1 Exercises

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

```python
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

```bash
$ 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

```bash
$ python3 stats.py
1 2 3 4 5
<ctrl-d>
mean = 3.000 , var = 2.000 , std = 1.414
```

The mean \(\mu\), variance \(Var\), and standard deviation \(\sigma\) of the numbers \(x_1, x_2, \ldots, x_n\) are computed as

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

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.

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

Solution 2.

```python
import stdio
import stdrandom
import sys
```

```bash
$ python3 randomints.py
```

```python
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.

```python
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.writeln("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
```