These are the additional exercises not printed in the text. These exercises are available only to instructors. Solutions for these exercises are named with suffix Extra (e.g., Exercise01_01Extra) and can be downloaded along with all other programming exercises by instructors from the IR Website. When you download the solutions for programming exercises, the zip file also contains the solutions for extra exercises.

These extra are set up in LiveLab named Exercise01_01Extra, etc.

Extra Exercise for Chapter 1

*1.1 (*Simple computation*) The formula for computing the discriminant of a quadratic equation $ax^2 + bx + c = 0$ is b^2 – 4ac. Write a program that computes the discriminant for the equation 3x^2 + 4x + 5.

*1.2 (*Physics: acceleration*) Average acceleration is defined as the change of velocity divided by the time taken to make the change, as shown in the following formula:

$$a = \frac{v_1 - v_0}{t}$$

Here, v0 is the starting velocity in meters/second, v1 is the ending velocity in meters/second, and t is the time span in seconds. Assume v0 is 5.6, v1 is 10.5, and t is 0.5, and displays the average acceleration.

*1.3 (*Display pattern*) Write a program that displays the following a big sign for 100 as shown in the sample run:

<output>

```
*   *****   *****
*   *   *   *   *
*   *   *   *   *
*   *   *   *   *
*   *****   *****
```

<end output>

Extra Exercise for Chapter 2

*2.1 (*Rectangle perimeter, area, and diagonal length*) Write a program that prompts the user to enter the width and height of a rectangle and displays the perimeter, area, and the length of diagonal. Here is a sample run:

<output>

Enter the width and height of a rectangle: 4.25 7.26 ***<enter icon>***

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```
The perimeter is 23.02
The area is 30.855
The length of the diagonal is 8.412496656760108
```

<end output>

*2.2 (*Physics: one dimensional motion*) By one dimension, we mean that the object is moving in a straight line.

There are five variables that put together in several equations for describing this motion:

Eq1: $v_1 = v_0 + a \times t$

Eq2: $d = averageSpeed \times t$ **,** $averageSpeed = (v_0 + v_1)/2$

Eq3: $d = v_0 \times t + a \times t^2 / 2$ **(Eq3 is derived from Eq1 and Eq2)**

Eq4: $v_1^2 = v_0^2 + 2 \times a \times d$ **(Eq4 is derived from Eq1 and Eq2)**

Where

v_1 is the final velocity in meters per second (m/s)

v_0 is the initial velocity in meters per second (m/s)

t is the time elapsed in seconds

a is the object's acceleration in meters per square second (m/s^2)

d is the distance traveled in meters

Suppose a ball is released from the top of a building, you can write a program to find out the height of the building, given the travel time for the ball to the ground using Eq3. Note that the acceleration due to gravity is constant 9.8 m/s^2. Here is a sample run:

<output>

```
Enter the ball travel time in seconds: 2.5 <enter icon>

The height of the building is 30.625 meters
```

<end output>

*2.3 (*Physics: friction coefficient*) The force pushing or pulling an object is related to the object's mass, acceleration, and a coefficient of friction in the following formula:

$$F = u \times m \times g + m \times a$$

Where

F is the force applied to push or pull an object in Newtons (N)

u is a coefficient of friction (u_k is small for a smooth surface and large for a rough surface)

m is the object's mass in kilograms (kg)

g is the acceleration due to gravity, which is a constant 9.8 m/s^2 (meters per square second)

a is the object's acceleration in meters per square second (m/s^2)

Write a program that prompts the user to enter input for F , m , and a , and displays the coefficient of friction.

Here is a sample run:

<output>

```
Enter the friction force in Newtons: 150 <enter icon>
Enter the object's mass in kg: 24.5 <enter icon>
Enter the object's acceleration in m/s^2: 4.5 <enter icon>
The coefficient for friction is 0.165556
```

<end output>

*2.4 (*Slope of a line*) Write a program that prompts the user to enter the coordinates of two points (x1, y1) and (x2, y2), and displays the slope of the line connects the two points. The formula of the slope is $(y_2 - y_1)/(x_2 - x_1)$. Here is a sample run:

<output>

```
Enter the coordinates for two points: 4.5 -5.5 6.6 -6.5 <enter icon>
The slope for the line that connects two points (4.5, -5.5) and (6.6, -6.5) is -0.47619
```

<end output>

*2.5 (*Financial application: initial deposit amount*) Suppose you want to deposit a certain amount of money into a savings account with a fixed annual interest rate. Write a program that prompts the user to enter the final account value, the annual interest rate in percent, and the number of years, and then displays the initial deposit amount. The initial deposit amount can be obtained using the following formula:

$$initialDepositAmount = \frac{finalAccountValue}{(1 + monthlyInterestRate)^{numberOfMonths}}$$

Here is a sample run:

<output>

Enter final account value: 1000 ***<Enter icon>***

Enter annual interest rate in percent: 4.25 ***<Enter icon>***

Enter number of years: 5 ***<Enter icon>***

Initial deposit value is 808.8639197424636

<end output>

*2.6 (*Split digits*) Write a program that prompts the user to enter a four-digit integer and displays the number in reverse order. Here is a sample run:

<output>

Enter an integer: 5213 ***<Enter icon>***

3125

<end output>

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