Python Looping and Matrix Practice with Sophistication

1. Write a function f1(n) that prints the following triangle.

```
>>> f1(5)
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
>>> f1(0)
>>> f1(1)
1
```

Show Solution

```
def f1(n):
    for i in range(n):
        for j in range(i+1):
            print(j+1, end=" ")
        print()
```

2. Write a function f2(n) that prints the following triangle.

```
>>> f2(3)
1
2 3
4 5 6
>>> f2(0)
>>> f2(1)
1
>>> f2(5)
1
2 3
4 5 6
7 8 9 10
11 12 13 14 15
```

```
def f2(n):
    count = 1
    for i in range(n):
        for j in range(i+1):
            print(count, end=" ")
            count = count + 1
        print()
```

3. Write a function f3(n) that prints the following triangle.

```
>>> f3(3)
1
2 3
4 5 6
2 3
1
>>> f3(4)
1
2 3
4 5 6
7 8 9 10
4 5 6
2 3
1
>>> f3(0)
>>> f3(1)
1
```

Show Solution

```
def f3(n):
    count = 1
    for i in range(n):
        for j in range(i+1):
            print(count, end=" ")
            count = count + 1
        print()
    for i in range(n-1):
        count = count - (2*(n-i-1)+1)
        for j in range(n-i-1):
            print(count, end=" ")
            count = count + 1
        print()
```

4. Write a function f4(n) that prints the following triangle.

```
>>> f4(3)
1
2 3
4 5 6
7 8
9
>>> f4(0)
>>> f4(1)
1
```

Show Solution

```
def f4(n):
    count = 1
    for i in range(n):
        for j in range(i+1):
            print(count, end=" ")
            count = count + 1
        print()
    for i in range(n-1):
        for j in range(n-i-1):
            print(count, end=" ")
            count = count + 1
        print()
```

5. Write a function f5(matrix) that prints the sum of every row in the matrix.

```
>>> f5([[1,0],[0,1]])
1
1
>>> f5([[1,2,3],[4,5,6]])
6
15
>>> f5([[1],[2],[3],[4]])
1
2
3
4
```

Show Solution

```
def f5(matrix):
    for i in range(len(matrix)):
        sum = 0
        for j in range(len(matrix[i])):
            sum = sum + matrix[i][j]
        print(sum)
```

6. Write a function f6(matrix) that returns the sum of all the elements in the matrix.

```
>>> f6([[1,0],[0,1]])
2
>>> f6([[1,2,3],[4,5,6]])
21
>>> f6([[1],[2],[3],[4]])
10
```

Show Solution

```
def f6(matrix):
    sum = 0
    for i in range(len(matrix)):
        for j in range(len(matrix[i])):
            sum = sum + matrix[i][j]
    return sum
```

7. Write a function f7(matrix) that returns the product of all the elements in the matrix.

```
>>> f7([[1,0],[0,1]])
0
>>> f7([[1,2,3],[4,5,6]])
720
>>> f7([[1],[2],[3],[4]])
24
```

```
def f7(matrix):
    prod = 1
    for i in range(len(matrix)):
        for j in range(len(matrix[i])):
            prod = prod * matrix[i][j]
    return prod
```

8. Write a function f8(matrix) that will print the odd numbers in the matrix with each row on one line.

```
>>> f8([[1,0],[0,1]])
1
1
>>> f8([[1,2,3],[4,5,6]])
1 3
5
>>> f8([[1],[2],[3],[4]])
1

3
```

Show Solution

```
def f8(matrix):
    for i in range(len(matrix)):
        for j in range(len(matrix[i])):
            if matrix[i][j] % 2 == 1:
                print(matrix[i][j], end=" ")
        print()
```

9. Write a function f9(matrix1, matrix2) that will return the sum of |matrix1| and |matrix2|. Assume |matrix1| and |matrix2| have the same dimensions.

```
>>> f9([[1,0],[0,1]],[[1,0],[0,1]])
[[2, 0], [0, 2]]
>>> f8([[1,2,3],[4,5,6]],[[-1,-1,-1],[-1,-1,-1]])
[[0, 1, 2], [3, 4, 5]]
>>> f15([[1],[2],[3],[4]],[[4],[3],[2],[1]])
[[5], [5], [5], [5]]
```

Show Solution

```
def f9(matrix1, matrix2):
    res = []
    for i in range(len(matrix1)):
        row = []
        for j in range(len(matrix1[i])):
            row.append(None)
        res.append(row)
    for i in range(len(matrix1)):
        for j in range(len(matrix1[i])):
            res[i][j] = matrix1[i][j] + matrix2[i][j]
```

10. Write a function f10(matrix1, matrix2) that will return the product of |matrix1| and |matrix2|. Assume |len(matrix1) == len(matrix2[0])|.

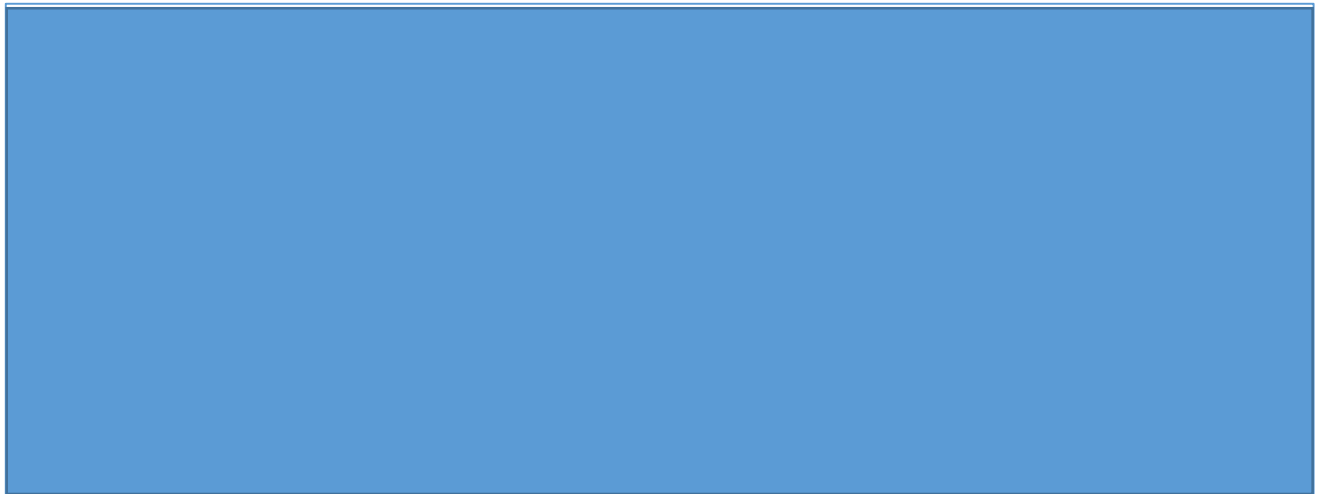
```
>>> f10([[1,0],[0,1]],[[1,0],[0,1]],)
[[1, 0], [0, 1]]
>>> f10([[1,2,3],[4,5,6]],[[-1,-1],[-1,-1],[-1,-1]])
[[-6, -6], [-15, -15]]
>>> f10([[4,3,2,1]],[[1],[2],[3],[4]])
[20]
```

```
def f10(matrix1, matrix2):
    res = []
    for i in range(len(matrix1)):
        row = []
        for j in range(len(matrix2[0])):
            row.append(0)
        res.append(row)

    for i in range(len(matrix1)):
        for j in range(len(matrix2[0])):
            for k in range(len(matrix1[0])):
                res[i][j] = res[i][j] + matrix1[i][k] * matrix2[k][j]

    return res
```

11. Write a function f11(matrix) that returns True if the matrix is the identity matrix, and False otherwise. Assume len(matrix) == len(matrix[0]).

```
>>> f11([[1]])
True
>>> f11([[1,0,0],[0,1,0],[0,0,1]])
True
>>> f11([[1,0,0],[0,1,5],[0,0,1]])
False
```

```
def f11(matrix):
    for i in range(len(matrix)):
        for j in range(len(matrix[i])):
            if i == j and matrix[i][j] != 1:
                return False
            if i != j and matrix[i][j] != 0:
                return False
    return True
```



12. Write a function f12(rows, cols) that returns a two dimensional list where each element corresponds to how many adjacent neighbors it has. Neighbors are defined as spaces above, below, to the left, and to the right.

```
>>> f12(3,3)
[[2, 3, 2], [3, 4, 3], [2, 3, 2]]
>>> f12(5,1)
[[1], [2], [2], [2], [1]]
>>> f12(5,0)
[[], [], [], [], []]
>>> f12(0,5)
[]
>>> f12(2,2)
[[2, 2], [2, 2]]
```

```
def f12(rows, cols):
    matrix = []
    for i in range(rows):
        row = []
        for j in range(cols):
            row.append(0)
        matrix.append(row)

    for row in range(rows):
        for col in range(cols):
            num_neighbors = 0
            if (row - 1) in range(rows):
                num_neighbors += 1
            if (row + 1) in range(rows):
                num_neighbors += 1
            if (col - 1) in range(cols):
                num_neighbors += 1
            if (col + 1) in range(cols):
                num_neighbors += 1
            matrix[row][col] = num_neighbors
    return matrix
```