PROGRAMS

1. (*Display matrix of 0s and 1s*) Write a function that displays an n-by-n matrix using the following header:

```
def printMatrix(n):
```

Each element is 0 or 1, which is generated randomly. Write a program that prompts the user to enter *n* and displays an *n-by-n* matrix.

An example run of the program is shown:

```
Enter n: 3 ↵Enter
0 1 0
0 0 0
1 1 1
```

2. A Write a program that determines the magnitude and direction of a two dimensional vector. In 2D, a vector is presented with two components x- and y-components. Main program will take the x- and y-components from user as float numbers. There will be two functions named `magnitude` and `direction` which receives the x- and y-components from the main (caller) and returns the magnitude and directions of the given vectors.

Remember:

Magnitude

$$A = \sqrt{A_x^2 + A_y^2}$$

and

Direction

$$\theta = \arctan\frac{A_y}{A_x}$$

For direction θ is measured from +x axis in CCW direction. You may use the `math` module functions to calculate these expressions. You may need to add or subtract π in radians or 180 in degrees.

An example terminal output of the program is given below (*results should be written with 2 digits after decimal point)*:

Enter the x-component: -4
Enter the y-component: 3
Magnitude: 5.00
Direction: 143.13

3. Write a program that determines the desired lowest common multiple of a given three integer numbers. Main function takes the three numbers from user and calls a function named `lcm` which determines and returns the lowest common multiple of the numbers. Then the main program prints this value to the screen.

For example, lcm(3, 4,16) should return 48

Terminal output for program as below when executed for 3, 4, and 16 input values.

```
Enter three integer numbers: 3 4 16
Lowest Common Multiple of 3, 4, and 16 is 48.
```

Hint: LCM of set of numbers is larger or equal to largest number. LCM is divisible with the all numbers completely.

4. Now repeat the program 3 that finds the greatest common divisor of given three integers, again in your program there will be function named gcd that receives three values from the caller (main) and returns the greatest common divisor of these numbers.

5. (*Sum the digits in an integer*) Write a function that computes the sum of the digits in an integer. Use the following function header:

```
def sumDigits(n):
```

For example, `sumDigits(234)` returns `9` (2 + 3 + 4). (Hint: Use the `%` operator to extract digits, and the `//` operator to remove the extracted digit. For instance, to extract `4` from `234`, use `234 % 10` (= 4). To remove `4` from `234`, use `234 // 10` (= 23). Use a loop to repeatedly extract and remove the digits until all the digits are extracted.) Write a test program that prompts the user to enter an integer and displays the sum of all its digits.