Introduction to Programming: Problem Set 1

1.1 (*Display three different messages*) Write a program that displays `Welcome to Python`, `Welcome to Computer Science`, and `Programming is fun`.

1.2 (*Display the same message five times*) Write a program that displays `Welcome to Python` five times.

***1.3** (*Display a pattern*) Write a program that displays the following pattern:

```
FFFFFFF    U       U    NN       NN
FF         U       U    NNN      NN
FFFFFFF    U       U    NN N     NN
FF           U   U      NN  N    NN
FF             UUU      NN    NNN
```

1.4 (*Print a table*) Write a program that displays the following table:

```
a       a^2     a^3
1       1       1
2       4       8
3       9       27
4       16      64
```

1.5 (*Compute expressions*) Write a program that displays the result of

$$\frac{9.5 \times 4.5 - 2.5 \times 3}{45.5 - 3.5}$$

1.6 (*Summation of a series*) Write a program that displays the result of $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9$.

1.7 (*Approximate π*) π can be computed using the following formula:

$$\pi = 4 \times \left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \ldots\right)$$

Write a program that displays the result of $4 \times \left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11}\right)$.

and $4 \times \left(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \frac{1}{13} - \frac{1}{15}\right)$.

1.8 (*Area and perimeter of a circle*) Write a program that displays the area and perimeter of a circle that has a radius of `5.5` using the following formulas:

$$area = radius \times radius \times \pi$$
$$perimeter = 2 \times radius \times \pi$$

1.9 (*Area and perimeter of a rectangle*) Write a program that displays the area and perimeter of a rectangle with the width of `4.5` and height of `7.9` using the following formula:

$$area = width \times height$$

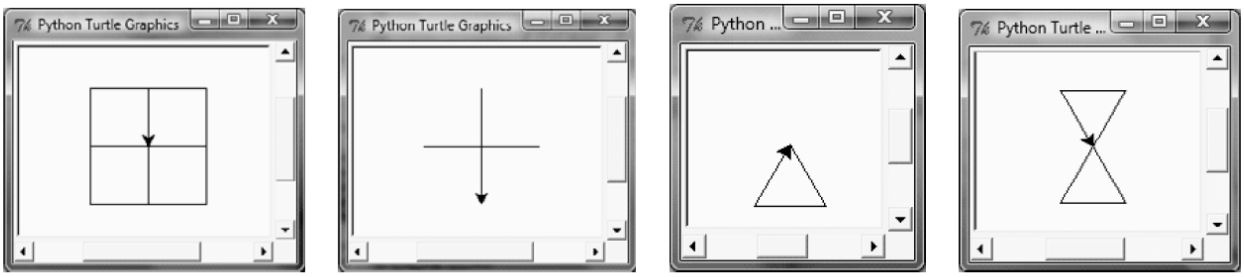
1.10 (*Average speed*) Assume a runner runs `14` kilometers in `45` minutes and `30` seconds. Write a program that displays the average speed in miles per hour. (Note that `1` mile is `1.6` kilometers.)

***1.11** (*Population projection*) The US Census Bureau projects population based on the following assumptions:

One birth every 7 seconds
One death every 13 seconds
One new immigrant every 45 seconds

Write a program to display the population for each of the next five years. Assume the current population is 312032486 and one year has 365 days. Hint: in Python, you can use integer division operator `//` to perform division. The result is an integer. For example, `5 // 4` is `1` (not `1.25`) and `10 // 4` is `2` (not `2.5`).

1.12 (*Turtle: draw four squares*) Write a program that draws four squares in the center of the screen, as shown in Figure 1.18a.



(a) (b) (c) (d)

FIGURE 1.18 Four squares are drawn in (a), a cross is drawn in (b), a triangle is drawn in (c), and two triangles are drawn in (d).

1.13 (*Turtle: draw a cross*) Write a program that draws a cross as shown in Figure 1.18b.

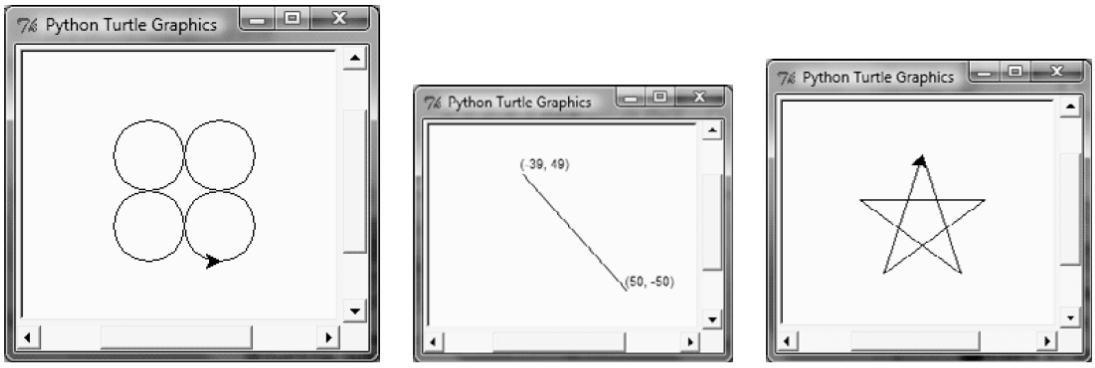
1.14 (*Turtle: draw a triangle*) Write a program that draws a triangle as shown in Figure 1.18c.

1.15 (*Turtle: draw two triangles*) Write a program that draws two triangles as shown in Figure 1.18d.

1.16 (*Turtle: draw four circles*) Write a program that draws four circles in the center of the screen, as shown in Figure 1.19a.

1.17 (*Turtle: draw a line*) Write a program that draws a red line connecting two points (**-39**, **48**) and (**50**, **-50**) and displays the coordinates of the two points, as shown in Figure 1.19b.

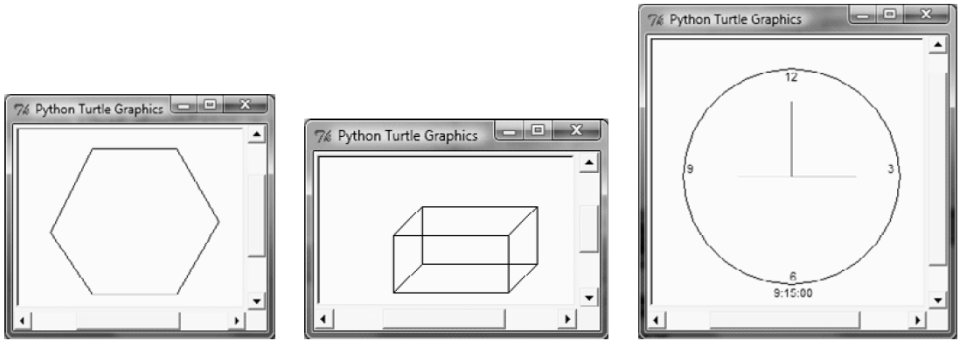
****1.18** (*Turtle: draw a star*) Write a program that draws a star, as shown in Figure 1.19c. (Hint: The inner angle of each point in the star is 36 degrees.)



(a) (b) (c)

FIGURE 1.19 Four circles are drawn in (a), a line is drawn in (b), and a star is drawn in (c).

1.19 (*Turtle: draw a polygon*) Write a program that draws a polygon that connects the points (`40`, `-69.28`), (`-40`, `-69.28`), (`-80`, `-9.8`), (`-40`, `69`), (`40`, `69`), and (`80`, `0`) in this order, as shown in Figure 1.20a.



(a) (b) (c)

FIGURE 1.20 (a) The program displays a polygon. (b) The program displays a rectanguloid. (c) The program displays a clock for the time.

1.20 (*Turtle: display a rectanguloid*) Write a program that displays a rectanguloid, as shown in Figure 1.20b.

*__1.21__ (*Turtle: display a clock*) Write a program that displays a clock to show the time 9:15:00, as shown in Figure 1.20c.