

# Assessment Using MATLAB - A Project Overview

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**Abstract:** *Almost all academic institutes in Pakistan use database software for their students' assessment purposes. The database currently being used at Karachi Institute of Economics & Technology (PAF-KIET) has only two options of sum and average that our teachers use when they record marks in it. We have developed a software as a student project course named "Probability & Statistics" to improve the functionality and capability of this database. This assessment software uses different basic statistical options that can help educators, especially math educators, to make assessment of their students in general. We have developed it using MATLAB with a graphical user interface to make it user friendly.*

## 1. Introduction

This section provides our assessment objectives. We have developed this software to make assessment easy for educators and to understand what kinds of study groups are taking the course. For this, we have kept options of calculation of mean, median, mode, range, variance and standard deviation [1]. Not only this, we have kept graphical options as well that show bar chart and pie chart. The user of our program can provide marks for a maximum of 60 students. We have limited the size of data, as the class size at our institute is usually 50 or less. Side by side, one can observe time performance graph that can determine when in a semester, a student was motivated most or demotivated most, and which students maintained their position in class or not. If, simultaneously, the teacher maintains a list of the topics covered in each quiz or hourly exam, then the teacher can easily determine the difficulty level of any topic for the class, and hence plan accordingly for the next time they take the same course. This time performance graph technique improves the teaching methodology by assisting a teacher how to plan for a course and how to assess the students. The graphical view in form of a time-series graph makes it easy to understand the ups and downs of a student's performance individually and therefore produces adoption of more focused and concerned teaching style. It will help the teacher to comprehend the students where they need to put more effort and where are they good to proceed further.

We have the intention to continue this project in future on a large scale and for usage purpose for other institutions in Pakistan and rest of the world on free basis, as other comprehensive systems available as commercial products such as Blackboard, MapleTA etc are simply not yet freely available.

## 2. Working Methodology

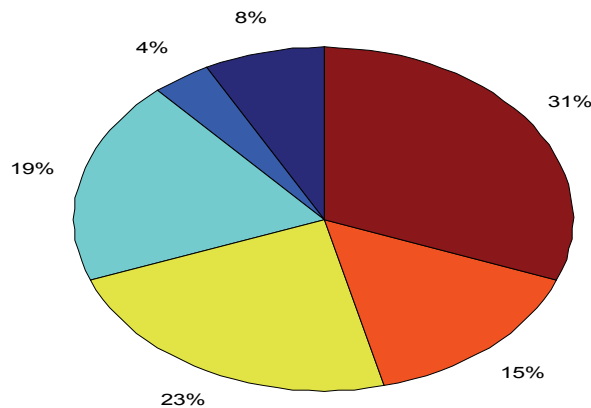
In this section, we mention how we use different statistical options in MATLAB.

### 2.1 Median, Variance and Standard Deviation

For vectors  $X$ , we use `MEDIAN (X)`, which shows the median value of its elements. For matrices, `MEDIAN (X)` is a row vector containing the median. For vectors, defining  $Y = \text{VAR} (X)$  returns the variance of the values in  $X$ . For matrices,  $Y$  will be a row vector containing the variance of each column of  $X$ . For  $n$  - dimensional arrays, `VAR` operates along the first non-singleton dimension of  $X$ . For vectors, defining  $y = \text{std} (x)$  returns the standard deviation of  $X$ . For matrices,  $y$  is a row vector containing the standard deviation of each column. For  $n$ -dimensional arrays, `std` operates along the first non-singleton dimension of  $x$ . Defining  $y = \text{std} (x, 1)$  normalizes by  $n$  and produces the square root of the second moment of the sample about its mean.

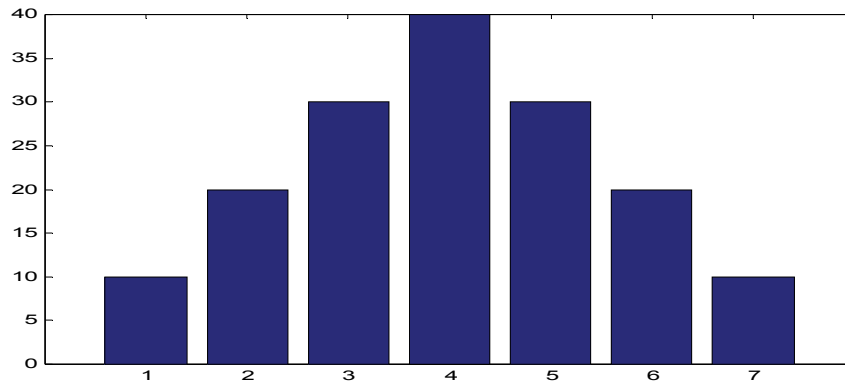
### 2.2 Graphical Options

Our command `PIE (X)` draws a pie plot of the data in the vector  $X$ , see, for example, Figure 2.2.1. The values in  $X$  are normalized via the command  $X / \text{SUM}(X)$  to determine the area of each slice of pie. If  $\text{SUM} (X) \leq 1.0$ , the values in  $X$  directly specify the area of the pie slices. The command `PIE (X, EXPLODE)` is used to specify slices that are required to be extracted from the pie. The vector `EXPLODE` must be the same size as that of  $X$ . The slices where `EXPLODE` is non-zero are those that are extracted.



**Figure 2.2.1 PIE CHART**

The command `BAR (X, Y)` draws the columns of a  $M$ -by- $N$  matrix  $Y$  as  $M$  groups of  $N$  vertical bars. In this command, the vector  $X$  must be either monotonically increasing or decreasing. The command `BAR (Y)` uses the default value of  $X=1:M$ . For vector inputs, `BAR (X, Y)` or `BAR (Y)` draws `LENGTH (Y)` bars. The colors used are set by the color map. An example bar chart is provided in Figure 2.2.2.



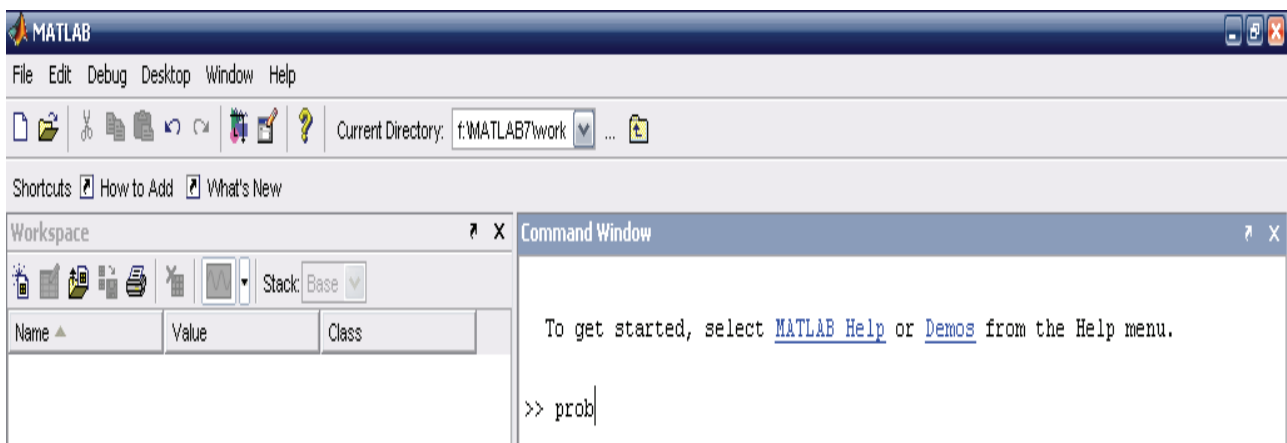
**Figure 2.2.2 BAR CHART**

## 2.3 Graphical User Interface

A GUI (graphical user interface) provides an easy and efficient interaction between the end user and the computer program or computer controlled devices. In this project we have created a GUI so that the user can easily handle the program.

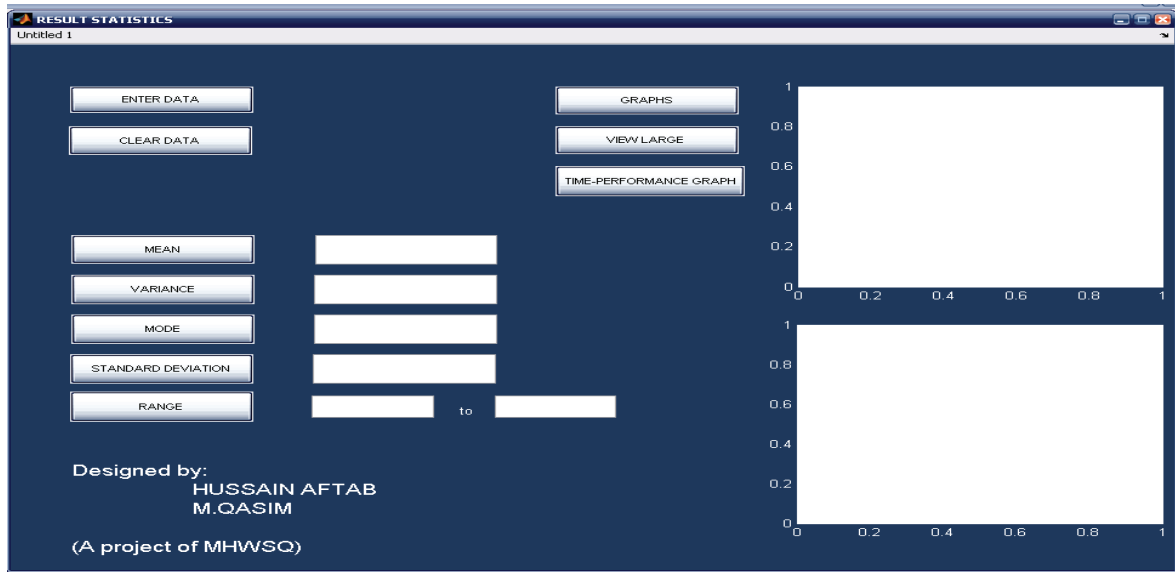
## 2.4 How To Use Our Program In MATLAB

After installing MATLAB, one can run MATLAB by clicking the shortcut on the desktop. After opening MATLAB, the GUI is activated by simply entering “prob” on the workspace [see Figure 2.4.1]. This process is shown in the figure below.



**Figure 2.4.1 MATLAB**

After pressing ENTER the required GUI will be displayed. This is shown in the Figure 2.4.2.



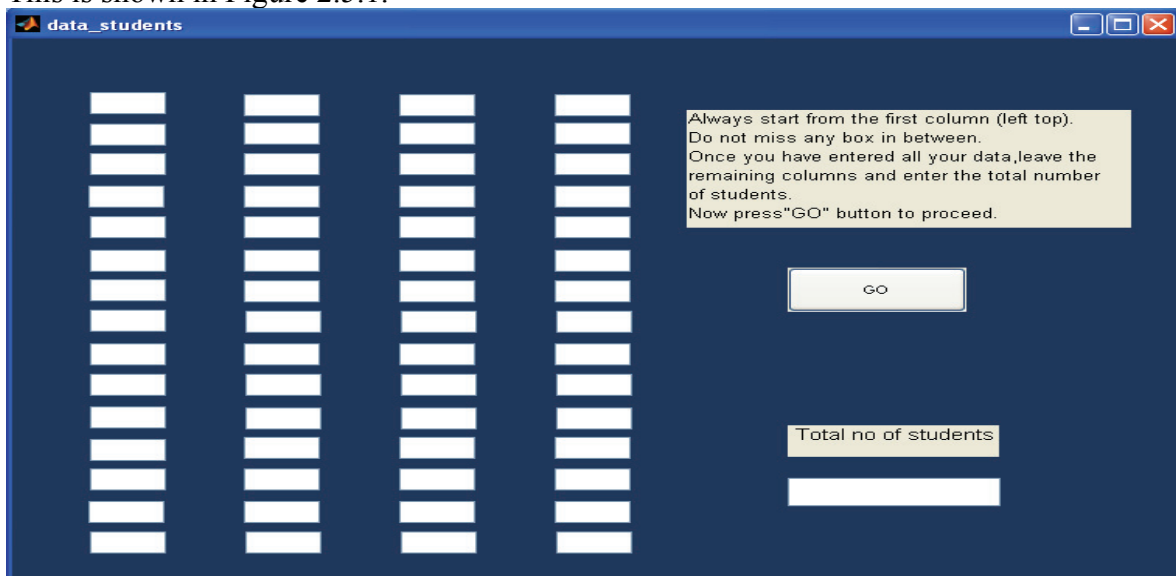
**Figure 2.4.2 GUI**

We now explain the use of each of the nine buttons appearing in Figure 2.4.2.

## 2.5 Uses Of Buttons

### Button 1: ENTER DATA

Used for entering the data of students. Clicking on this button results in a new GUI being opened. This is shown in Figure 2.5.1.



**Figure 2.5.1 Data Entry**

The software allows for these entries be imported from another spreadsheet that may be used to store student results for partial assessment tasks.

**Button 2: CLEAR DATA**

This button is used for clearing all data. (Should always be done before entering any new data.)

**Button 3: MEAN**

This button returns the value of the mean in its output box.

**Button 4: VARIANCE**

This button returns the value of the variance in its output box.

**Button 5: MODE**

This button returns the modal class in its output box.

**Button 6: STANDARD DEVIATION**

This button returns the value of the positive square root of the variance in its output box.

**Button 7: GRAPHS**

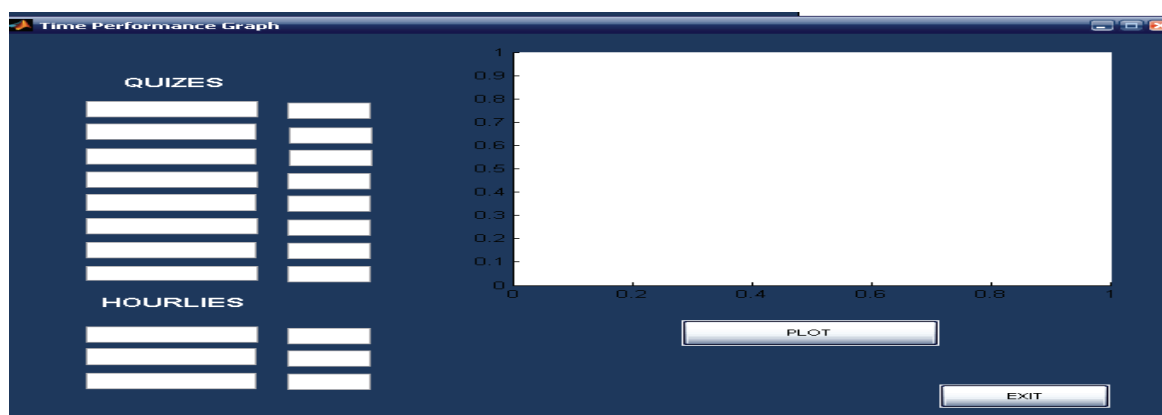
This button returns the pie and bar charts.

**Button 8: VIEW LARGE**

This button is used to enlarge the graphs, which are opened in new window.

**Button 9: TIME-PERFORMANCE GRAPH**

This button opens new GUI for entering data (marks of quizzes and hourlies) to present the time



**Figure 2.5.2 Time-Performance Graph**

performance graph of a student. (With reference to Figure 2.5.2, students' marks should be entered in the large boxes on the left while a quiz number or hourly number, with respect to time sequence, should be entered in small boxes on the right.) The use of the two buttons on the GUI for time performance graph are explained as follows.

#### **Button 1: PLOT**

This button plots the time performance graph.

#### **Button 2: EXIT**

This button allows the user to exit from the current GUI and return to the previous one.

### **3. Concluding Remarks and Future work**

With the help of our software, math educators can easily obtain the overall performance of each particular student and therefore the performance of their whole class. Furthermore, as noted in [2], a math educator is responsible for understanding the differences between how students learn. Consequently, using this software, we believe our work will help math teachers to analyze the performance of each student leading to an understanding of the differences in their students' capabilities. Identifying, for example, who are average, who are below average and who are above average so that they can be treated accordingly. In fact, our software will also help math teachers in planning within the semester of a course and for the next course: whether in setting examination papers, or setting of the course outline. This will be achieved using our time-performance graph option, which indicates the level of each student under consideration and providing a measure of the difficulty level of a course. Our future work includes extension to this project by developing an interesting website for math learners and educators and making its use free for all our teaching community.

### **4. Acknowledgement**

The third author is grateful to her students (the first and second authors of this paper) for developing the software and unlimited thanks are due to Dr. Sarwar J. Abbasi for her moral support and motivation. We are also grateful to Higher Education Commission (HEC), Pakistan for providing financial support.

### **References**

- [1] Neil A. Weiss (1995). "*Introductory Statistics*", 4<sup>th</sup> edition, Addison Wesley, pp 654 – 659, 742 – 842.
- [2] Abbasi S. J. & Iqbal K. (2007). "*How learning & teaching of Mathematics can be made interesting – a case study*", Proc. The Twelfth Asian Technology Conference in Mathematics (ATCM), December 16 – 20, Taipei, Taiwan, pp 59-68, ISSN 1940-4204. [URL]  
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