

# Exercises

## FOSSEE

Department of Aerospace Engineering  
IIT Bombay

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Day 2, Session 5

# Problem 1.1

The aliquot of a number is defined as: the sum of the *proper* divisors of the number. For example:

$$\text{aliquot}(12) = 1 + 2 + 3 + 4 + 6 = 16.$$

Write a function that returns the aliquot number of a given number.

# Problem 1.2

Pair of numbers  $(a, b)$  is said to be **amicable** if aliquot number of  $a$  is  $b$  and aliquot number of  $b$  is  $a$ .

Example: 220, 284

Write a program that prints all four digit amicable pairs.

20 m

# Problem 2

Given a string of numbers like, “1, 3-7, 12, 15, 18-21”,  
produce the following list

**[1, 3, 4, 5, 6, 7, 12, 15, 18, 19, 20, 21]**

30 m

# Problem 3

Given a list of words, find all the anagrams in the list.  
Solve the problem without using dictionaries.

# Problem 4

Count frequencies of words in a file named 'holmes.txt'.

55 m

# Problem set 4

## Central difference

$$\frac{\sin(x + h) - \sin(x - h)}{2h}$$

```
In []: x = linspace(0, 2*pi, 100)
```

```
In []: y = sin(x)
```

```
In []: deltax = x[1] - x[0]
```

- Given this, get the finite difference of sin in the range 0 to 2\*pi

# Problem set 4

## Central difference

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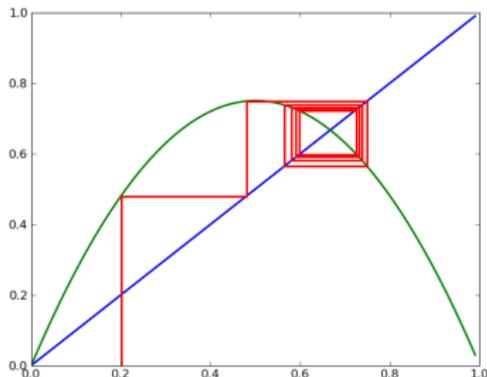
- 1 Given this, get the finite difference of sin in the range 0 to 2\*pi

# Problem Set 5

- 5.1 Write a function that plots any regular n-gon given  $n$ .
- 5.2 Consider the logistic map,  $f(x) = kx(1 - x)$ , plot it for  $k = 2.5, 3.5$  and  $4$  in the same plot.

# Problem Set 5

- 3 Consider the iteration  $x_{n+1} = f(x_n)$  where  $f(x) = kx(1 - x)$ . Plot the successive iterates of this process as explained below.



# Problem Set 5.3

Plot the cobweb plot as follows:

- 1 Start at  $(x_0, 0)$  ( $\implies i=0$ )
- 2 Draw a line to  $(x_i, f(x_i))$
- 3 Set  $x_{i+1} = f(x_i)$
- 4 Draw a line to  $(x_{i+1}, x_{i+1})$
- 5 ( $i \implies i + 1$ )
- 6 Repeat from 2 for as long as you want

75 m