

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

EEE 4416: Simulation Lab
Lab – 04

Exercise - 01:

Problem statement: An array is given that contains the marks received by a group of students in their class test. Find out –

- I. What is the highest mark received by the group of students?
- II. What is the average mark received by the students?
- III. How many students received the highest mark?
- IV. Find the index of the students who received the highest mark.
- V. What are the highest 3 marks received by the students?

Test case - 01:

- Input: Marks = [9, 6, 7, 6.5, 8, 9.5, 8, 9.5, 8, 8.5, 6, 7, 9]
- Output -
 - I. 9.5
 - II. 7.85
 - III. 2
 - IV. [6,8]
 - V. [9.5, 9, 8.5]

Test case - 02:

- Input: Marks = [93, 97, 67,84,91,81,56,67,55,67,45,98,56,55,44,44,44,91,78]
- Output -
 - I. 98
 - II. 69.1
 - III. 1
 - IV. 12
 - V. [98,97,93]

Classwork: Solve the 1st 4 questions above for 'lowest mark'.

Exercise - 02:

Problem statement: An array is given that contains the number of students in different departments in IUT. Suppose, the associated department for each index of IUT is -- {'CSE', 'EEE', 'ME', 'CE', 'BTM'} or ["CSE", "EEE", "ME", "CE", "BTM"]. (u cannot use hard coding for any problem)

Find out –

- I. Which department(index) has the highest #students?
- II. What is the total no of students in IUT?
- III. What is the total number of departments in IUT?
- IV. Create a 'bar plot' of the input data.
- V. How many students are there in the 'ME' department?
- VI. Which department has 55 students?

Test Case - 01:

- Input: IUT = [45,90,85,55,30]
- Output:
 - I. 2
 - II. 305
 - III. 5

Test Case - 02:

- Input: BUET = [120,180,150,180,40,55,210,40,30,30]
- Output:
 - I. 7
 - II. 1035
 - III. 10

Additional Exercise:

- Find how many students are in the EEE department of IUT.
- Find which department/departments of BUET has 40 students.

****Key takeaway: Understand the concept of vectorization and how it can be applied in the above scenarios.**

Exercise - 03:

Problem statement: A matrix is provided.

1st column of the matrix contains the student ID and

2nd column of the matrix contains the marks received by those students.

For example, a = [101, 9;

103, 6;

105, 7;

109, 8;

111, 6.5;

113, 9;

117, 9;

119, 6]

So, ID 101 received 9 marks.

Find out –

- I. What is the highest mark received by the group of students?
- II. Find the IDs of the students who received the highest mark.
- III. What are the highest 3 marks received by the students?
- IV. What is the average mark received by the students?

Output:

- I. 9
- II. [101,113,117]
- III. [9,8,7]
- IV. 7.5625

Additional questions (classwork):

Solve the 1st 3 questions above for the 'lowest mark'.

Exercise – 04:

Problem statement: Take an integer 'n' as the input. Return a matrix of size –

- I. (n,n) i.e. n-by-n , where all the elements are 0.
- II. (n+1, n+1), where all the elements are 5.
- III. (1, n), where all the elements are -8.
- IV. (n, 1), where all the elements are 25.
- V. (n, n+4), where all the elements are 5.

Test Case:

- Input: n=3
- Output:
 - I. [0,0,0;
0,0,0;
0,0,0]
 - II. [5,5,5,5;
5,5,5,5;
5,5,5,5;
5,5,5,5]
 - III. [-8, -8, -8]
 - IV. [25;
25;
25]
 - V. [5,5,5,5,5,5,5;
5,5,5,5,5,5,5;
5,5,5,5,5,5,5]

Key takeaway:

- Creating a matrix of different sizes.
- Element-wise multiplication.

Exercise – 05:

Problem Statement: A matrix is given. Perform the following operations –

```
A= [ 16   2   3  13  
     5  11  10   8  
     9   7   6  12  
     4  14  15   1]
```

- i. Create a random matrix of size (4,2). Multiply it with A.
- ii. Create a random matrix of size (2,2). Multiply it with A. [can u guess what will happen]
- iii. Multiply the 1st row with [2,4,6,8].
- iv. Divide the matrix A by 3.
- v. Add a magic matrix of size 6 with A.
- vi. Subtract the identity matrix of size 4 with A.
- vii. Extract the diagonal elements from A.

Key Takeaway:

- Matrix multiplication
- Arithmetic operation on a matrix
- `magic()`, `rand()`, `eye()`, `diag()`, `randi()`

Exercise – 06:

Problem Statement: An array is given. Perform the following tasks:

- i. Sort the array in descending order. [high to low]
- ii. Sort the array in ascending order.
- iii. Find the unique elements of the array.
- iv. Find the unique elements of the array. [keep the sequence unchanged]

Test Case:

- Input: a= [2,12,65,4,5,2,2,12,7,4]
- Output:
 - i. [65,12,12,7,5,4,4,2,2,2]
 - ii. [2,2,2,4,4,5,7,12,12,65]
 - iii. [2,4,5,7,12,65]
 - iv. [2,12,65,4,5,7]

Key Takeaway:

- Sorting
- Unique
- **Learn to use MATLAB documentation****

Exercise – 07

Problem statement: An array or a matrix is given.

- i. Create a list of all the even numbers in that matrix.
- ii. Find the index (linear) of all the even numbers in that matrix.
- iii. Find the subscripts of all the even numbers in that matrix.

Test Case – 01:

➤ input:

```
a= [213 209 310 49 251 139 134 230 346 80 269 361 80 120 199  
356 201 111 214 230 166 6 282 203 153]
```

➤ output: even = [310 134 230 346 80 80 120 356 214 230 166 6 282]
index= [3 7 8 9 10 13 14 16 19 20 21 22 23]

Test case – 02:

➤ i/p:

```
b= [ 26 158 365 28 57
```

```
144 22 128 381 205
```

```
94 151 132 64 289
```

```
82 310 82 115 372
```

```
326 67 307 275 293]
```

➤ o/p: even = [26 144 94 82 326 158 22 310 128 132 82 28 64 372]
index= [1 2 3 4 5 6 7 9 12 13 14 16 18 24]

Classwork: Instead of solving for even numbers, solve for

- I. odd numbers.
- II. Numbers that are divisible by 3

****Key Takeaway:**

- linear index, subscripts, logical indexing, Boolean masking
- find(), ind2sub(), sub2ind(), mod()