

Chapter 2

Summarizing and Graphing
Data

Sections 2.1 – 2.4

Frequency Distributions

■ Frequency Distribution:

A method to tabulate data using classes and frequencies.

Example 1:

The following refers to the weights of 27 new members to a gym.

Lets tabulate this data by separating it into 5 groups. These groups are called classes.

167, 200, 188, 175, 181, 155, 203, 204, 193, 156,
177, 179, 160, 185, 159, 171, 191, 199, 202, 166,
157, 189, 181, 183, 179, 181, 194

	Weight	Frequency	Relative Frequency	Cumulative Frequency
Classes	155 – 164	5	0.185 / 18.5%	5
	165 – 174	3	0.112 / 11.2%	8
	175 – 184	7	0.259 / 25.9%	15
	185 – 194	7	0.259 / 25.9%	22
	195 – 204	5	0.185 / 18.5%	27

Lower Class Limits Upper Class Limits

- Class Width:
Given a frequency distribution. The difference between the lower limit of one class and the lower limit of the previous class.
The class width above is 10.
- Relative Frequency:
$$\frac{\text{Class frequency}}{\text{Sum of all frequencies}}$$
- Cumulative Frequency:
A running total of frequencies.

- How do we construct a frequency table if we were given data?
Follow these steps.
- Step 1:
If not given, select the number of classes you want.
The number of classes should be between 5 and 20.
 - Step 2:
Calculate the class width: $\frac{\text{Maximum value} - \text{Minimum value}}{\text{number of classes}}$ then **-Round Up-**
 - Step 3:
Select a convenient starting point and add the class width to it. This will give you the next lower class limit. Continue until you end up with the number of classes you desire.
 - Step 4:
List the lower class limits vertically in your table, then find the corresponding upper class limits.
 - Step 5:
Find the corresponding values for the frequency distribution.
You can also determine the relative frequency or the cumulative frequency.

Example 2:

The data below describes the IQ scores for a gifted classroom in a particular elementary school.

117, 123, 124, 125, 127, 128, 129, 130, 130,
133, 136, 138, 141, 142, 149, 150, 154

Construct a frequency distribution with 6 classes.

1st → Maximum = 154, Minimum = 117

2nd → Class width = $\frac{154 - 117}{6} = \frac{37}{6} \approx 6.166$

3rd → We will use a class width of 7.

Now that we have this valuable information, we can construct a frequency table.

Classes	Frequency	Cumulative Frequency	Relative Frequency
117 – 123	2	2	0.118 / 11.8%
124 – 130	7	9	0.411 / 41.1%
131 – 137	2	11	0.118 / 11.8%
138 – 144	3	14	0.176 / 17.6%
145 – 151	2	16	0.118 / 11.8%
152 – 158	1	17	0.059 / 5.9%
Total	17	Must Equal	1 / 100%

*NOTE: It is recommended to input the frequency column before constructing the cumulative and relative frequency columns.

If you notice, the previous frequency distributions have gaps between classes.

What do we do in order to have no gaps?

- We will need *class boundaries*. These are used when constructing histograms.

Find the difference between the upper class limit of one class and the lower class limit of the next class. Then divide by 2. Take this result and add it to every upper class limit and subtract it from every lower class limit.

Weight	Frequency		Weight	Frequency
155 – 164	5	➔	154.5 – 164.5	5
165 – 174	3		164.5 – 174.5	3
175 – 184	7		174.5 – 184.5	7
185 – 194	7		184.5 – 194.5	7
195 – 204	5		194.5 – 204.5	5

Class	With Class Boundaries	Frequency	Cumulative Frequency	Relative Frequency
117 – 123	116.5 – 123.5	2	2	0.118 / 11.8%
124 – 130	123.5 – 130.5	7	9	0.411 / 41.1%
131 – 137	130.5 – 137.5	2	11	0.118 / 11.8%
138 – 144	137.5 – 144.5	3	14	0.176 / 17.6%
145 – 151	144.5 – 151.5	2	16	0.118 / 11.8%
152 – 158	151.5 – 158.5	1	17	0.059 / 5.9%
Total		17	Must Equal	1 / 100%

We will use 123 and 124, but we can use any other pair.

$$\text{Now, } \frac{124 - 123}{2} = 0.5$$

We will add this number to each upper class limit and subtract it from each lower class limit.

Example 3:

The scores on the first test of a statistics class in fall of 2008 are as follows.

**76 78 71 86 80 62 55 89 66 72 68 96 78 81 82 69 89 88 85 86
79 73 58 85 99 90 66 76 70 63 79 88 59 55 75 86 92 92 62 83
52 94 93 80 78 97 50 88 60 61**

Construct a frequency table, frequency table with class boundaries, relative frequency table and cumulative frequency table.

Use 5 classes with 50 as the lower class limit of the first class.

Visualizing Data

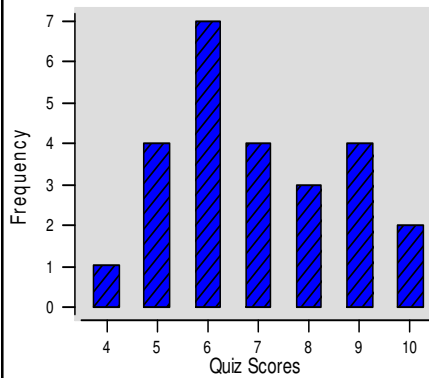
■ *Graphs most commonly used:*

- *Histograms.*
- *Frequency Polygons.*
- *Relative Frequency Histograms.*
- *Ogive.*
- *Dotplots.*
- Bar Charts.
- Stem-and-Leaf Plots.
- Pareto Charts.
- Pie Charts.
- Scatter Diagrams.

Will be discussed in Chapter 10

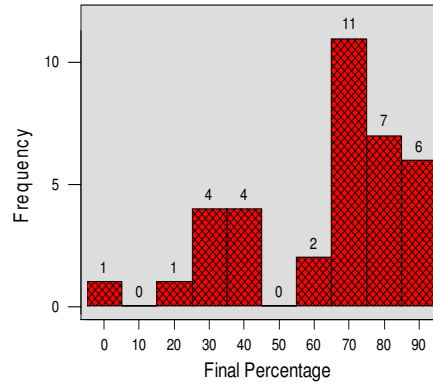
■ Bar Chart:

Must have gaps.



■ Histogram:

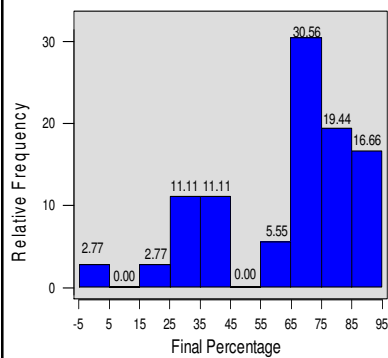
Like a Bar Chart, but with no gaps. Made from a frequency distribution with class boundaries.



■ Relative Frequency

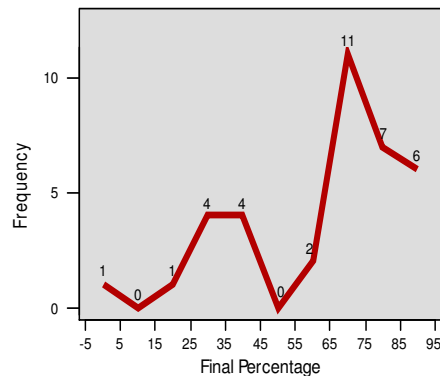
Histogram:

Similar to a Histogram, but instead of counts, it consists of percentages.



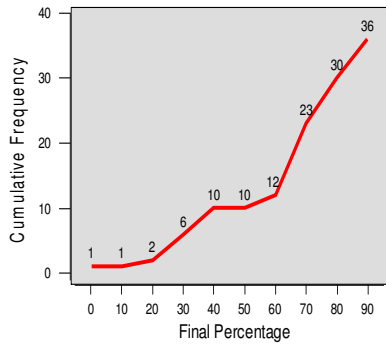
■ Frequency Polygon:

Similar to a Histogram, but instead of bars, it has lines that construct a polygon.



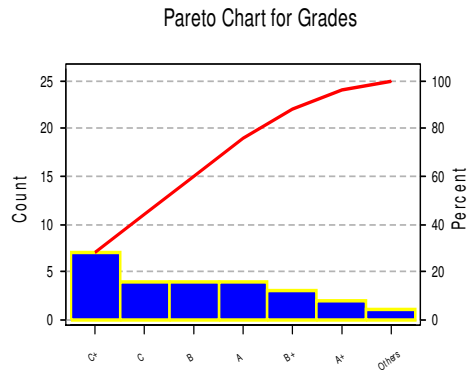
■ Ogive:

Same as a relative frequency polygon, but with cumulative counts.



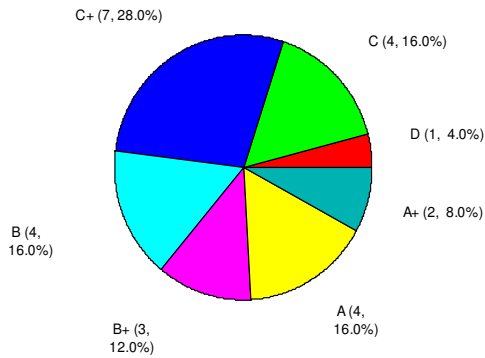
■ Pareto Chart:

Depicts qualitative data arranged in order according to frequencies.



■ Pie Chart:

Pie Chart of Quiz Grade



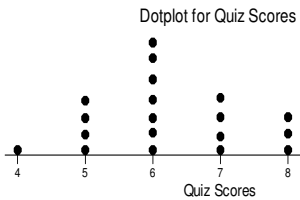
■ Stem-and-Leaf:

Stem-and-leaf of Final % N = 36
Leaf Unit = 1.0

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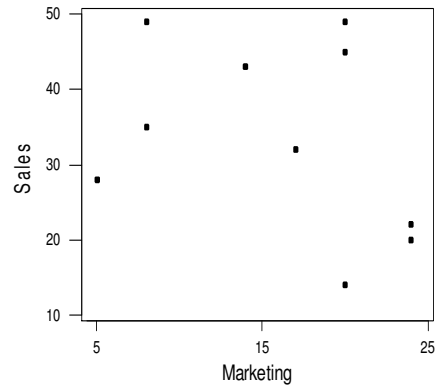
1  0  4
1  1
6  2  35799
8  3  88
10 4  44
10 5
15 6  04788
(13) 7  0113344455568
8  8  2466689
1  9  2
    
```

■ Dotplot:



■ Scatter Diagram:

We will see this later in the semester when we get to Regression.



We can draw all of these graphs without computer assistance.

Lets start with a Histogram, Relative Histogram, Frequency Polygon and an Ogive. The reason why we will start with these 4 graphs is because they all need a form of a frequency distribution table.

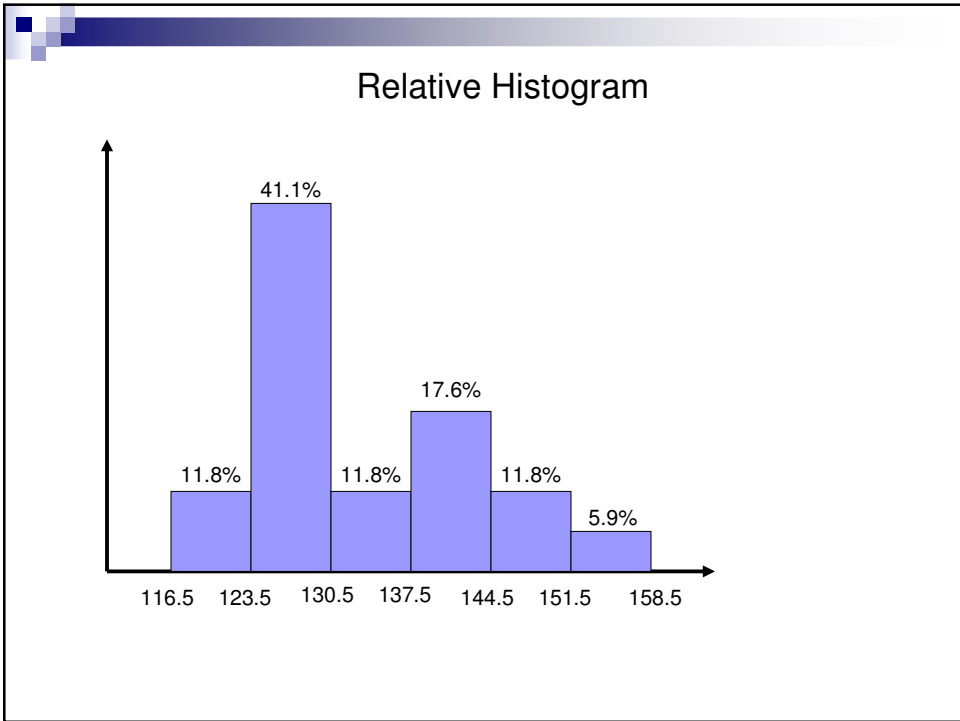
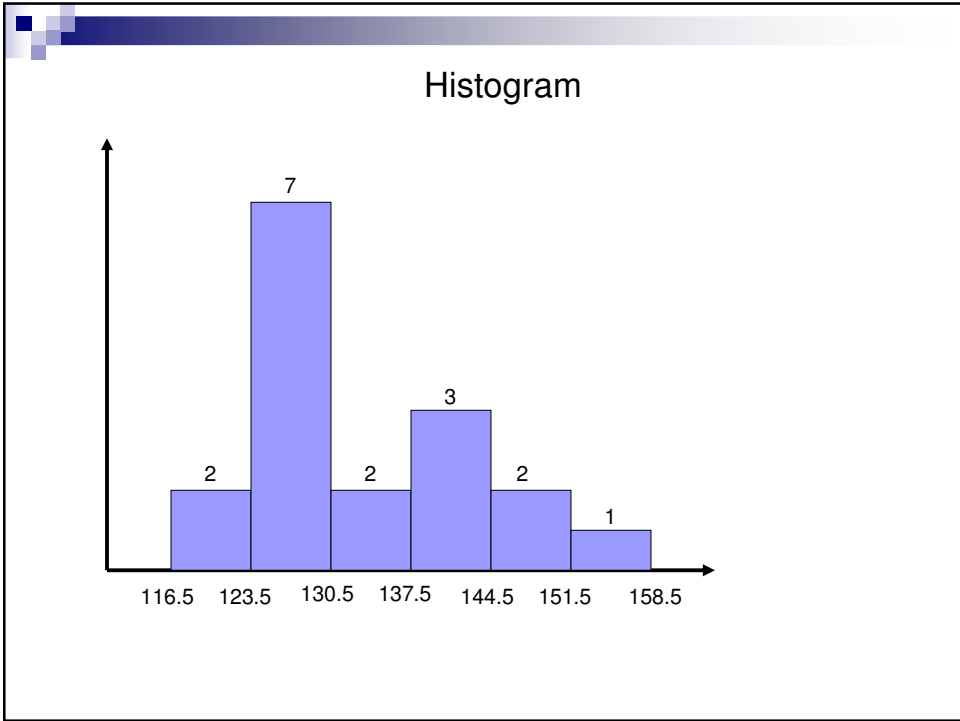
A Histogram and a Frequency Polygon only need a frequency table

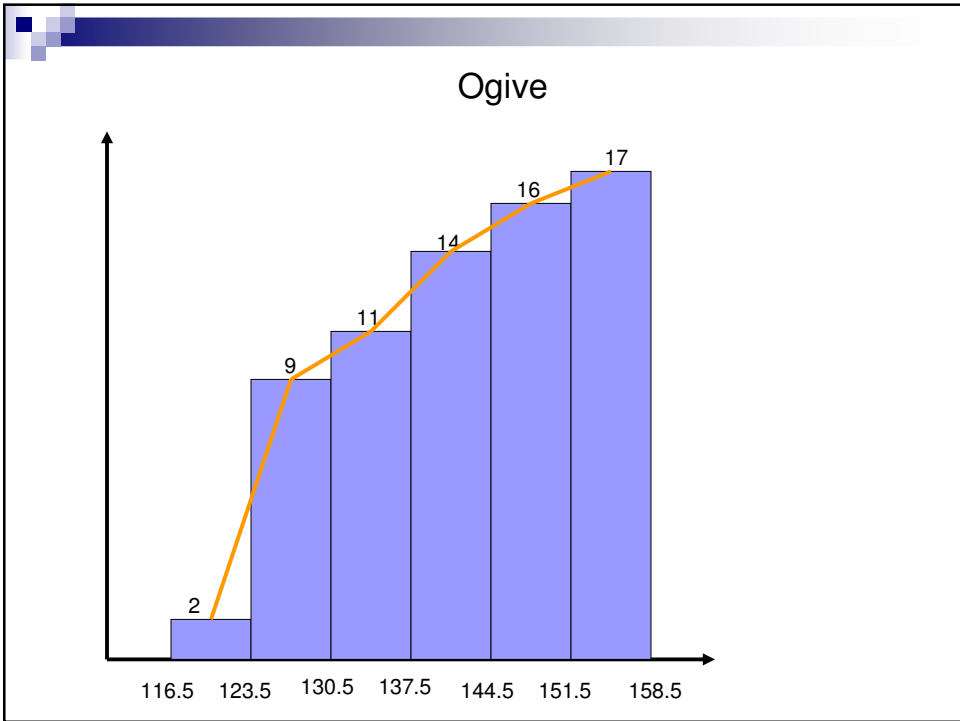
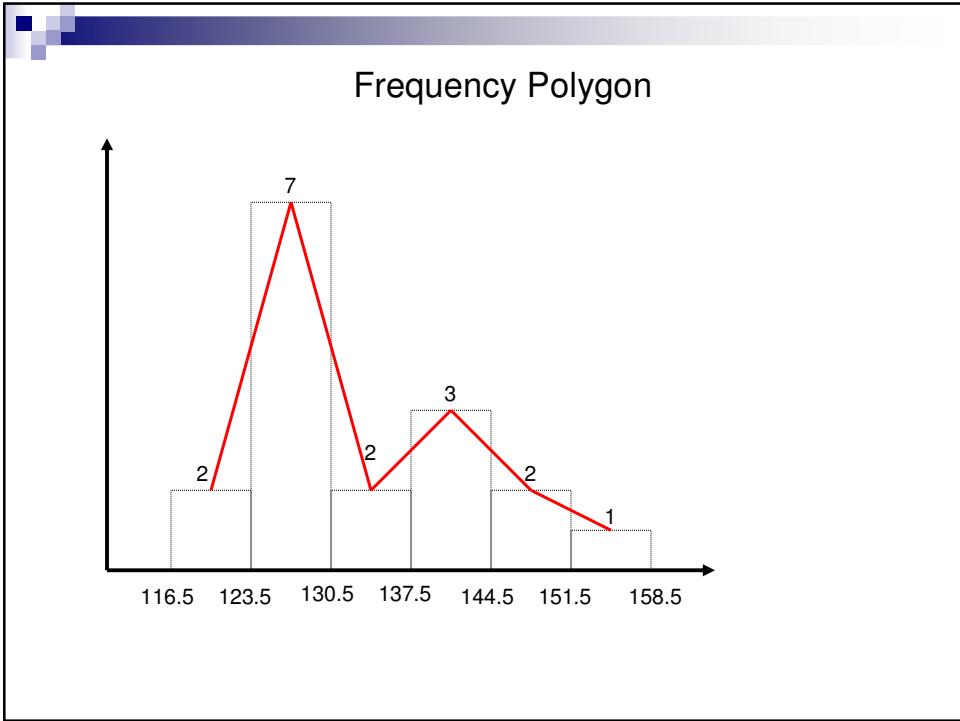
A Relative Frequency Histogram needs a Relative frequency table

An Ogive needs a cumulative frequency table.

Example 4:

Construct a Histogram, Relative Histogram, Frequency Polygon and an Ogive using the data that describes IQ scores for a gifted classroom in a particular elementary school.





Example 5:

Construct a Bar Cart, Pie Chart, Pareto Chart and a Dot Plot using the following data.

The following are the Final grades of a Math 227 class.

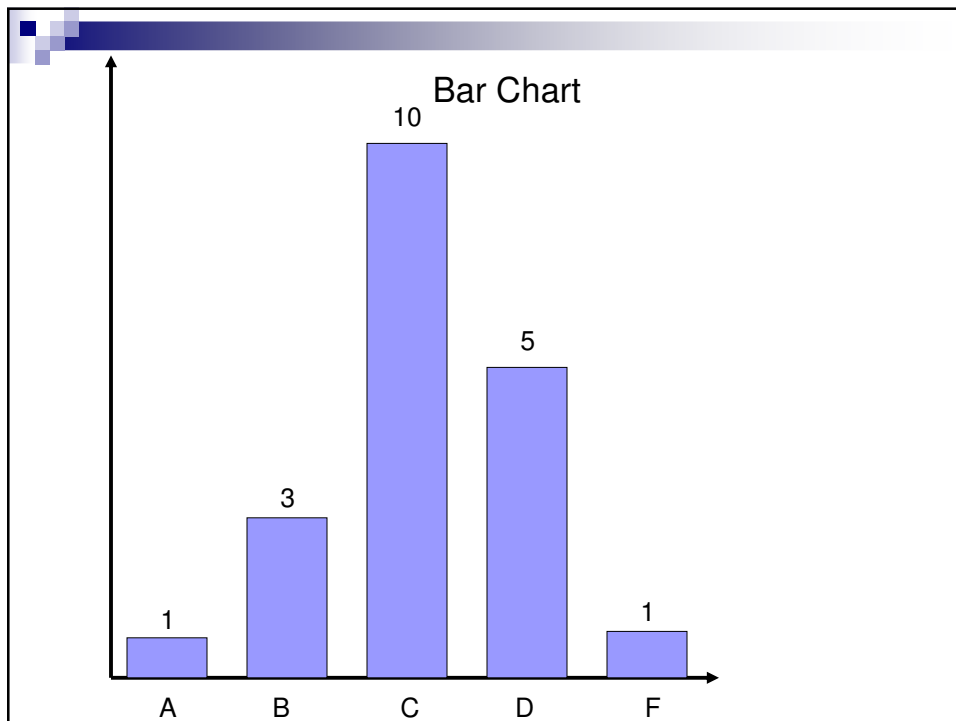
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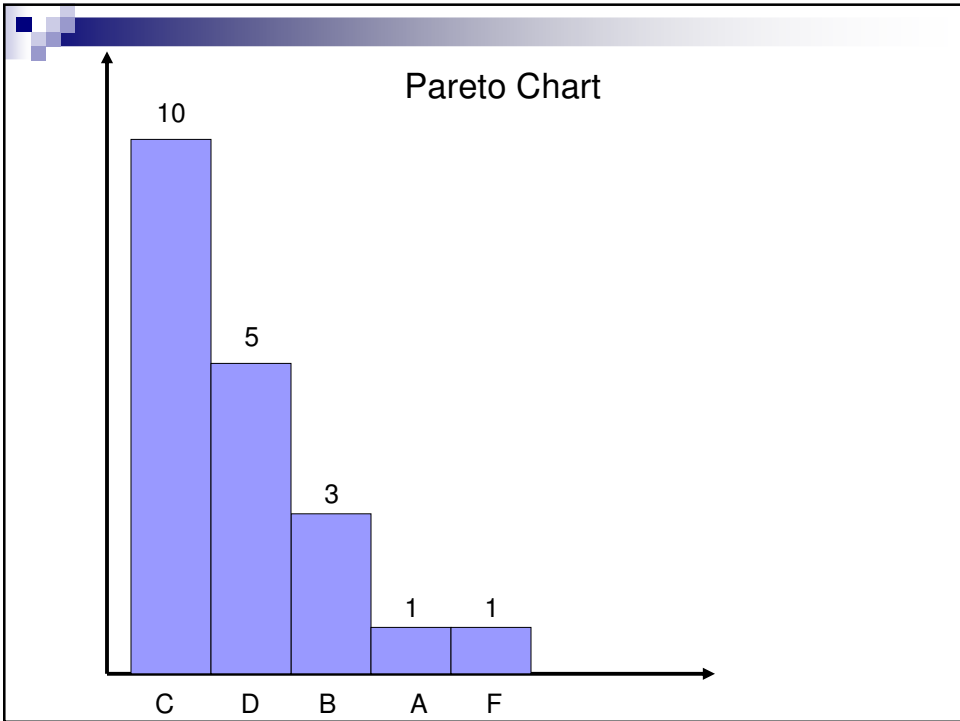
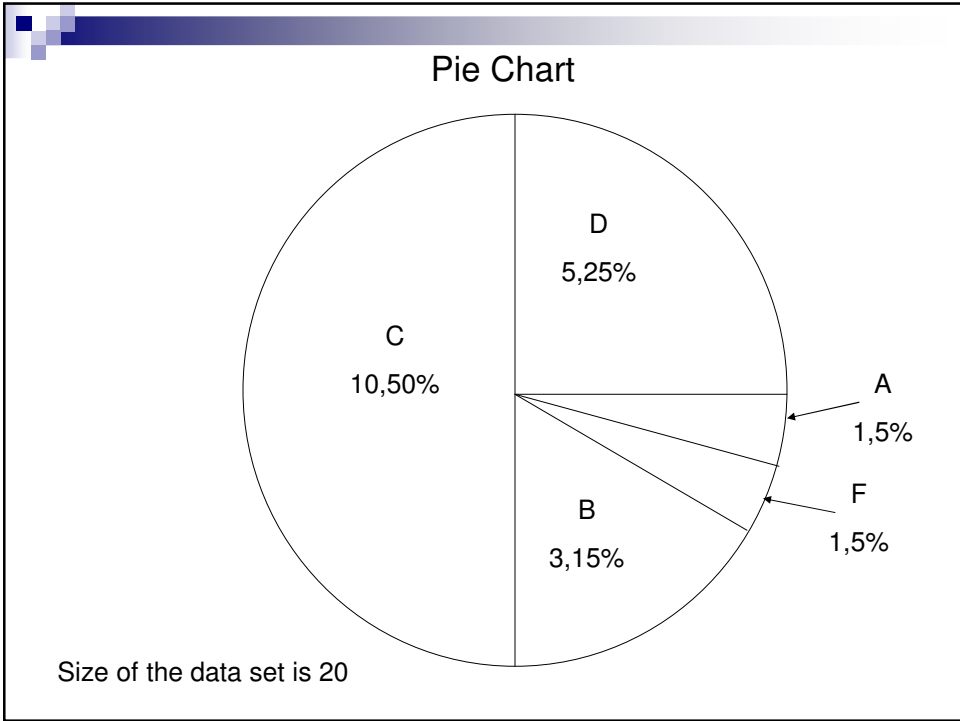
B B B

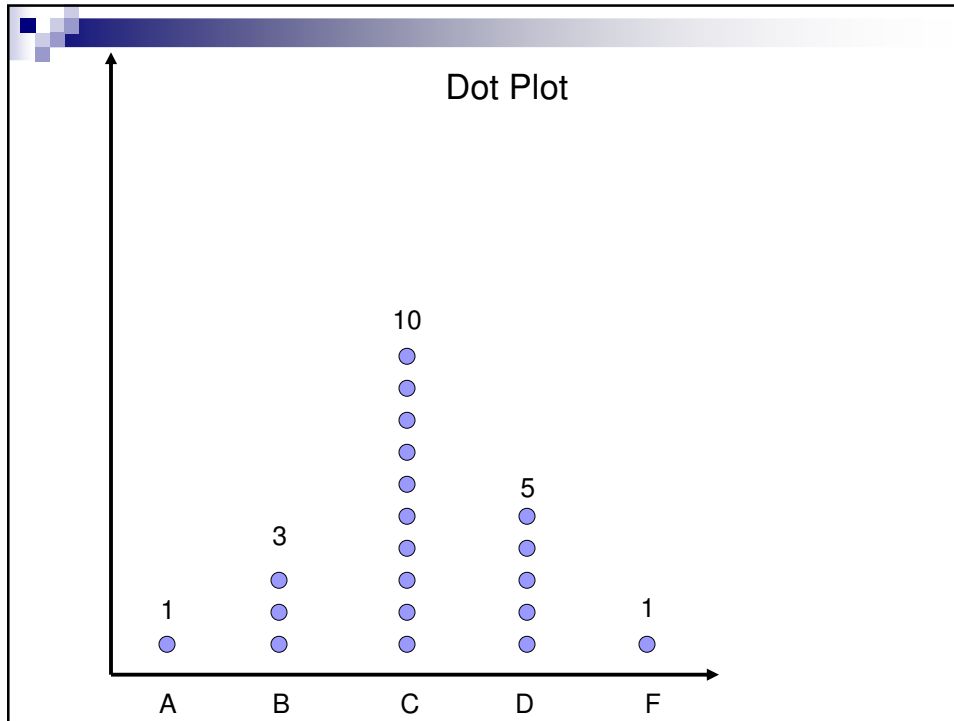
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D D D D D

F







Example 6:

The following refers to the weights of 27 new members to a gym.

167, 200, 188, 175, 181, 155, 203, 204, 193, 156,
 177, 179, 160, 185, 159, 171, 191, 199, 202, 166,
 157, 189, 181, 183, 179, 181, 194

Construct a stem and leaf chart with given data.

15	5679
16	067
17	15799
18	1113589
19	1349
20	0234