

# Addis Ababa institute of Technology

## Center of Information Technology and Scientific Computing

### Fundamentals of computer science and programming

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#### *Lab 06(PART B) Iteration*

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1. There is a popular myth about the man who invented chess. This man invented the chess and present it to his king. The king was so pleased with the invention that he offered the inventor a great reward in gold. The inventor suggested an alternative reward: he would get one grain of wheat on the first square of the chess board, two grains on the second square, four on the third, eight on the fourth, etc., doubling the number of grains each time. The ruler saw that this must be a much better deal for him, and he accepted. The board has 64 squares. Write a program to determine the following:

- a) How many total grains of wheat did the ruler have to pay the inventor?
- b) If a wheat grain weighs approximately 50 mg. How much did the wheat weigh?

2.  $\pi$ : The following is the Leibniz formula for pi

$$\sum_0^{\infty} \frac{(-1)^n}{2n+1} = \frac{\pi}{4}.$$

Use a while loop to compute pi. Check what happens when the number of iteration is fluctuated.

3. GCD

Write a function that calculates the gcd of two numbers that are given as parameters

4. **The Collatz conjecture**

Let's look at a simple sequence that has fascinated mathematicians for many years. They still cannot answer even quite simple questions about this.

The "computational rule" for creating the sequence is to start from some given  $n$ , and to generate the next term of the sequence from  $n$ , either by halving  $n$ , (whenever  $n$  is even), or else by multiplying it by three and adding 1. The sequence terminates when  $n$  reaches 1.

Write a function that generates a sequence given a number n.

```
>>> collatz_conj(3)
3, 10, 5, 16, 8, 4, 2, 1
>>> collatz_conj(10)
10, 5, 16, 8, 4, 2, 1
collatz_conj(100)
100, 50, 25, 76, 38, 19, 58, 29, 88, 44, 22, 11, 34, 17, 52, 26, 13, 40, 20, 10, 5, 16, 8, 4, 2, 1
```

**CLUE:** to print on the same line use  
`print(<printable object>, end=', ')`

5. Counting digits  
Write a function that counts the number of digits a given number has. A call to the function `num_digits(710)` will print 3.  
Find a scenario where this function fails. Why would it fail?
6. Write a function that counts the frequency of a given digit in a number.  
`frequency_of_num(15213323231790, 3)` will print 4.
7. Write a function named `print_big_v (size)`, where size indicates the size of the pattern that the function will print. Here is the output when the function is called with 6 as the argument for size, then it should print the following:

