Activity #2: Arithmetic Operations and Assignment

Recorder's Report

Manager:	Reader:
Recorder:	Driver:
Date:	Score: Satisfactory / Not Satisfactory

Record your team's answers to the key questions (marked with ) below.

(a) Model 1, Question #3

(b) Model 2, Question #9

(c) Model 3, Question #12

Activity #2: Arithmetic Operations and Assignment

In this course, you will work in teams of 3–4 students to learn new concepts. This activity will introduce you to the process of analyzing an algorithm complexity.

Content Learning Objectives

After completing this activity, students should be able to:

- Explain how to print content to the screen using C++
- Explain how to create a comment in C++ code
- Determine the difference between a *string literal* and a *integer*
- Explain how to input data into a variable in C++
- Explain the meaning and purpose of a variable

Process Skill Goals

During the activity, students should make progress toward:

- Create input and output statements in C++
- Create C++ code that displays the results to calculated addition facts
- Create C++ code that prompts the user for data and stores it in a variable
- Select valid and meaningful variable names
- Discuss problems and programs with all group members

Model 1 A C++ Program

```
#include <iostream>
using namespace std;

int main() {
  cout << 16 + 3 << endl;
  cout << 16 - 3 << endl;
  cout << 16 * 3 << endl;
  cout << 16 / 3 << endl;
  cout << 16 % 3 << endl;
}
```

Refer to Model 1 above as your team develops consensus answers to the questions below.

Questions (20 min) Start time:

1. Starting with the file `activity02a.cpp`, enter and run the C++ program above. What is the output of each of the following lines?

(a) `cout « 16 + 3 « endl;`

(b) `cout « 16 - 3 « endl;`

(c) `cout « 16 * 3 « endl;`

(d) `cout « 16 / 3 « endl;`

(e) `cout « 16 % 3 « endl;`

2. Were any of these a surprise to your team?

3. Name the arithmetic operation represented by each symbol in C++.

(a) `+`

(b) `-`

(c) `*`

(d) `/`

(e) `%`

4. An *assignment statement* uses the "=" sign to store the result of an operation performed on the right-hand side into the memory location named by the variable on the left-hand side.

Enter and execute the following two lies of C++ code (modify the `activity02a.cpp` file to do this).

```
int age = 15;
cout << "Your age is: " << age;
```

(a) What does the *assignment statement* on line 1 of this code chunk do?

(b) Split up the *variable declaration* and *assignment statement* into two separate lines of code.

(c) What happens if you replace the assignment statement only (without altering the declaration) with `age = "fifteen";`?

5. Enter and execute the following three lines of C++ code (again, use the `activity02a.cpp` file), but **remember to add `#include <string>` in the header**.

```
string schoolName = "Walla Walla";
string schoolType = "University";
string fullName = schoolName + schoolType;
cout << fullName << endl;
```

(a) What value is stored in the `fullName` variable at line 3?

(b) How does the "+" sign behave differently when used with strings instead of numbers?

(c) How could you fix the output so that the words are all separated?

(d) When two strings are "glued" together, they are said to be *concatenated*. What would happen if you tried to concatenate a string with an integer?

Model 2 Some Arithmetic Expressions in C++ Syntax

Mathematical Expression	C++ Expression	Value
$3 + 2 \times 5$	`3+2*5`	13
$\frac{3+5}{2}$	`(3+5)/2`	4
$6^2 + 3 \times \frac{4}{2}$	`6*6+3*4/2`	42

Refer to Model 2 above as your team develops consensus answers to the questions below.

6. If the parentheses were removed from the C++ Expression in the second row so that it was `3+5/2`, what would its value be?

7. What is stored in memory after each assignment statement below is executed? Assume all variables have been declared as integers.

Assignment Statement	Computer Memory	
`answer = 6*6+3*4/2;`	`answer`	
`answer = answer + 1;`	`answer`	
`final = answer % 4;`	`final`	

8. Convert each expression to a C++ arithmetic expression. Do not compute its value.

(a) $3(6 - 1)$

(b) $12 - \dfrac{3+2}{6-1}$

(c) $\dfrac{3+2^2}{5}$

(d) Eight to the fourth power

9. What is the value of each C++ arithmetic expression below?

(a) `4 + 3 % 2`

(b) `3 + 9 % 2 * (-1+3)`

Model 3 C++ Division Program

Example Output:

First number: 10
Second number: 2.5
Quotient: 10/2.5 = 4

```
#include <iostream>
using namespace std;

int main() {
  int a;
  double b;
  cout << "First number: ";
  cin >> a;
  cout << "Second number: ";
  cin >> b;
  cout << "Quotient: " << a << "/" << b << " = " << (a/b) << endl;
}
```

Refer to Model 3 above as your group develops consensus answers to the questions below.

Questions (20 min) Start time:

10. This program can be found in `activity02c.cpp`. Run it several times with the following inputs and write down the resulting output.

a) First number: 10, Second number: 4

b) First number: 10, Second number: 3

c) First number: 9.5, No second number

d) First number: 10, Second number: x

11. A *floating point* number is a number that contains a floating decimal point (as opposed to integers, which have no decimals). For example, 5.5 or 0.001. In C++ we often use the `double` variable type to hold floating point values.

a) How did the division operation change (as compared to earlier models) because one of the variables was of type `double`?

b) How would your results in problem 10 differ if both variables were of type `int`?

c) How would your results in problem 10 differ if both variables were of type `double`?

12. Write a conjecture as to when the division operation in C++ will return decimals and when it will only return an integer. Use the phrase *floating point* in your answer.

13. Create a program that asks asks for a number of cookies and a number of children and then prints out how many cookies each child will get (assuming they are split evenly) and how many are left over. Be creative and professional in prompting the user and displaying the results.