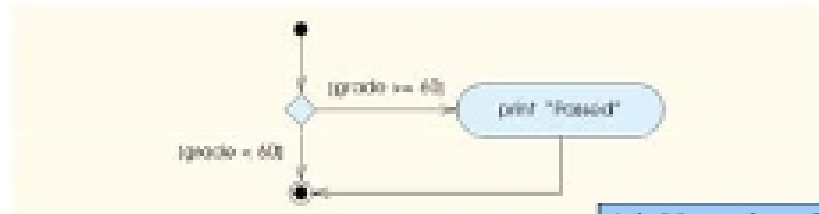


Fig. 2.3 if single-selection structure activity diagram.

A decision can be made on any expression.
 zero - **false**
 nonzero - **true**
 Example:
 3 - 4 is **true**

2.6 if/else Selection Structure

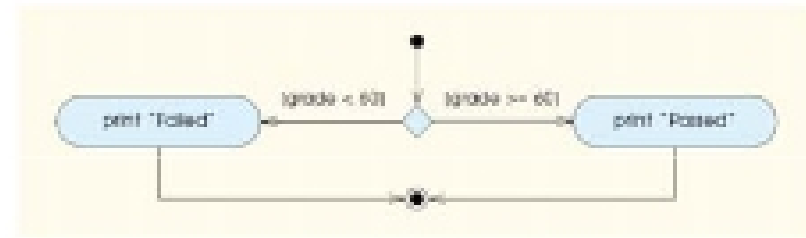


Fig. 2.4 if/else double-selection structure activity diagram.

2.7 The while Repetition Structure

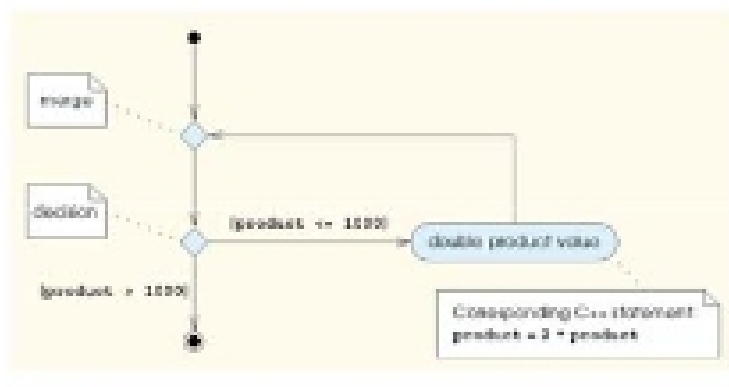


Fig. 2.5 while repetition structure activity diagram.

Control Structures and Programming

- Each C++ Program made up of these 7 control structures combined appropriately (turns out that we can make the last of these more specific, but we'll see that later)
 - Sequentially
 - Nested

2.5 if Selection Structure

- Selection structure
 - Choose among alternative courses of action
 - Pseudocode example:
 - If student's grade is greater than or equal to 60 Print "Passed"
 - If the condition is **true**
 - Print statement executed, program continues to next statement
 - If the condition is **false**
 - Print statement ignored, program continues
 - Indenting makes programs easier to read
 - C++ ignores whitespace characters (tabs, spaces, etc.)

2.5 if Selection Structure

- Flowchart of pseudocode statement

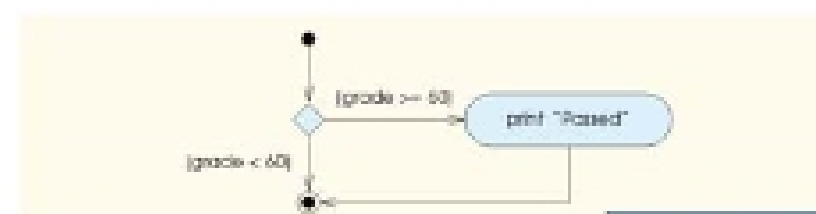


Fig. 2.3 if single-selection structure activity diagram.

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 Example:
 3 - 4 is **true**

2.5 if Selection Structure

- Translation into C++

*If student's grade is greater than or equal to 60
Print "Passed"*

```
if ( grade >= 60 )  
    cout << "Passed";
```

- Diamond symbol (decision symbol)

- Indicates decision is to be made
- Contains an expression that can be true or false
 - Test condition, follow path

- if structure

- Single-entry/single-exit

2.6 if/else Selection Structure

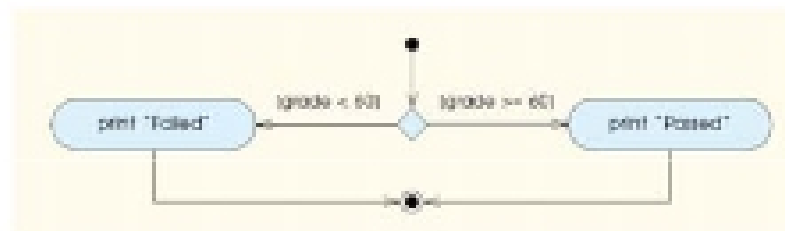


Fig. 2.4 if/else double-selection structure activity diagram.

2.6 if/else Selection Structure

- if

- Performs action if condition true

- if/else

- Different actions if conditions true or false

- Pseudocode

*if student's grade is greater than or equal to 60
print "Passed"
else
print "Failed"*

- C++ code

```
if ( grade >= 60 )  
    cout << "Passed";  
else  
    cout << "Failed";
```

if-else Statement Syntax

- Formal syntax:

```
if (<boolean_expression>)  
    <yes_statement>  
else  
    <no_statement>
```

- Note each alternative is only ONE statement!
- To have multiple statements execute in either branch → use compound statement

Branching Mechanisms

- if-else statements

- Choice of two alternate statements based on condition expression

- Example:

```
if (hrs > 40)  
    grossPay = rate*40 + 1.5*rate*(hrs-40);  
else  
    grossPay = rate*hrs;
```

if-else Statement Syntax

- Formal syntax:

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else  
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```

- Note each alternative is only ONE statement!
- To have multiple statements execute in either branch → use compound statement