Chapter 1 Homework

HW1.1 The following program is wrong. Reorder the lines so that the program displays morning followed by afternoon.

```java
public static void main(String[] args) {
    public class Welcome {
        System.out.println("afternoon");
        System.out.println("morning");
    }
}
```

HW1.2 Identify and fix the errors in the following code:

```java
1 public class Welcome {
2     public void Main(String[] args) {
3         System.out.println('Welcome to Java!');
4     }
5 }
```

HW1.3 Show the output of the following code:

```java
public class Test {
    public static void main(String[] args) {
        System.out.println("3.5 * 4 / 2 - 2.5 is ");
        System.out.println(3.5 * 4 / 2 - 2.5);
    }
}
```

HW1.4 (Displaying five messages) Write a program that displays Welcome to Java five times.
Chapter 2 Homework

HW2.1 (Computing the volume of a cylinder) Write a program that reads in the radius and length of a cylinder and computes volume using the following formulas:

\[
\text{area} = \text{radius} \times \text{radius} \times \pi \\
\text{volume} = \text{area} \times \text{length}
\]

Here is a sample run:

Enter the radius and length of a cylinder: 16
The area is 95.0331
The volume is 1140.4

HW2.2 (Financial application: calculating tips) Write a program that reads the subtotal and the gratuity rate, then computes the gratuity and total. For example, if the user enters 10 for subtotal and 15% for gratuity rate, the program displays $1.5 as gratuity and $11.5 as total. Here is a sample run:

Enter the subtotal and a gratuity rate: 15.69 15
The gratuity is 2.35 and total is 18.04 15.69 15
Chapter 3 Homework

HW3.1 (Game: scissor, rock, paper) Write a program that plays the popular scissor-rock-paper game. (A scissor can cut a paper, a rock can knock a scissor, and a paper can wrap a rock.) The program randomly generates a number 0, 1, or 2 representing scissor, rock, and paper. The program prompts the user to enter a number 0, 1, or 2 and displays a message indicating whether the user or the computer wins, loses, or draws. Here are sample runs:

```
scissor (0), rock (1), paper (2): 1
The computer is scissor. You are rock. You won

scissor (0), rock (1), paper (2): 2
The computer is paper. You are paper too. It is a draw
```

HW3.2 (Science: day of the week) Zeller’s congruence is an algorithm developed by Christian Zeller to calculate the day of the week. The formula is

\[ h = (q + \left\lfloor \frac{26(m+1)}{10} \right\rfloor + k + \left\lfloor \frac{k}{4} \right\rfloor + \left\lfloor \frac{j}{4} \right\rfloor + 5j) \mod 7 \]

where
- \( h \) is the day of the week (0: Saturday, 1: Sunday, 2: Monday, 3: Tuesday, 4: Wednesday, 5: Thursday, 6: Friday).
- \( q \) is the day of the month.
- \( m \) is the month (3: March, 4: April, … 12: December). January and February are counted as months 13 and 14 of the previous year.
- \( j \) is the century (i.e., \( \left\lfloor \frac{\text{year}}{100} \right\rfloor \)).
- \( k \) is the year of the century (i.e., year \% 100).

(Hint: \( \lfloor n \rfloor = (\text{int})n \) for a positive \( n \). January and February are counted as 13 and 14 in the formula. So you need to convert the user input 1 to 13 and 2 to 14 for the month and change the year to the previous year.)

Write a program that prompts the user to enter a year, month, and day of the month, and displays the name of the day of the week. Here are some sample runs:

```
Enter year: (e. g., 2008): 2002
Enter month: 1- 12: 3
Enter the day of the month: 1- 31: 26
Day of the week is Tuesday

Enter year: (e. g., 2 008): 2011
Enter month: 1- 12: 5
Enter the day of the month: 1- 31: 2
Day of the week is Monday
```
Chapter 4 Homework

HW4.1 (Counting positive and negative numbers and computing the average of numbers)
Write a program that reads an unspecified number of integers, determines how many positive and negative values have been read, and computes the total and average of the input values (not counting zeros). Your program ends with the input 0. Display the average as a floating-point number. Here is a sample run:

Enter an int value, the program exits if the input is 0:
1 2 -1 3 0
The number of positives is 3
The number of negatives is 1
The total is 5
The average is 1.25

HW4.2 (Math: combinations) Write a program that displays all possible combinations for picking two numbers from integers 1 to 7. Also display the total number of all combinations.

1 2
1 3
...
...
Chapter 5 Homework

HW5.1 (Displaying an integer reversed) Write the following method to display an integer in reverse order:

```java
public static void reverse(int number)
```

For example, reverse(3456) displays 6543. Write a test program that prompts the user to enter an integer and displays its reversal.

HW5.2 (Geometry: area of a regular polygon) A regular polygon is an n-sided polygon in which all sides are of the same length and all angles have the same degree (i.e., the polygon is both equilateral and equiangular). The formula for computing the area of a regular polygon is

\[
Area = \frac{n \cdot s^2}{4 \cdot \tan \left( \frac{\pi}{n} \right)} \quad \text{where } s \text{ is length of side, } n \text{ is number of sides}
\]

Write a method that returns the area of a regular polygon using the following header:

```java
public static double area(int n, double side)
```

Write a main method that prompts the user to enter the number of sides and the length of a side of a regular polygon and displays its area.
Chapter 6 Homework

HW6.1 (Assigning grades) Write a program that reads student scores, gets the best score, and then assigns grades based on the following scheme:

Grade is A if score is 7 = best - 10;
Grade is B if score is 7 = best - 20;
Grade is C if score is 7 = best - 30;
Grade is D if score is 7 = best - 40;
Grade is F otherwise.

The program prompts the user to enter the total number of students, then prompts the user to enter all of the scores, and concludes by displaying the grades. Here is a sample run:

Enter the number of students:  4
Enter 4 scores:  40 55 70 58
Student 0 score is 40 and grade is C
Student 1 score is 55 and grade is B
Student 2 score is 70 and grade is A
Student 3 score is 58 and grade is B

HW6.2 (Counting single digits) Write a program that generates 100 random integers between 0 and 9 and displays the count for each number. (Hint: Use (int) (Math.random() * 10) to generate a random integer between 0 and 9. Use an array of ten integers, say counts, to store the counts for the number of 0s, 1s, 9s.)

HW6.3 (Game: locker puzzle) A school has 100 lockers and 100 students. All lockers are closed on the first day of school. As the students enter, the first student, denoted S1, opens every locker. Then the second student, S2, begins with the second locker, denoted L2, and closes every other locker. Student S3 begins with the third locker and changes every third locker (closes it if it was open, and opens it if it was closed). Student S4 begins with locker L4 and changes every fourth locker. Student S5 starts with L5 and changes every fifth locker, and so on, until student S100 changes L100.

After all the students have passed through the building and changed the lockers, which lockers are open? Write a program to find your answer.

(Hint: Use an array of 100 Boolean elements, each of which indicates whether a locker is open (true) or closed (false). Initially, all lockers are closed.)
Chapter 7 Homework

HW7.1 (Summing the major diagonal in a matrix) Write a method that sums all the integers in the major diagonal in an n x n matrix of integers using the following header:

```
public static int sumMajorDiagonal (int[][] m)
```

Write a test program that reads a 4-by-4 matrix and displays the sum of all its elements on the major diagonal. Here is a sample run:

```
Enter a 4-by-4 matrix row by row:
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
Sum of the elements in the major diagonal is 34
```

HW7.2 (Game: nine heads and tails) Nine coins are placed in a 3-by-3 matrix with some face up and some face down. You can represent the state of the coins using a 3-by-3 matrix with values 0 (head) and 1 (tail). Here are some examples:

```
0 0 0    1 0 1    1 1 0    1 0 1    1 0 0
0 1 0    0 0 1    1 0 0    1 1 0    1 1 1
0 0 0    1 0 0    0 0 1    1 0 0    1 1 0
```

Each state can also be represented using a binary number. For example, the preceding matrices correspond to the numbers

```
000010000 101001100 110100001 101110100 100111110
```

There are a total of 512 possibilities. So, you can use decimal numbers 0, 1, 2, 3, ..., and 511 to represent all states of the matrix. Write a program that prompts the user to enter a number between 0 and 511 and displays the corresponding matrix with characters H and T. Here is a sample run:

```
Enter a number between 0 and 511: 7
H H H
H H H
T T T
```

The user entered 7, which corresponds to 000000111. Since 0 stands for H and 1 for T, the output is correct.