

**Islamic University of Technology (IUT)**  
Organization of Islamic Cooperation (OIC)  
Department of Electrical and Electronic Engineering (EEE)

**EEE 4416**

**Lab – 04**

**Exercise - 01:**

**Problem statement:** Find the 1<sup>st</sup> 10 pentatope number.

$$n\text{-th pentatope no} = \frac{n(n+1)(n+2)(n+3)}{24}$$

**output:** [1,5,14,35,70,126,210,330,495,715]

**Additional exercise:**

- I. Find the 1<sup>st</sup> 8 triangular numbers. [search the web to find out what is a triangular number]
- II. Find the 1<sup>st</sup> 20 prime numbers [ There is a built-in function for that]

**Key Takeaway:**

- Broadcasting.
- Element-wise Multiplication.

\*These two things will become clearer as you practice more and more problems.

## Exercise - 02:

**Problem statement:** Last week, you saw the following dataset. It contains the number of students in different departments in different universities in Bangladesh.

The data contains some nan values. If you remember from last week, these nan values sometimes create problem while plotting the data. Also create problems while using the sum function.

In order to avoid that, let's do something that will help us to process the data easily.

Let's replace the nan values with 0.

Now we can work with this matrix without any hinderance. Try visualizing the matrix using the plots bar.

```
Data= [ 120  120  100  80  40
        180  120  150  80  80
        150  80  150  80  55
        195  80  150  80  45
        40  NaN  30  80  NaN
        100  50  80  80  NaN
        50  50  NaN  80  30]
```

🚦 NaN is necessary to represent our original data. But while processing the data, we can ignore it and replace it with 0 for our convenience.

### Key takeaway:

- `isnan`
- `ismissing`

## Exercise - 03:

### \*Problem statement: Factorization

- ✚ Every positive integer has a unique prime factorization. For example,  $8 = 2 * 2 * 2$ ;  $12 = 2 * 2 * 3$ .

Here, (2,2,2) or (2,2,3) is called the prime factors of the integer 8 and 12 consecutively.

There is a built-in function already provided in matlab to do this task for us.

➤ `factor(n)`

- ✚ Now, say I want to find all the divisors of a number (excluding 1 and the number itself). For example,  $8 = 2, 4$ ;  $12 = 2, 3, 4, 6$   
Here, 12 is divisible by 2,3,4,6. How to do that?

Unfortunately, MATLAB doesn't provide a built-in function for that. So, we'll try to write our own function.

Later in other codes, you'll be able to re-use your defined function just as the built-in functions that you've already created. That will prove a great advantage in many programming exercises later.

### Key Takeaway:

- User-defined function\*\*
- Vectorization
- Logical indexing
- Variables – local, global, persistent\*\*

## Exercise – 04:

**\*Problem statement:** Given an array of integers, find the least common multiple(lcm) of the numbers.

Write a function named 'lcm\_array' that takes an array as the input and returns the lcm.

### Test Case - 01:

- Input: a= [ 6,7]
- Output: 42

### Test Case - 02:

- Input: a= [ 4,12]
- Output: 12

### Test Case - 03:

- Input: a= [ 4,12,25]
- Output: 300

### Test Case - 04:

- Input: a= [ 4,12,25,2,3,14,52,23,45]
- Output: 1883700

### Key Takeaway:

- lcm(a,b)
- gcd(a,b)

### Additional Exercise:

- do the same for greatest common divisor(gcd)
- build a function named 'gcd\_array'

## Exercise – 05:

**Problem Statement:** Write a function 'prime\_out' that takes as input - a number or a vector or a matrix of integer values and returns –

- I. if input is a number – return either of the following string based on whether the number is prime or not – “Input is a prime number” or “Input is not a prime number”
- II. if input is a matrix – return a list containing only the prime numbers.
- III. if input is a string – return the following string – “Input must be a numerical array”

### Test Case – 01:

- Input: a = 7
- output: “Input is a prime number”

### Test Case – 02:

- Input: a = [2,1,77,4,79]
- output: [2,79]

### Key Takeaway:

- `isprime()` , `isrow()` , `iscolumn()` , `isnumeric()`, `islogical()`, `ischar()`, `isscalar()`, `isequal()` etc.  
There are many this type of inquiry functions. When you try to solve different problems, They'll come in handy in many scenarios.
- MATLAB Toolbox
- Conditional statements

### Additional Information:

- ✚ `nthprime()` , `nextprime()`, `prevprime()`
- ✚ If you search MATLAB documentation, you'll find these functions belong to 'symbolic math toolbox'.