Computational Statistics & Probability

Mid-Term, **MATLAB®** Solutions.

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MATLAB®

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Installation tutorial link:
https://www.youtube.com/watch?v=YTMQNI7KhPQ

Ubuntu or Linux distribution installation tutorial:
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Just click on the following download link according to your device and then install **MATLAB®** to run on your mobile device.
Download Link:
IOS: https://apps.apple.com/us/app/matlab-mobile/id370976661
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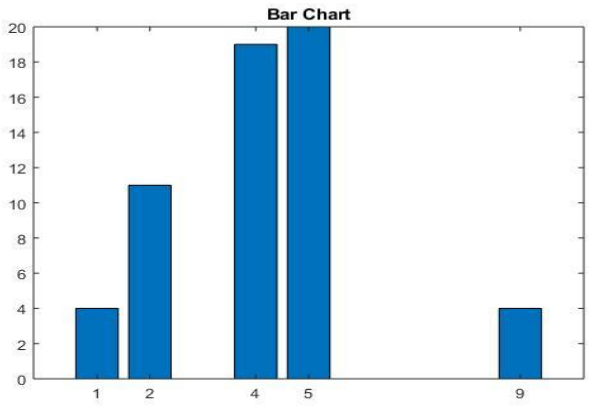
Online compiler: https://octave-online.net

Chapter 01: Data Representation

Code 01:

```
x = [1 2 4 5 9];
y = 20-(5-x).^2;
bar(x, y)
title('Bar Chart')
```

Output 01:

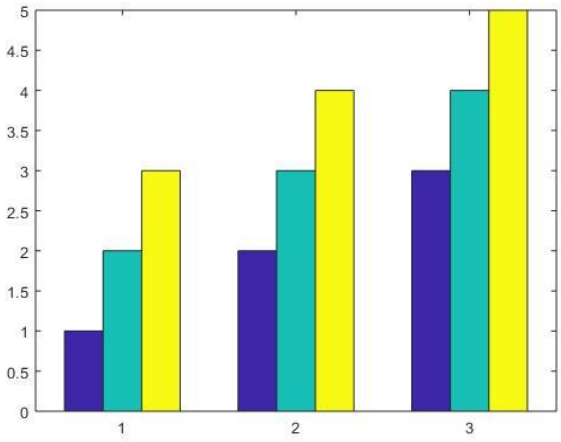


Explanation:
Declared an array ‘x’ with sort of values and a variable named ‘y’ with sort of values which defines the characteristics of the axis ‘y’. For plotting a bar chart used ‘bar()’ and passed both parameter ‘x’ and ‘y’ and set up a title with ‘title()’.

Code 02:

```
bar(1:3,[1 2 3; 2 3 4; 3 4 5], 'grouped')
bar(1:3,[1 2 3; 2 3 4; 3 4 5], 'hist')
```

Output 02:



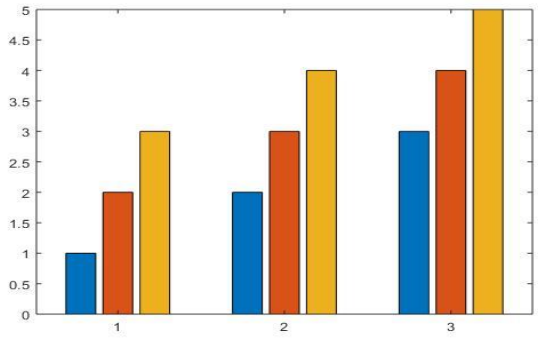
Explanation:
As like previous one here we called the built-in function 'bar()' for plotting the bar chart vector or Matrix. For that particular configuration we have used '1:3' into the first portion. Which signifies that in a position there would be three bar charts. Eg. In the position 1 of axis 'x' there would be three bar charts. Again in the following code 'grouped' and 'hist' enlist that there would be no space between the bars and space into the bars at the particular position respectively.

According to the given explanation now see the individual output with the following code:

Code 02_1:

```
bar(1:3,[1 2 3; 2 3 4; 3 4 5], 'grouped')
```

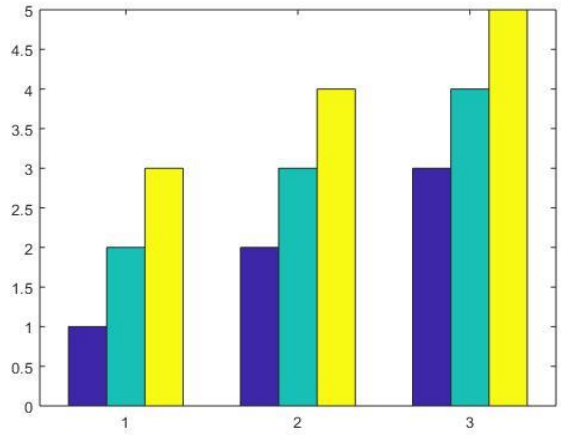
Output 02_1:



Code 02_2:

```
bar(1:3,[1 2 3; 2 3 4; 3 4 5], 'hist')
```

Output 02_2:



Chapter 02: Descriptive Statistics

Code:

```
x = [1 2 3; 4 5 6]
y = [1 5 2; 4 3 6]
z = [1 2 3 4 7 10; 2 5 6 10 11 13]
%Sum of the Matrix 'x'.
sum(x)
%Sum of the rows of Matrix 'x'.
sum(x')
%Mean values of vector or Matrix 'x'.
mean(x)
%Varience of vector or Matrix 'x'.
var(x)
%Convariance of vector or Matrix 'x'.
cov(x)
%Standard deviation of vector or Matrix 'x' (column-by-column).
std(x)
%Sort the values of rows of vector or Matrix 'y'.
a = sort(y)
median(a)
mode(y)
%Skewness of vector or Matrix 'x' (column-by-column).
skewness(x)
%Kurtosis of vecor or Matrix 'x'.
kurtosis(x)
%Quartile of vetor or Matrix 'z'.
%quartile(z)
```

Outputs:

```
>> Descriptive_Statistics

x =

   1   2   3
   4   5   6


y =

   1   5   2
   4   3   6


z =

   1   2   3   4   7   10
   2   5   6   10  11  13


ans =
```

```
   5    7    9


ans =

   6   15


ans =

   2.5000    3.5000    4.5000


ans =

   4.5000    4.5000    4.5000


ans =

   4.5000    4.5000    4.5000
   4.5000    4.5000    4.5000
   4.5000    4.5000    4.5000


ans =

   2.1213    2.1213    2.1213


a =

   1    3    2
   4    5    6


ans =

   2.5000    4.0000    4.0000


ans =

   1    3    2


ans =

   0    0    0


ans =
```

```
   1   1   1

>>
```

Explanation:
Three matrices has been declared as ‘x’, ‘y’ and ‘z’ into different arrays. For taking sum of the whole matrix used ‘sum()’ function and passed parameter through it. Again, for taking sum of the values of row just give an inverted comma after the parameter given into the ‘sum()’ built-in function. Afterward, for taking mean, variance and convariance respectively used ‘mean()’, ‘var()’ and ‘cov()’, passed the parameter into them for performing operations. Like ‘Bubble Sort’, ‘Insertion Sort’ and ‘Selection Sort’ there is a conventional built-in function named ‘sort()’ in MATLAB®. Which is used to sort the rows of a vector or Matrix. ‘median()’ returns the median of elements along with dimension dim. ‘mode()’ basically returns a row vector contains the mode of each column of the matrix or vector. ‘skewness()’ and ‘kurtosis()’ functions returns the skewness and kurtosis of a vector or matrix. Currently ‘quartile()’ functions is not perfectly works with the latest versions of MATLAB®. But it returns the quartile scaler value of a vector or matrix.

Chapter 05: Discrete Distributions

Code:

```
%1. Compute the pdf of the Binomial distribution with 10 trials and the
probability of success 0.5.
x = 0:10;
y = binopdf(x, 10, 0.5)
%2. Eighty five percent devices of a workshop work properly. One day 20
devices are selected at random. Find the probability that, out of 20 devices
5 work properly.
binopdf(5, 20, 0.85)
%3. Compute the pdf of the Poisson distribution with Lemda = 4.
x = 0:10;
y = poisspdf(x, 4)
%4. In the computer hard disk manufacturing process, flaws occur randomly.
Assuming that on average a 4 GB hard disk has two flaws, compute the
probability that a disk has no flaws.
poisspdf(0, 2)
%5. Compute the pdf of the geometric distribution with the probability of
success 0.25.
x = 0:20;
y = geopdf(x, 0.25)
%6. Suppose you toss a fair coin repeatedly, and a "success" occurs when the
coin lands with heads facing up. What is the probability of observing
exactly three tails ("failures") before tossing a head? [ The probability of
success (tossing a heads) p in any given trial is 0.5 ].
geopdf(3, 0.5)
```

Outputs:

```
>> Discrete_Distributions

y =

  Columns 1 through 5

    0.0010    0.0098    0.0439    0.1172    0.2051

  Columns 6 through 10

    0.2461    0.2051    0.1172    0.0439    0.0098

  Column 11

    0.0010


ans =

   3.0124e-09


y =
```

```
 Columns 1 through 5

   0.0183    0.0733    0.1465    0.1954    0.1954

 Columns 6 through 10

   0.1563    0.1042    0.0595    0.0298    0.0132

 Column 11

   0.0053


ans =

   0.1353


y =

 Columns 1 through 5

   0.2500    0.1875    0.1406    0.1055    0.0791

 Columns 6 through 10

   0.0593    0.0445    0.0334    0.0250    0.0188

 Columns 11 through 15

   0.0141    0.0106    0.0079    0.0059    0.0045

 Columns 16 through 20

   0.0033    0.0025    0.0019    0.0014    0.0011

 Column 21

   0.0008


ans =

   0.0625

>>
```

Explanation:
Variables are declared with the 'starting value : ending value'. If the difference is not defined enough, it takes one as the default difference as well. The Binomial Probability Function is defined as 'binopdf()' and 'poisspdf()', 'geopdf()' determines the Poison Probability Density Function and Geometric Probability Density Function.

Basic command:

clc -> To clear all off the window in **MATLAB**®.
clear -> To clear all of the old programs.
close all -> To clear all off the old allocated memories.

References:

1. **MATLAB**® DOCUMENTATION:
   https://www.mathworks.com/help/matlab/

2. **MATLAB**® - HOLD:
   https://www.mathworks.com/help/matlab/ref/hold.html

3. **MATLAB**® – 2D LINE PLOT:
   https://www.mathworks.com/help/matlab/ref/plot.html

4. **MATLAB**® - SUBPLOT:
   https://www.mathworks.com/help/matlab/ref/subplot.html

5. School of Computing – University of Utah:
   https://www.cs.utah.edu/~germain/PPS/Topics/Matlab/plot.html#:~:text=The%20plot%20function%20in%20Matlab,looking%20at%20the%20raw%20numbers