

Exercises Chapter 4

1. Mark the following statements as true or false:

- a. The result of a logical expression cannot be assigned to an int variable. **False**
- b. In a one-way selection, if a semicolon is placed after the expression in an if statement, the expression in the if statement is always true. **False**
- c. Every if statement must have a corresponding else. **False**
- d. The expression in the if statement: `if (score = 30) grade = 'A';` always evaluates to true. **True**
- e. The expression: `(ch >= 'A' && ch <= 'Z')` evaluates to false if either `ch < 'A'` or `ch >= 'Z'`. **False**
- f. Suppose the input is 5. The output of the code:

```
cin >> num;  
if (num > 5)  
    cout << num;  
num = 0;  
else cout << "Num is zero" << endl;
```

is: Num is zero **False**
- g. The expression in a switch statement should evaluate to a value of the simple data type. **False**
- h. The expression `!(x > 0)` is true only if x is a negative number. **False**
- i. In C++, both `!` and `!=` are logical operators. **False**
- j. The order in which statements execute in a program is called the flow of control. **True**

2. Evaluate the following expressions:

- a. `5 + 6 == 3 + 7` **False**
- b. `2 * 6 - 4 >= 9 - 1` **True**
- c. `'U' >= 't'` **True**
- d. `'A' <= 'a'` **True**
- e. `'#' <= '+'` **False**
- f. `6.28 / 3 < 3 - 1.2` **False**

3. Suppose that x, y, and z are int variables, and x = 10, y = 15, and z = 20. Determine whether the following expressions evaluate to true or false:

- a. $!(x > 10)$ True
- b. $x \leq 5 \ || \ y < 15$ False
- c. $(x \neq 5) \ \&\& \ (y \neq z)$ True
- d. $x \geq z \ || \ (x + y \geq z)$ True
- e. $(x \leq y - 2) \ \&\& \ (y \geq z) \ || \ (z - 2 \neq 20)$ False

4. Suppose that str1, str2, and str3 are string variables, and str1 = "English", str2 = "Computer Science", and str3 = "Programming". Evaluate the following expressions:

- a. $str1 \geq str2$ True
- b. $str1 \neq "english"$ True
- c. $str3 < str2$ False
- d. $str2 \geq "Chemistry"$ True

5. Suppose that x, y, z, and w are int variables, and x = 3, y = 4, z = 7, and w = 1. What is the output of the following statements?

- a. `cout << "x == y: " << (x == y) << endl;` x=y:0
- b. `cout << "x != z: " << (x != z) << endl;` x!=z:1
- c. `cout << "y == z - 3: " << (y == z - 3) << endl;` y==z-3:1
- d. `cout << "!(z > w): " << !(z > w) << endl;` !(z>w):0
- e. `cout << "x + y < z: " << (x + y < z) << endl;` x+y<z:0

6. Which of the following are relational operators?

- a. <
- b. <=
- c. =
- d. !=
- e. <>

7. What is the output of the following statements?

- a. `if ('+' < '*') cout << "+*"; cout << "%%" << endl;` %%
- b. `if (10 <= 2 * 5) cout << "10 "; cout << "2 * 5"; cout << endl;` 10 2*5
- c. `if ('a' < 'A') cout << 'a'; cout << 'A'; cout << endl;` A
- d. `if ("C++" >= "C--") cout << "C++" << endl; cout << "C--" << endl;` C--
- e. `if ("Sam" <= "Tom") cout << "Sam Tom" << endl; cout << "Tom Sam" << endl;` Sam Tom, Tom
- f. `if (6 == 2 * 4 - 2) cout << 3 * 4 / 6 - 8 << endl; cout << "***" << endl;` -6, **

Sam

8. Which of the following are logical (Boolean) operators?

a. ! b. != c. \$\$

9. What is the output of the following statements?

a. if ('R' < '\$' && '&' <= '#') cout << "\$#"; cout << "R&"; cout << endl; **R&**

b. if ('4' > '3' || 2 < -10) cout << "1 2 3 4" << endl; cout << "\$\$" << endl; **1 2 3 4, \$\$**

c. if ("Jack" <= "John" && "Business" >= "Accounting") cout << "Jack Accounting" << endl; cout << "John Business" << endl; **Jack Accounting, John Business**

10. What is the output of the following code?

```
int num = 10; //Line 1
double temp = 4.5; //Line 2
bool found; //Line 3
found = (num == 2 * static_cast<int>(temp) + 1); //Line 4
cout << "The value of found is: " << found << endl; //Line 5 The value of found is:
```

11. How does the output in Exercise 10 change if the statement in Line 4 is replaced by the following statement?

```
found = (num == 2 * static_cast<int>(temp + 1)); //Line 4 The value of found is 1
```

12. What is the output of the following program?

```
#include <iostream>
using namespace std;
int main()
{
    int x; int a = 265;
    cout << (x = 25) << endl; //25
    cout << (x == 90) << endl; False
    cout << (x > 10) << endl; True
    cout << (3 * x < a) << endl; True
    cout << (10 * x == a - 15) << endl; True

    return 0;
}
```

13. Correct the following code so that it prints the correct message:

```
if (score >= 60)
    cout << "You pass." << endl;
else
    cout << "You fail." << endl;
```

```
if (score >= 60)
    cout << "You pass." << endl;
else
    cout << "You fail." << endl;
```

14. Write C++ statements that output Male if the gender is 'M', Female if the gender is 'F', and invalid gender otherwise.

```
if (Gender=='M') then cout << "Male" << endl;
else if (Gender=='F') then cout << "Female" <<endl;
else cout << "Invalid Gender" << endl;
```

15. If the number of items bought is less than 5, then the shipping charges are \$5.00 for each item bought; if the number of items bought is at least 5, but less than 10, then the shipping charges are \$2.00 for each item bought; if the number of items bought is at least 10, there are no shipping charges. Correct the following code so that it computes the correct shipping charges.

```
if (0 < numOfItemsBought || numOfItemsBought <> 5)
    shippingCharges = 5.00 * numOfItemsBought;
else if (5 <= numOfItemsBought && numOfItemsBought < 10);
    shippingCharges = 2.00 * numOfItemsBought;
else
    shippingCharges = 0.00;
if (0 < numOfItemsBought && numOfItemsBought < 5)
    shippingCharges = 5.00 * numOfItemsBought;
else if (5 <= numOfItemsBought && numOfItemsBought < 10);
    shippingCharges = 2.00 * numOfItemsBought;
else
    shippingCharges = 0.0;
```

16. What is the output of the following C++ code?

```
int x = 10;
```

```

int y = 20;
if (x < 20 && y > 20)
{
    x = 2 * x;
    y = y / 2;
    cout << x << " " << y << " " << x - y << endl;
}
else
{
    x = y / x;
    cout << x << " " << y << " " << x * x + y * y << endl;
}

```

17. What is the output of the following program?

```

#include <iostream>
using namespace std;
int main() { int myNum = 10; int yourNum = 30;
if (yourNum % myNum == 3) { yourNum = 3; myNum = 1; } else if (yourNum % myNum == 2) { yourNum = 2; myNum = 2; } else { yourNum = 1; myNum = 3; }
cout << myNum << " " << yourNum << endl;
return 0;
}

```

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18. a. What is the output of the program in Exercise 17, if myNum = 5 and yourNum = 12?

b. What is the output of the program in Exercise 17, if myNum = 30 and yourNum = 33?

19. Suppose that sale and bonus are double variables. Write an if...else statement that assigns a value to bonus as follows: If sale is greater than \$20,000, the value assigned to bonus is 0.10; if sale is greater than \$10,000 and less than or equal to \$20,000, the value assigned to bonus is 0.05; otherwise, the value assigned to bonus is 0.

```

if (sale > 20000)
    bonus = 0.10
else if (sale > 10000 && sale <= 20000)
    bonus = 0.05;

```

else

bonus = 0.0;

20. Suppose that overSpeed and fine are double variables. Assign the value to fine as follows: If $0 < \text{overSpeed} \leq 5$, the value assigned to fine is \$20.00; if $5 < \text{overSpeed} \leq 10$, the value assigned to fine is \$75.00; if $10 < \text{overSpeed} \leq 15$, the value assigned to fine is \$150.00; if $\text{overSpeed} > 15$, the value assigned to fine is \$150.00 plus \$20.00 per mile over 15.

21. Suppose that score is an int variable. Consider the following if statements:

```
if (score >= 90);
```

```
cout << "Discount = 10%" << endl;
```

a. What is the output if the value of score is 95? Justify your answer.

b. What is the output if the value of score is 85? Justify your answer.

a. The output is: Discount = 10%. The semicolon at the end of the if statement terminates the if statement. So the cout statement is not part of the if statement. The cout statement will execute regardless of whether the expression in the if statement evaluates to true or false.

b. The output is: Discount = 10%. The semicolon at the end of the if statement terminates the if statement. So the cout statement is not part of the if statement. The cout statement will execute regardless of whether the expression in the if statement evaluates to true or false.

22. Suppose that score is an int variable. Consider the following if statements:

i. if (score == 70)

```
cout << "Grade is C." << endl;
```

ii. if (score = 70)

```
cout << "Grade is C." << endl;
```

Answer the following questions:

a. What is the output in (i) and (ii) if the value of score is 70? What is the value of score after the if statement executes?

b. What is the output in (i) and (ii) if the value of score is 80? What is the value of score after the if statement executes?

23. Rewrite the following expressions using the conditional operator. (Assume that all variables are declared properly.)

a. if ($x \geq y$)

```
z = x - y;
```

else

`z = y - x; a. (x >= y) ? z = x - y : z = y - x;`

`b. if (hours >= 40.0)`

`wages = 40 * 7.50 + 1.5 * 7.5 * (hours - 40);`

`else`

`wages = hours * 7.50; b. (hours >= 40.0) ? wages = 40 * 7.50 + 1.5 * 7.5 * (hours - 40) : wages = hours * 7.50;`

`c. if (score >= 60)`

`str = "Pass";`

`else`

`str = "Fail"; c. (score >= 60) ? str = "Pass" : str = "Fail";`

24. Rewrite the following expressions using an if...else statement. (Assume that all variables are declared properly.)

a. `(x < 5) ? y = 10 : y = 20;`

b. `(fuel >= 10) ? drive = 150 : drive = 30;`

c. `(booksBought >= 3) ? discount = 0.15 : discount = 0.0;`

25. Suppose that you have the following conditional expression. (Assume that all the variables are properly declared.)

`(0 < backyard && backyard <= 5000) ? fertilizingCharges = 40.00`

`: fertilizingCharges = 40.00 + (backyard - 5000) * 0.01;`

a. What is the value of fertilizingCharges if the value of backyard is 3000?

b. What is the value of fertilizingCharges if the value of backyard is 5000?

c. What is the value of fertilizingCharges if the value of backyard is 6500?

a. 40.00

b. 40.00

c. 55.00

26. State whether the following are valid switch statements. If not, explain why. Assume that n and digit are int variables.

a. `switch (n <= 2)`

`{`

`case 0: cout << "Draw." << endl;`

`break;`

`case 1: cout << "Win." << endl;`

```
break;
case 2:
cout << "Lose." << endl;
break;
}
b. switch (digit / 4)
{
case 0,
case 1:
    cout << "low." << endl;
    break;
case 1,
case 2:
    cout << "middle." << endl;
    break;
case 3:
    cout << "high." << endl;
}
c. switch (n % 6)
{
case 1:
case 2:
case 3:
case 4:
case 5:
    cout << n;
    break;

case 0:
    cout << endl;
    break;
}
d. switch (n % 10)
{

case 2:

case 4:

case 6:

case 8:

cout << "Even";

break;

case 1:

case 3:
```

```
case 5:  
case 7:  
    cout << "Odd";  
    break;  
}
```

27. Suppose that alpha is an int variable. Consider the following C++ code:

```
cin >> alpha;  
switch (alpha % 6)  
{  
case 0:  
alpha--;  
break;  
case 1: case 2:  
    alpha = alpha * 2;  
    break;  
case 3:  
    break;  
case 4:  
    alpha = alpha - 5;  
case 5:  
    alpha++;  
    break;  
default:  
    alpha = alpha / 3;  
}
```

- a. What is the output if the input is 8? **16**
- b. What is the output if the input is 3? **3**
- c. What is the output if the input is 17? **18**
- d. What is the output if the input is 24? **23**

28. Suppose that beta is an int variable. Consider the following C++ code:

```
cin >> beta;
switch (beta % 7)
{
case 0:
case 1:
    beta = beta * beta;
    break;
case 2:
    beta++;
    break;
case 3: beta = static_cast<int>(sqrt(beta * 1.0));
    break;
case 4: beta = beta + 4;
case 6: beta = beta--;
    break;
default:
    beta = -10;
}
```

- a. What is the output if the input is 11?
- b. What is the output if the input is 12?
- c. What is the output if the input is 0?
- d. What is the output if the input is 16?

29. Suppose that num is an int variable. Consider the following C++ code:

```
cin >> num;
if (num >= 0)
    switch (num)
    {
case 0:
```

```

        num = static_cast<int>(pow(num, 3.0));
        break;
case 2:
        num = ++num; break;
case 4:
        num = num - 4;
        break;
case 5:
        num = num * 4;
case 6:
        num = num / 6;
        break;
case 10:
        num--;
        break;
default:
        num = -20;
}
else
        num = num + 10;

```

- a. What is the output if the input is 5? **3**
- b. What is the output if the input is 26? **-20**
- c. What is the output if the input is 2? **3**
- d. What is the output if the input is -5? **5**

30. In the following code, correct any errors that would prevent the program from compiling or running:

```

include <iostream>
main ()
{
        int num1, num2;

```

```

    bool found;
    cout << "Enter two integers: ";
    cin >> num1 >> num2;
    cout << endl;
if (num1 >= num2) && num2 > 0
switch (num % num2)
{
case 1
    found = (num / num2) >= 6;
    break;
case 2: case 3
    num1 = num2 / 2;
    brake;
default:
    num2 = num1 * num2;
}
else
{
    found = (2 * num2 < num1);

    if found
        cin >> num2
        num 1 = num2 - num1;
        temp = (num1 + num2) / 10;
    if num2
    {
        num1 = num2;
        num2 = temp;
    }
}

```

```
cout << num1 << " " << num2 << endl;
}
```

After correcting the code, answer the following questions. (If needed, insert prompt lines to inform the user for the input.)

- a. What is the output if the input is 10 8 6?
- b. What is the output if the input is 4 9 11?

31. The following program contains errors. Correct them so that the program will run and output $w = 21$.

```
#include <iostream>
using namespace std;
const int SECRET = 5
main ()
{
int x, y, w, z;
z = 9;
if z > 10
    x = 12; y = 5, w = x + y + SECRET;
else
    x = 12; y = 4, w = x + y + SECRET;
cout << "w = " << w << endl;
}
```

```
#include <iostream>
using namespace std; const int SECRET = 5;
int main() { int x, y, w, z;
z = 9;
if (z > 10) { x = 12; y = 5; w = x + y + SECRET; } else { x = 12; y = 4; w = x + y + SECRET; }
cout << "w = " << w << endl;
return 0;
}
```

32. Write the missing statements in the following program so that it prompts the user to input two numbers. If one of the numbers is 0, the program should output a message indicating that both numbers

must be nonzero. If the first number is greater than the second number, it outputs the first number divided by the second number; if the first number is less than the second number, it outputs the second number divided by the first number; otherwise, it outputs the product of the numbers.

```
#include <iostream>

using namespace std;

int main()
{
    double firstNum, secondNum;

    cout << "Enter two nonzero numbers: ";

    cin >> firstNum >> secondNum; cout << endl;

    //Missing statements

    return 0;
}
```

33. Suppose that classStanding is a char variable, and gpa and dues are double variables. Write a switch expression that assigns the dues as following: If classStanding is 'f', the dues are \$150.00; if classStanding is 's' (if gpa is at least 3.75, the dues are \$75.00; otherwise, dues are 120.00); if classStanding is 'j' (if gpa is at least 3.75, the dues are \$50.00; otherwise, dues are \$100.00); if classStanding is 'n' (if gpa is at least 3.75, the dues are \$25.00; otherwise, dues are \$75.00). (Note that the code 'f' stands for first year students, the code 's' stands for second year students, the code 'j' stands for juniors, and the code 'n' stands for seniors.)

```
switch (classStanding)
{
    case 'f'
        : dues = 150.00;
        break;
    case 's':
        if (gpa >= 3.75)
            dues = 75.00;
        else
            dues = 120.00;
            break;
    case 'j':
        if (gpa >= 3.75)
            dues = 50.00;
        else
            dues = 100.00;
            break;
    case 'n':
        if (gpa >= 3.75)
```

```
        dues = 25.00;
else
    dues = 75.00;
break;
default:
    cout << "Invalid class standing code." << endl;
}
```

34. Suppose that `billingAmount` is a double variable, which denotes the amount you need to pay to the department store. If you pay the full amount, you get \$10.00 or 1% of the `billingAmount`, whichever is smaller, as a credit on your next bill; if you pay at least 50% of the `billingAmount`, the penalty is 5% of the balance; if you pay at least 20% of the `billingAmount` and less than 50% of the `billingAmount`, the penalty is 10% of the balance; otherwise, the penalty is 20% of the balance. Design an algorithm that prompts the user to enter the billing amount and the desired payment. The algorithm then calculates and outputs the credit or the remaining balance. If the amount is not paid in full, the algorithm should also output the penalty amount.