1 Exercises

Exercise 1. Consider the following code fragment:

```python
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?

```python
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 calles 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?

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

Exercise 5. What does the following code fragment write?

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

Exercise 6. What does the following code fragment write?

```python
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
 0 2 2 2
 0 0 2 2
 0 0 0 2
 0 0 0 2
$
```

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

a. How many variables does the program define?

b. Write down the names of the variables and the scope of each variable.

2 Solutions

Solution 1.

a. Fall 2020

b. Spring 2021

C. Summer 2022

Solution 2.

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

Solution 3.

a. \( [] \)

b. \( [0, 1, 2, 3, 4] \)

c. \( [3, 4, 5, 6, 7, 8, 9] \)

d. \( [3, 5, 7, 9] \)

e. \( [5, 4, 3, 2, 1, 0, -1, -2, -3, -4] \)
Solution 4.

15
35

Solution 5.

h
  ee
  lll
  llll
  ooooo

Solution 6.

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

Solution 7.

```python
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.

```python
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:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>stake</td>
<td>lines 9 — 25</td>
</tr>
<tr>
<td>goal</td>
<td>lines 10 — 25</td>
</tr>
<tr>
<td>trials</td>
<td>lines 11 — 25</td>
</tr>
<tr>
<td>bets</td>
<td>lines 12 — 25</td>
</tr>
<tr>
<td>wins</td>
<td>lines 13 — 25</td>
</tr>
<tr>
<td>t</td>
<td>lines 14 — 23</td>
</tr>
<tr>
<td>cash</td>
<td>lines 15 — 23</td>
</tr>
</tbody>
</table>