**Chapter 4**

**Exercise 1**

Find the error in each of the following code segments, and explain how to correct it:

1. i = 1;

while (i <= 10);

++i;

}

Answer:

The semicolon after *while (i <= 10);* terminates the loop. The *++i;* is outside the loop. So you remove the semicolon and wrap the loop body in braces like this:

*while (i <= 10) {*

*++i;*

*}*

1. for (k = 0.1; k != 1.0; k += 0.1)

System.out.println(k);

Answer:

Comparing floating-point numbers *(k != 1.0)* is unreliable because of precision errors. Use an integer loop or a tolerance for comparison like this:

*for (int i = 1; i <= 10; i++)*

*System.out.println(i \* 0.1);*

1. switch (n) {

case 1:

System.out.println("The number is 1");

case 2:

System.out.println("The number is 2");

break;

default:

System.out.println("The number is not 1 or 2");

break;

}

Answer:

A *break;* should come after *case 1*. So you insert one:

switch (n) {

case 1:

System.out.println("The number is 1");

break;

case 2:

System.out.println("The number is 2");

break;

default:

System.out.println("The number is not 1 or 2");

        break;

}

1. The following code should print the values 1 to 10:

n = 1;

while (n < 10)

System.out.println(n++);

Answer:

This prints 1 to 9, not 1 to 10. Use *n <= 10* in the condition.

**Exercise 2**

4.5 Describe the four basic elements of counter-controlled repetition.

a. Control variable initialization

b. Loop-continuation condition

c. Increment/decrement of the control variable

d. Loop body execution

4.6 Compare and contrast the while and for repetition statements.

While is more flexible, often used when the number of iterations is unknown.

For is concise and ideal for when the number of iterations is known in advance.

4.7 Discuss a situation in which it would be more appropriate to use a do…while statement than a while statement. Explain why.

Use do...while when you want the loop body to execute at least once, like showing a menu and waiting for a valid input.

4.8 Compare and contrast the break and continue statements.

Break leaves the loop entirely.

Continue skips the current iteration and proceeds with the next one.

4.9 Find and correct the error(s) in each of the following segments of code:

a) For (i = 100, i >= 1, i++) System.out.println(i);

Answer:

Incorrect for syntax (should use *;* not *,*), and *i++* should be *i--*.

*for (int i = 100; i >= 1; i--) System.out.println(i*);

b) The following code should print whether integer value is odd or even:

switch (value % 2) {

case 0:

System.out.println("Even integer");

case 1:

System.out.println("Odd integer");

}

Answer:

Put *break;*

*switch (value % 2) {*

*case 0:*

*System.out.println("Even integer");*

*break;*

*case 1:*

*System.out.println("Odd integer");*

*break;*

*}*

c) The following code should output the odd integers from 19 to 1:

for (i = 19; i >= 1; i += 2)

System.out.println(i);

Answer:

*i += 2*, makes the loop infinite

*for (int i = 19; i >= 1; i -= 2)*

*System.out.println(i);*

d) The following code should output the even integers from 2 to 100:

counter = 2;

do {

System.out.println(counter);

counter += 2;

} While (counter < 100);

Answer:

*While* should be in lowercase

*counter = 2;*

*do {*

*System.out.println(counter);*

*counter += 2;*

*} While (counter < 100);*

4.10 What does the following program do?

// Exercise 4.10: Printing.java

public class Printing {

public static void main(String[] args) {

for (int i = 1; i <= 10; i++) {

for (int j = 1; j <= 5; j++)

System.out.print('@');

System.out.println();

}

}

}

This program prints @ ten times.

4.11 (Find the Smallest Value) Write an application that finds the smallest of several integers. Assume that the first value read specifies the number of values to input from the user.

import java.util.Scanner;

public class FindSmallestValue {

public static void main(String[] args) {

Scanner input = new Scanner(System.in);

System.out.print("How many numbers will you enter? ");

int count = input.nextInt();

if (count <= 0) {

System.out.println("You must enter at least one number.");

return;

}

System.out.print("Enter number 1: ");

int smallest = input.nextInt();

for (int i = 2; i <= count; i++) {

System.out.printf("Enter number %d: ", i);

int num = input.nextInt();

if (num < smallest) {

smallest = num;

}

}

System.out.println("The smallest number entered is: " + smallest);

    }

}

4.12 (Calculating the Product of Odd Integers)

Write an application that calculates the product of the odd integers from 1 to 15.

long product = 1;

for (int i = 1; i <= 15; i += 2)

product \*= i;

System.out.println("Product is " + product);

4.13 (Factorials) Factorials are used frequently in probability problems. The factorial of a positive integer n (written n! and pronounced “n factorial”) is equal to the product of the positive integers from 1 to n. Write an application that calculates the factorials of 1 through 20. Use type long. Display the results in tabular format. What difficulty might prevent you from calculating the factorial of 100?

for (int i = 1; i <= 20; i++) {

long factorial = 1;

for (int j = 1; j <= i; j++)

factorial \*= j;

System.out.printf("%2d! = %d%n", i, factorial);

}

4.14 (Modified Compound-Interest Program) Modify the compound-interest application to repeat its steps for interest rates of 5%, 6%, 7%, 8%, 9% and 10%. Use a for loop to vary the interest rate.

public class ModifiedCompoundInterest {

public static void main(String[] args) {

double principal = 1000.0;

for (int rate = 5; rate <= 10; rate++) {

System.out.printf("Interest Rate: %d%%%n", rate);

System.out.printf("%4s%20s%n", "Year", "Amount on Deposit");

for (int year = 1; year <= 10; year++) {

double amount = principal \* Math.pow(1.0 + rate / 100.0, year);

System.out.printf("%4d%,20.2f%n", year, amount);

}

System.out.println();

       }

    }

}

**Making a Difference**

**4.30 (Global Warming Facts Quiz)**

The controversial issue of global warming has been widely publicized by the film “An Inconvenient Truth,” featuring former Vice President Al Gore. Mr. Gore and a U.N. network of scientists, the Intergovernmental Panel on Climate Change, shared the 2007 Nobel Peace Prize in recognition of “their efforts to build up and disseminate greater knowledge about man-made climate change.” Research both sides of the global warming issue online (you might want to search for phrases like “global warming skeptics”). Create a five-question multiplechoice quiz on global warming, each question having four possible answers (numbered 1–4). Be objective and try to fairly represent both sides of the issue. Next, write an application that administers the quiz, calculates the number of correct answers (zero through five) and returns a message to the user. If the user correctly answers five questions, print “Excellent”; if four, print “Very good”; if three or fewer, print “Time to brush up on your knowledge of global warming,” and include a list of some of the websites where you found your facts.

import java.util.Scanner;

public class GlobalWarmingQuiz {

public static void main(String[] args) {

Scanner input = new Scanner(System.in);

String[] questions = {

"1. What is the primary greenhouse gas emitted by human activities?\n1) Oxygen\n2) Carbon Dioxide\n3) Nitrogen\n4) Helium",

"2. What do global warming skeptics often cite as a natural cause of climate change?\n1) Human activity\n2) Volcanic eruptions\n3) Industrial pollution\n4) Fossil fuels",

"3. Which of these is a possible consequence of global warming?\n1) Rising sea levels\n2) Decreased plant growth\n3) Lower oxygen levels\n4) More lunar eclipses",

"4. What is the goal of the Paris Agreement?\n1) Eliminate fossil fuels by 2030\n2) Stop deforestation completely\n3) Limit global temperature rise to below 2°C\n4) Increase industrial output",

"5. What do critics argue about climate models?\n1) They are too simple\n2) They are 100% accurate\n3) They ignore CO2\n4) They rely on perfect data"

};

int[] correctAnswers = {2, 2, 1, 3, 4}; // Answers correspond to the numbering (1–4)

int score = 0;

for (int i = 0; i < questions.length; i++) {

System.out.println(questions[i]);

System.out.print("Your answer (1-4): ");

int answer = input.nextInt();

if (answer == correctAnswers[i]) {

score++;

}

System.out.println();

}

switch (score) {

case 5:

System.out.println("Excellent!");

break;

case 4:

System.out.println("Very good!");

break;

default:

System.out.println("Time to brush up on your knowledge of global warming.");

System.out.println("Visit:");

System.out.println(" - https://climate.nasa.gov");

System.out.println(" - <https://skepticalscience.com>");

System.out.println(" - https://www.ipcc.ch");

       }

    }

}

**4.31 (Tax Plan Alternatives; The “FairTax”)**

There are many proposals to make taxation fairer. Check out the FairTax initiative in the United States at www.fairtax.org. Research how the proposed FairTax works. One suggestion is to eliminate income taxes and most other taxes in favor of a 23% consumption tax on all products and services that you buy. Some FairTax opponents question the 23% figure and say that because of the way the tax is calculated, it would be more accurate to say the rate is 30%—check this carefully. Write a program that prompts the user to enter expenses in various expense categories they have (e.g., housing, food, clothing, transportation, education, health care, vacations), then prints the estimated FairTax that person would pay.

import java.util.Scanner;

public class FairTaxCalculator {

public static void main(String[] args) {

Scanner input = new Scanner(System.in);

double totalExpenses = 0;

String[] categories = {

"housing", "food", "clothing", "transportation",

"education", "health care", "vacations"

};

for (String category : categories) {

System.out.printf("Enter monthly expenses for %s: $", category);

totalExpenses += input.nextDouble();

}

double fairTaxRate = 0.23;

double estimatedTax = totalExpenses \* fairTaxRate;

System.out.printf("Estimated FairTax you would pay: $%.2f%n", estimatedTax);

System.out.printf("Alternate 30%% view (on pre-tax price): $%.2f%n", totalExpenses \* 0.30);

    }

}

**4.32 (Facebook User Base Growth)**

According to CNNMoney.com, Facebook hit one billion users in October 2012. Using the compound-growth technique you learned in Fig. 4.6 and assuming its user base grows at a rate of 4% per month, how many months will it take for Facebook to grow its user base to 1.5 billion users? How many months will it take for Facebook to grow its user base to two billion users?

users = 1\_000\_000\_000;

months = 0;

while (users < target) {

users \*= 1.04;

    months++;