

1 Exercises

Exercise 1. Consider the following code fragment:

```
if m >= 1 and m <= 5:
    stdio.write("Spring ")
elif m >= 6 and m <= 8:
    stdio.write("Summer ")
else:
    stdio.write("Fall ")
stdio.writeln(y)
```

What does the program write when `m` and `y` take on the following values?

- a. `m = 10` and `y = 2020`
- b. `m = 5` and `y = 2021`
- c. `m = 6` and `y = 2022`

Exercise 2. What does the following code fragment write?

```
i = 9
while i >= 0:
    stdio.writeln(str(i) + " " + str(2 ** i))
    i -= 2
```

Exercise 3. What are the arithmetic progressions returned by the following calls to `range()`?

- a. `range(-5)`
- b. `range(5)`
- c. `range(3, 10)`
- d. `range(3, 10, 2)`
- e. `range(5, -5, -1)`

Exercise 4. What does the following code fragment write?

```
for i in range(3, 40, 4):
    if i % 5 == 0:
        stdio.writeln(i)
```

Exercise 5. What does the following code fragment write?

```
i = 1
for c in "hello":
    stdio.writeln(c * i)
    i += 1
```

Exercise 6. What does the following code fragment write?

```
for i in range(5):
    for j in range(6):
        if j == 5:
            stdio.writeln(i + j)
        else:
            stdio.write(str(i + j) + "-")
```

Exercise 7. Implement a program called `generalizedharmonic.py` that accepts n (int) and r (int) as command-line arguments and writes the value of the generalized harmonic number $H(n, r)$ to standard output, computed using the formula

$$H(n, r) = \frac{1}{1^r} + \frac{1}{2^r} + \frac{1}{3^r} + \cdots + \frac{1}{n^r}.$$

Exercise 8. Implement a program called `matrix.py` that accepts n (int) and k (int) as command-line arguments and writes an $n \times n$ matrix in which the elements below the main diagonal are all zeros and the rest of the elements have the value k . The elements of the matrix must be separated by a single space and each row must end with a newline character at the end.

```
>_ ~/workspace/ipp/programs
$ python matrix.py 5 2
2 2 2 2 2
0 2 2 2 2
0 0 2 2 2
0 0 0 2 2
0 0 0 0 2
$ -
```

Exercise 9. Consider the program `gambler.py`.

- How many variables does the program define?
- Write down the names of the variables and the scope of each variable.

2 Solutions

Solution 1.

- Fall 2020
- Spring 2021
- Summer 2022

Solution 2.

```
9 512
7 128
5 32
3 8
1 2
$ -
```

Solution 3.

- `[]`
- `[0, 1, 2, 3, 4]`
- `[3, 4, 5, 6, 7, 8, 9]`
- `[3, 5, 7, 9]`
- `[5, 4, 3, 2, 1, 0, -1, -2, -3, -4]`

Solution 4.

```
15
35
```

Solution 5.

```
h
ee
lll
llll
ooooo
```

Solution 6.

```
0-1-2-3-4-5
1-2-3-4-5-6
2-3-4-5-6-7
3-4-5-6-7-8
4-5-6-7-8-9
```

Solution 7.

```
generalizedharmonic.py

import stdio
import sys

n = int(sys.argv[1])
r = int(sys.argv[2])
total = 0
for i in range(1, n + 1):
    total += 1 / i ** r
stdio.writeln(total)
```

Solution 8.

```
matrix.py

import stdio
import sys

n = int(sys.argv[1])
k = int(sys.argv[2])
for i in range(n):
    for j in range(n):
        e = 0 if i > j else k
        if j == n - 1:
            stdio.writeln(e)
        else:
            stdio.write(str(e) + " ")
```

Solution 9.

- a. There are seven variables defined in `gambler.py`.
- b. Here are their names and scopes:

Variable	Scope
<code>stake</code>	lines 9 — 25
<code>goal</code>	lines 10 — 25
<code>trials</code>	lines 11 — 25
<code>bets</code>	lines 12 — 25
<code>wins</code>	lines 13 — 25
<code>t</code>	lines 14 — 23
<code>cash</code>	lines 15 — 23