1 Exercises

Exercise 1. What does the following code fragment write to standard output?

```
r = 5
c = 2 * math.pi * r
a = math.pi * r ** 2
stdio.writef('radius = %.2f, circumference = %.2f, area = %.2f\n', r, c, a)
```

Exercise 2. Write a program called `randomints.py` that accepts n (int), a (int), and b (int) as command-line arguments, and writes to standard output n random integers from the interval $[a, b]$ in sorted order. For example

```
>_ ~/workspace/ipp/programs
$ python3 randomints.py 5 100 1000
238
379
597
748
978
```

Exercise 3. Write a program called `stats.py` that reads a sequence of floats from standard input, and writes to standard output their mean, variance, and standard deviation, each up to 3 decimal places. For example

```
>_ ~/workspace/ipp/programs
$ python3 stats.py
1 2 3 4 5
<ctrl-d>
mean = 3.000, var = 2.000, std = 1.414
```

The mean μ, variance Var, and standard deviation σ of the numbers $x_1, x_2, \ldots, x_n$ are computed as

$$\mu = \frac{x_1 + x_2 + \cdots + x_n}{n}, Var = \frac{(x_1 - \mu)^2 + (x_2 - \mu)^2 + \ldots (x_n - \mu)^2}{n}, \text{ and } \sigma = \sqrt{Var}.$$

Exercise 4. Consider the programs `randomints.py` and `stats.py` from the previous two problems.

a. What is the command for generating 100 random integers from the interval $[500, 1000]$?

b. What is the command for generating 100 random integers from the interval $[500, 1000]$ and saving the output in a file called `ints.txt`?

c. What is the command to compute stats for the numbers in `ints.txt`?

d. What is the command to perform the last two tasks in one shot?

2 Solutions

Solution 1.

```
radius = 5.00, circumference = 31.42, area = 78.54
```

Solution 2.

```
randomints.py
import stdio
import stdrandom
import sys
```

```
n = int(sys.argv[1])
a = int(sys.argv[2])
b = int(sys.argv[3])
ints = []
for i in range(n):
    r = stdrandom.uniformInt(a, b + 1)
    ints += [r]
for v in sorted(ints):
    stdio.writeln(v)
```

Solution 3.

stats.py

```
import stdio

ints = stdio.readAllInts()
mean = sum(ints) / len(ints)
var = 0.0
for v in ints:
    var += (v - mean) ** 2
var /= len(ints)
std = var ** 0.5
stdio.writef('mean = %.3f, var = %.3f, std = %.3f\n', mean, var, std)
```

Solution 4.

a.

```
$ python3 randomints.py 100 500 1000
```

b.

```
$ python3 randomints.py 100 500 1000 > ints.txt
```

c.

```
$ python3 stats.py < ints.txt
```

d.

```
$ python3 randomints.py 100 500 1000 | python3 stats.py
```