Chapter 3

Visualization of Quantitative Data

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Chapter 3 Visualization of Quantitative Data

3.1 Graphs of Quantitative Data

3.2 Visualization of Single Quantitative Variable

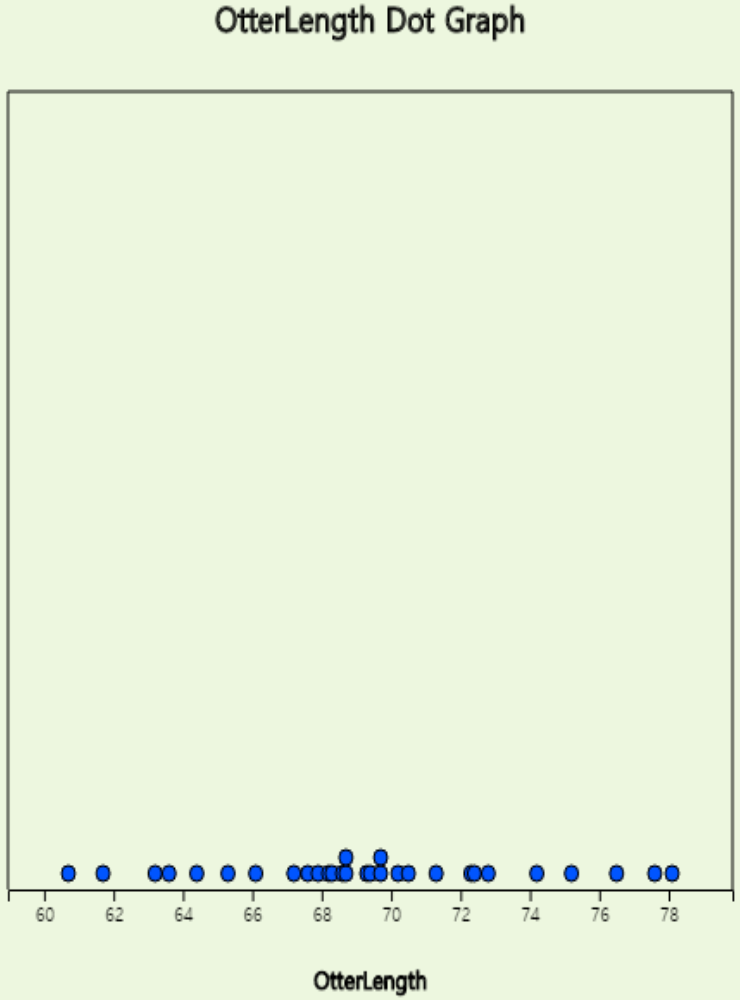
3.3 Visualization of Two Quantitative Variables

3.1 Graphs of Quantitative Data

- Data such as height and weight where possible values are real numbers are called Quantitative data.
- For visualizing single Quantitative variable, dot graph, histogram, stem and leaf plot are used.
- For visualizing two Quantitative variables, such as height and weight, a scatterplot in two-dimensional space is used with each variable being x-axis and y-axis.

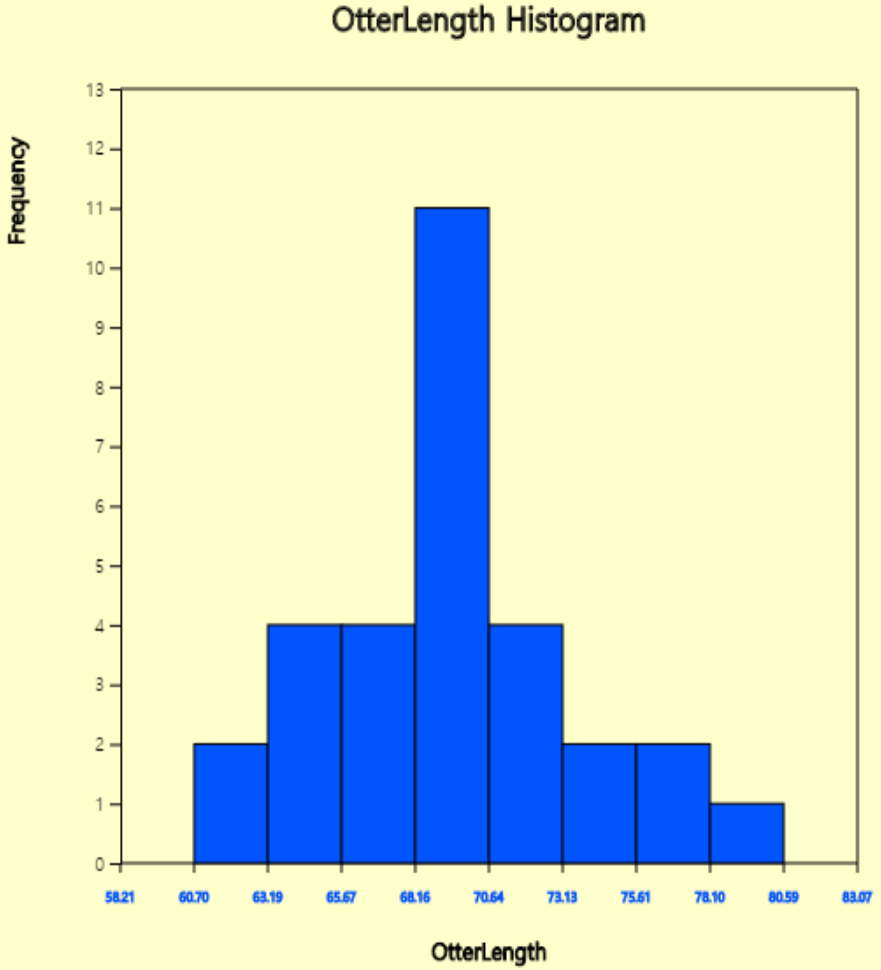
3.1 Graphs of Quantitative Data

- Dot graph is often used to visualize Quantitative data with fewer data counts.
- First draw the horizontal line and set the scale so that all data can be displayed, then mark each data value in dots.
- The dot graph make it easy to see the distribution patterns and anomalies of the data.



3.1 Graphs of Quantitative Data

- Quantitative data, such as monthly income, have so many types of values that it is meaningless to draw a bar chart.
- In such cases, a bar chart (with no spacing between bars) of each section is drawn after dividing several intervals, which is called a histogram.
- The question is, 'How many intervals do you prefer to have? ‘



3.1 Graphs of Quantitative Data

- Stem and leaf plot is recently used to visualize Quantitative data, which can easily tell the range of observations, shape of distribution, and concentration.

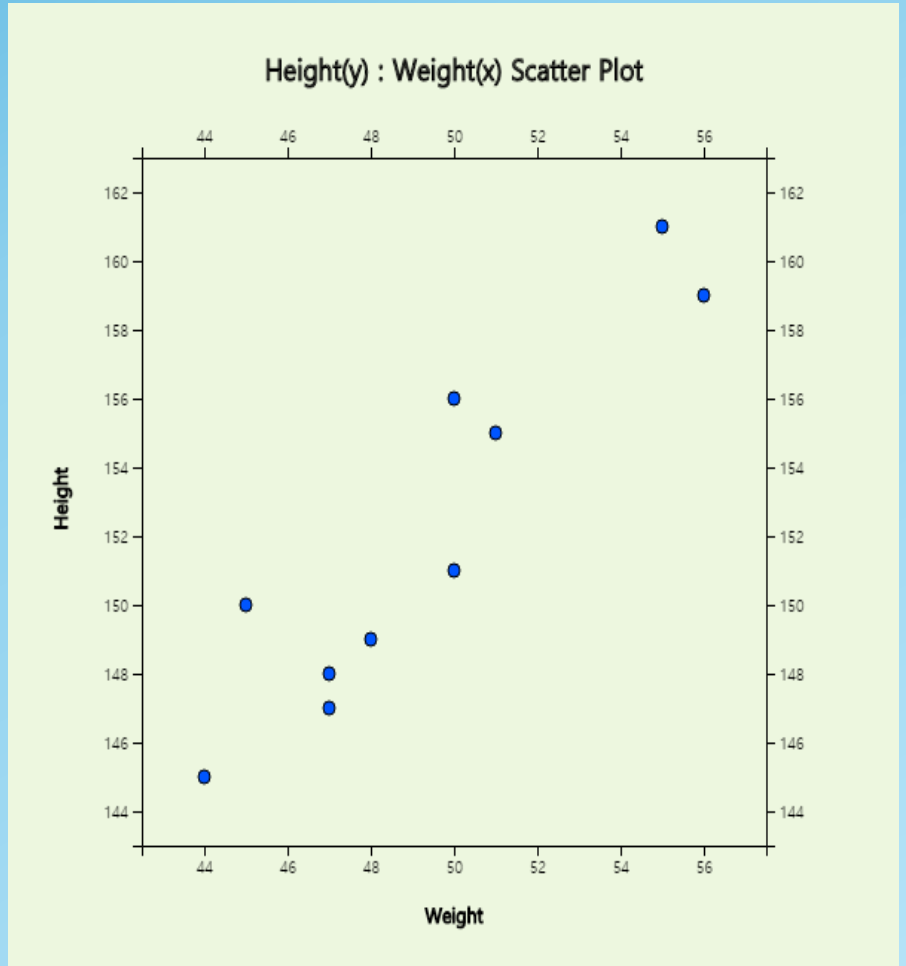
- The name literally shows the data in the form of stem and leaf, and considering the digits of the data values, the first few digits are called stem and the remaining digits are determined by the leaves.

OtterLength Stem and Leaf Plot

Stem	Leaf
60	7
61	7
62	
63	26
64	4
65	3
66	1
67	269
68	23677
69	3477
70	25
71	3
72	348
73	
74	2
75	2
76	5
77	6
78	1

3.1 Graphs of Quantitative Data

- Scatter plot is expressed as a dot with one variable on the X-axis and the other on the Y-axis as the coordinate value on the XY plane.
- An analysis of the relationship between two variables is very efficient by using the scatter plot.



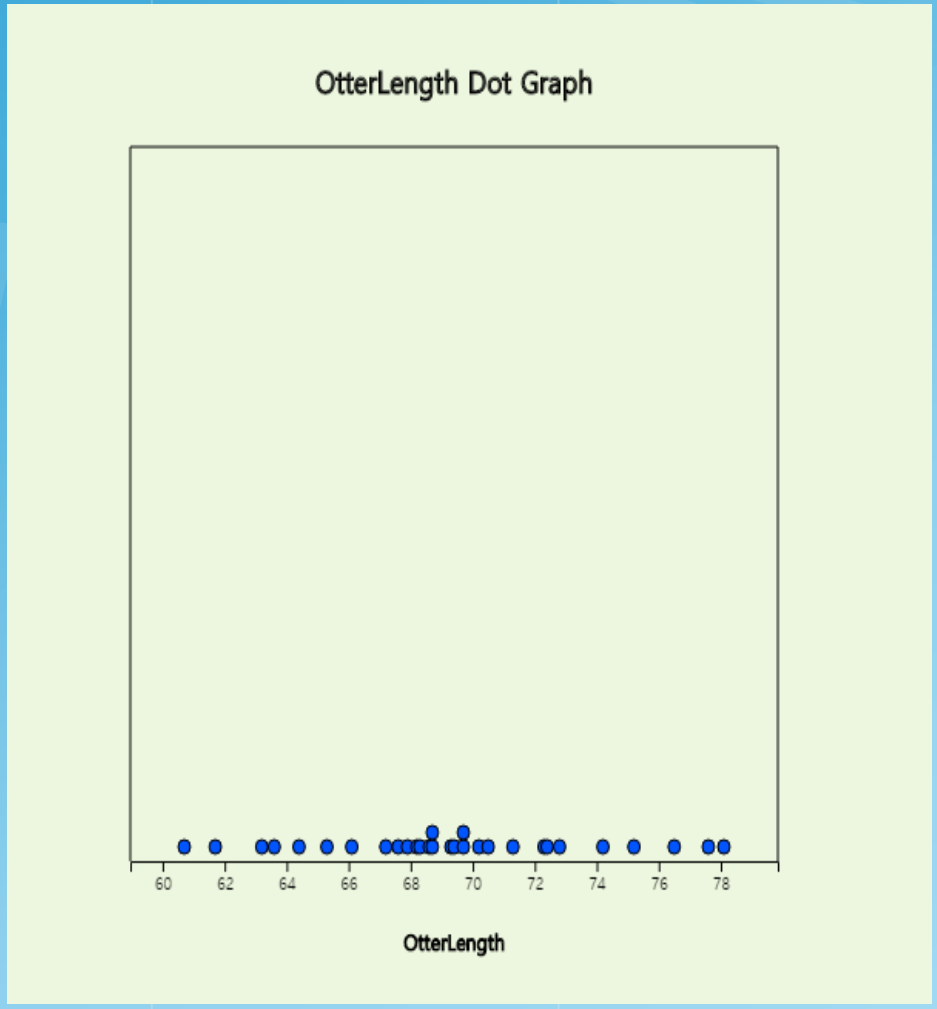
3.2 Visualization of Quantitative Data with Single Variable

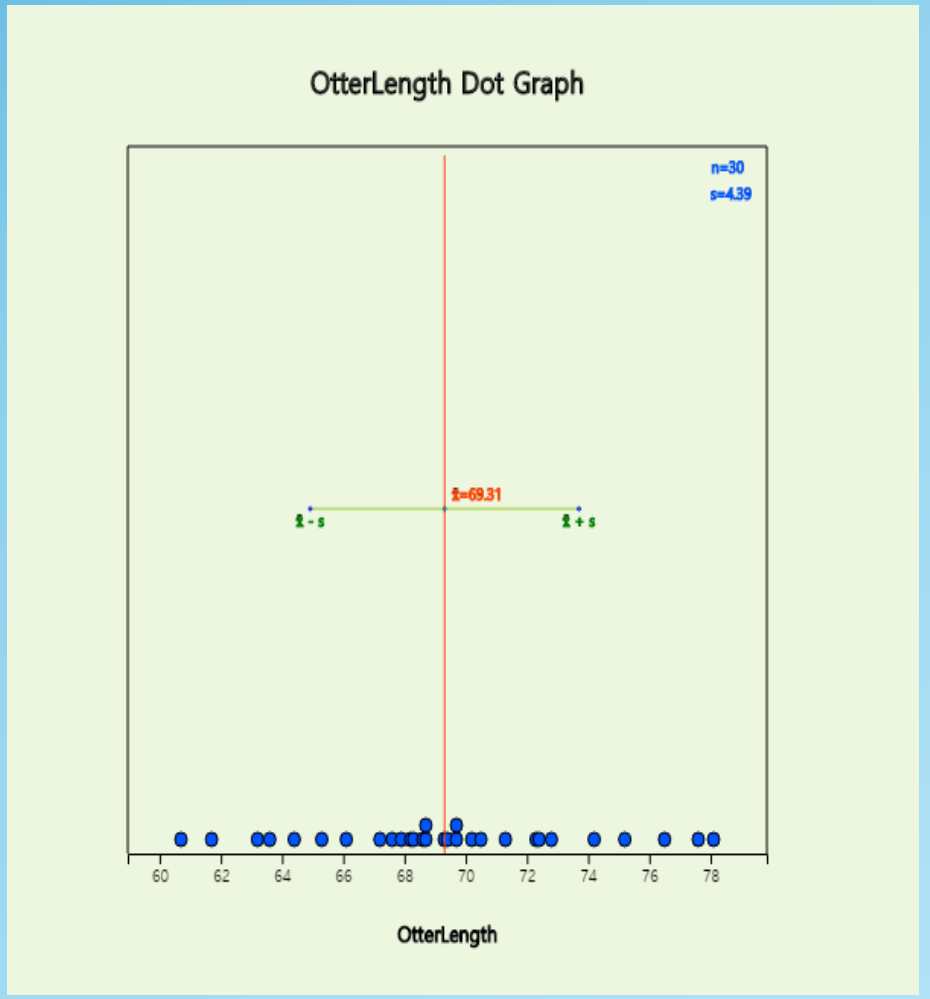
[Example 3.2.1] (Otter length – single quantitative variable)
The following data shows the length of 30 otters. Use 『eStat』 to draw a dot graph, histogram, stem and leaf plot.

63.2 65.3 67.6 68.7 69.7 60.7 72.4 75.2 64.4 76.5
68.3 69.3 70.2 71.3 74.2 63.6 66.1 67.9 68.7 70.5
72.3 72.8 77.6 78.1 69.7 69.4 68.6 68.2 67.2 61.7 (unit cm)

3.2 Visualization of Quantitative Data with Single Variable

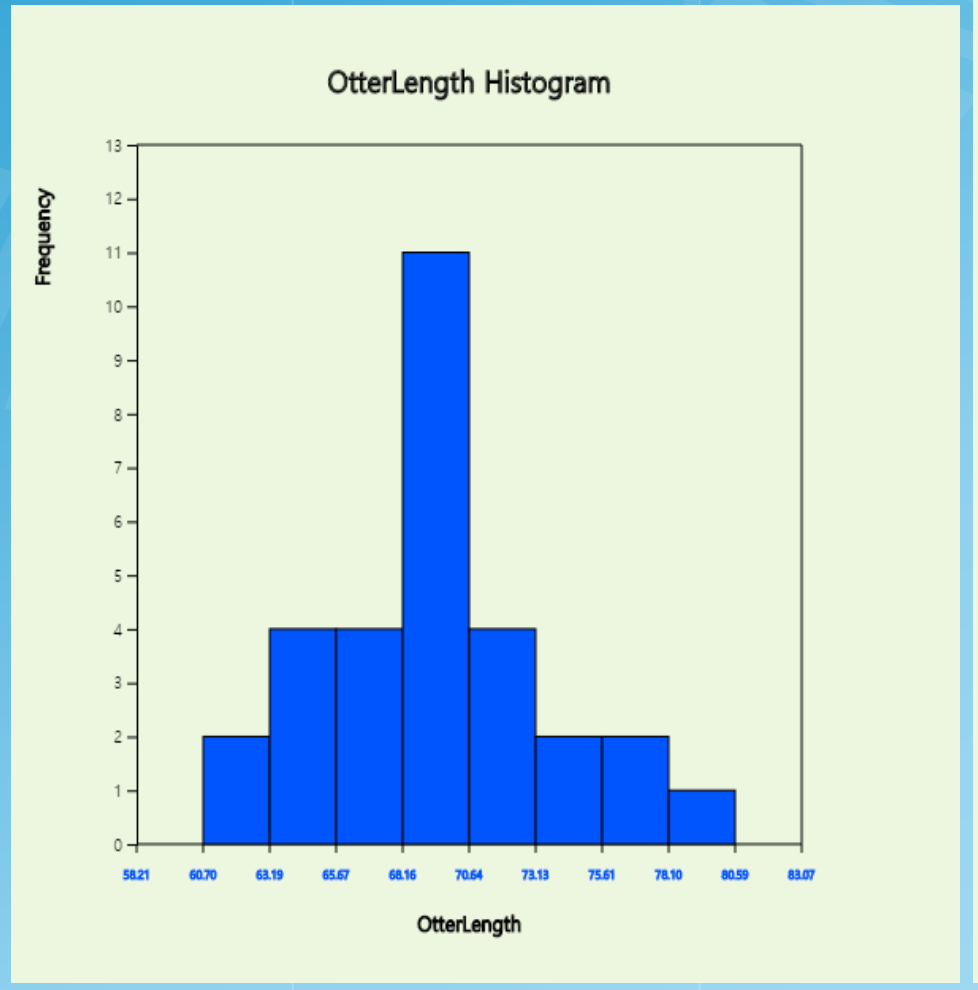
[Example 3.2.1] (Otter length – single quantitative variable)

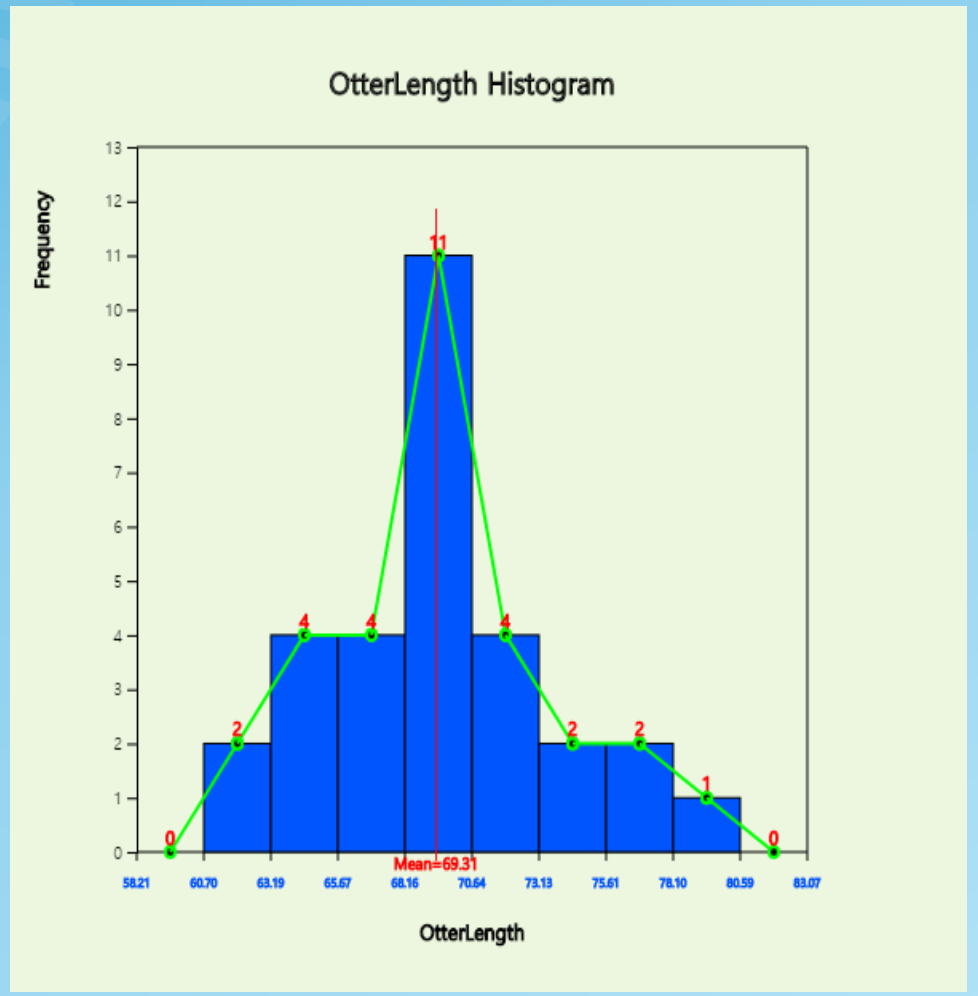




3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.1] (Otter length – single quantitative variable)





Histogram Frequency Table	Group Name	()
Interval (OtterLength)	Group 1 (null)	Total
1 [60.70, 63.19)	2 (6.7%)	2 (6.7%)
2 [63.19, 65.67)	4 (13.3%)	4 (13.3%)
3 [65.67, 68.16)	4 (13.3%)	4 (13.3%)
4 [68.16, 70.64)	11 (36.7%)	11 (36.7%)
5 [70.64, 73.13)	4 (13.3%)	4 (13.3%)
6 [73.13, 75.61)	2 (6.7%)	2 (6.7%)
7 [75.61, 78.10)	2 (6.7%)	2 (6.7%)
8 [78.10, 80.59)	1 (3.3%)	1 (3.3%)
Total	30 (100%)	30 (100%)

3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.1] (Otter length – single quantitative variable)

OtterLength Stem and Leaf Plot

Stem	Leaf
60	7
61	7
62	
63	26
64	4
65	3
66	1
67	269
68	23677
69	3477
70	25
71	3
72	348
73	
74	2
75	2
76	5
77	6
78	1

3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.2] (age – two group quantitative data)
The data on the gender and age of a middle school teacher is

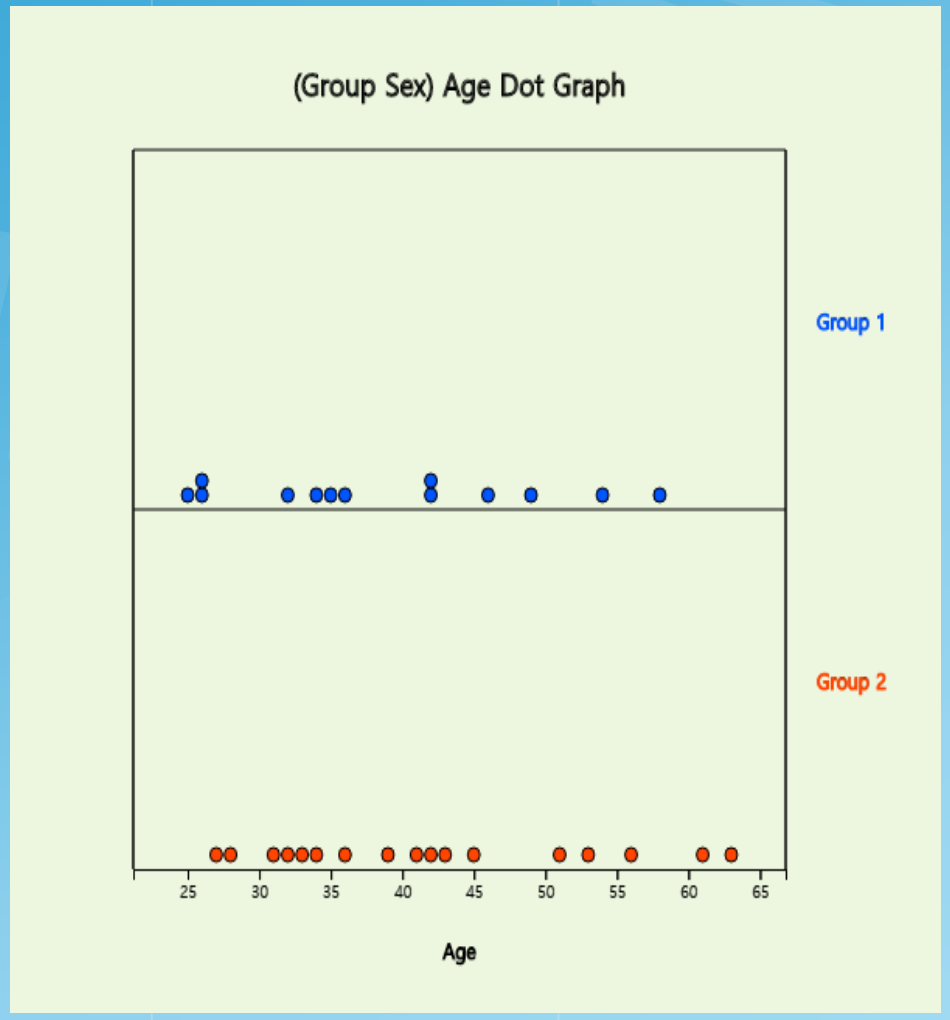
Ex ⇨ eBook ⇨ EX030202_Continuous_TeacherAgeByGender.csv.

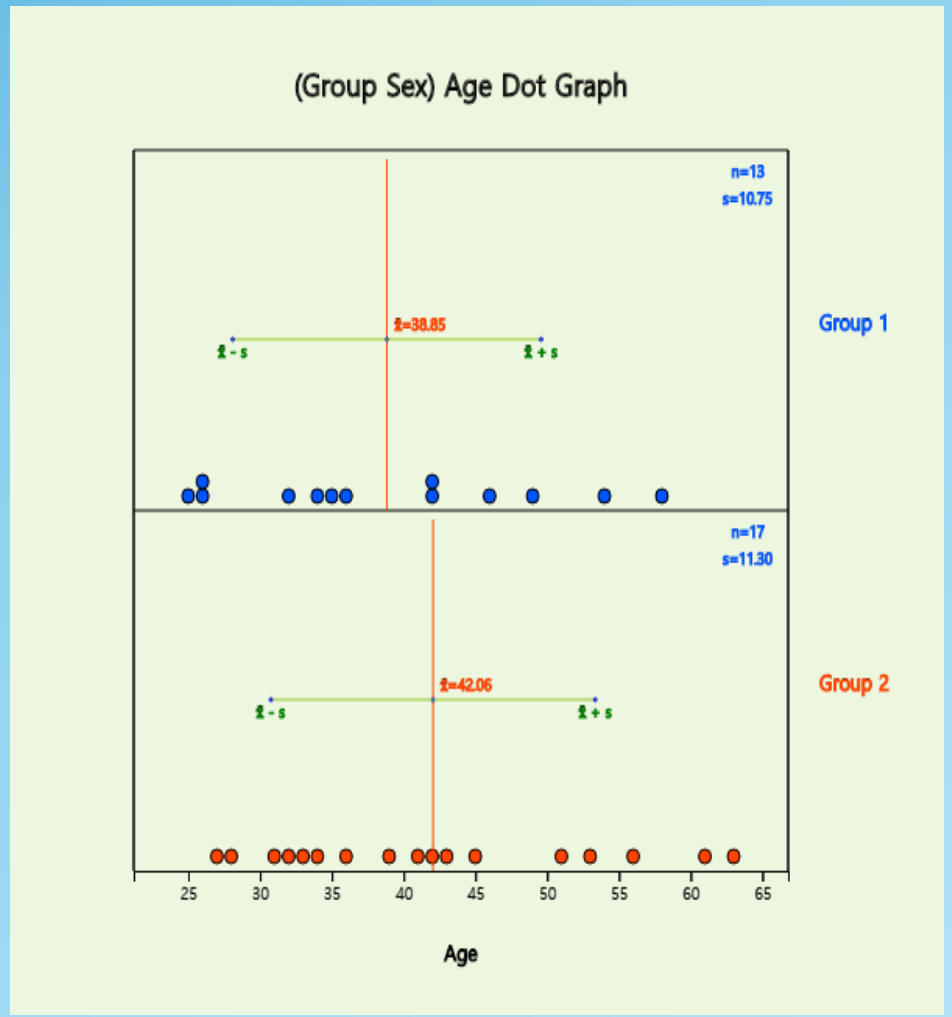
Use 『eStat』 to draw a dot graph, histogram, stem and leaf plot.

	Gender	Age
1	1	26
2	1	34
3	2	28
4	2	39
5	1	32
6	1	36
7	2	41
8	2	42
9	1	26
10	1	25
11	2	33
12	2	43
13	1	54
14	1	49
15	2	56
16	2	31
17	2	27
18	1	42
19	2	32
20	2	36
21	1	58
22	1	42
23	2	61
24	2	34
25	1	35

3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.2] (age – two group quantitative data)





3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.2] (age – two group quantitative data)

Histogram Frequency Table	Group Name	(Sex)	
Interval (Age)	Group 1 (Group 1)	Group 2 (Group 2)	Total
1 [25.00, 30.43)	3 (23.1%)	2 (11.8%)	5 (16.7%)
2 [30.43, 35.86)	3 (23.1%)	4 (23.5%)	7 (23.3%)
3 [35.86, 41.29)	1 (7.7%)	3 (17.6%)	4 (13.3%)
4 [41.29, 46.71)	3 (23.1%)	3 (17.6%)	6 (20.0%)
5 [46.71, 52.14)	1 (7.7%)	1 (5.9%)	2 (6.7%)
6 [52.14, 57.57)	1 (7.7%)	2 (11.8%)	3 (10.0%)
7 [57.57, 63.00)	1 (7.7%)	2 (11.8%)	3 (10.0%)
Total	13 (100%)	17 (100%)	30 (100%)

3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.2] (age - two group quantitative data)

(Group Sex) Age Stem and Leaf Plot

Stem	Group 1 Leaf
2	566
3	2456
4	2269
5	48
6	

Stem	Group 2 Leaf
2	78
3	123469
4	1235
5	136
6	13

(Group Sex) Age Stem and Leaf Plot

Group 1 Leaf	Stem	Group 2 Leaf
665	2	78
6542	3	123469
9622	4	1235
84	5	136
	6	13

3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.3] (Comparison Hotdog Calories – three group quantitative data)

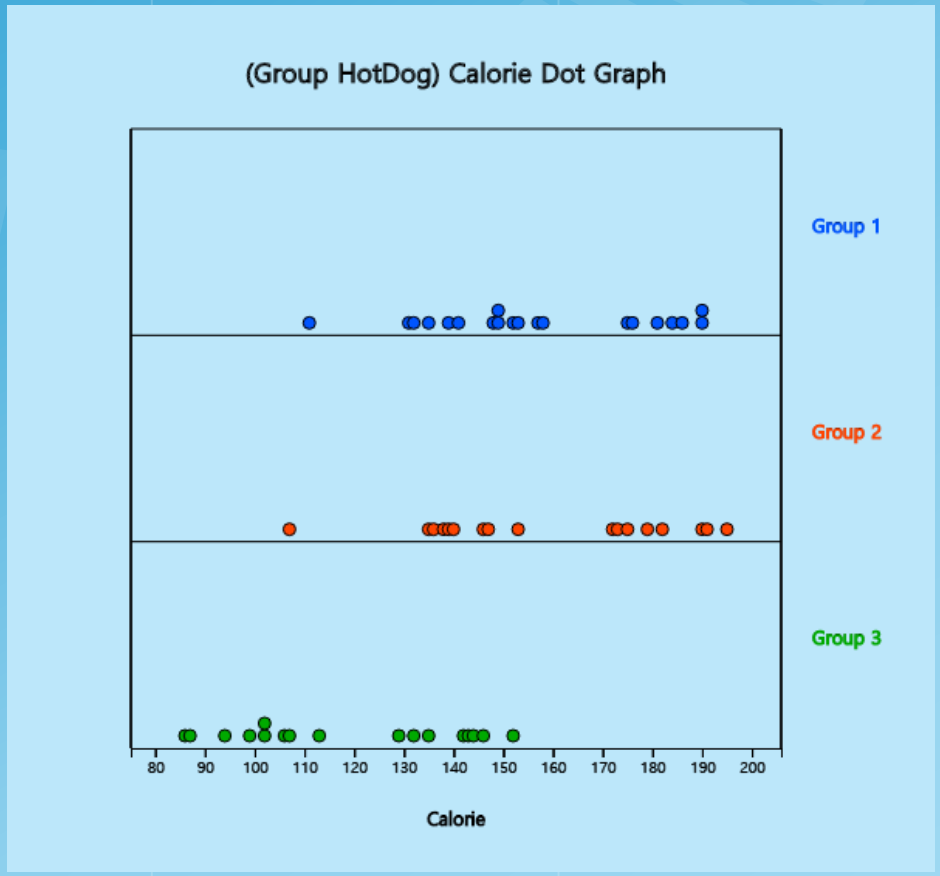
The calorie data of the hot dogs made by three ingredients (1: beef, 2: pork, 3: chicken) are surveyed and saved at the following location of『eStat』.

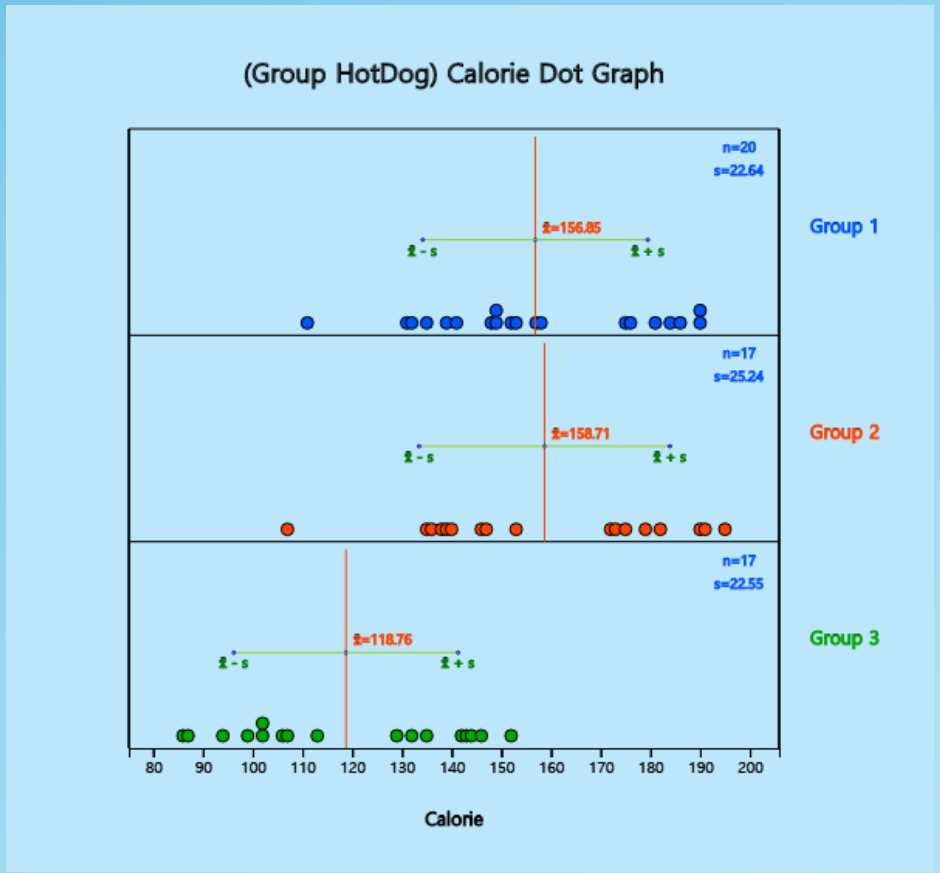
Ex ⇨ eBook ⇨ EX030203_Continuous_CalorieByHotdog.csv.

Use『eStat』to draw a dot graph, histogram, stem and leaf plot.

3.2 Visualization of Quantitative Data with Single Variable

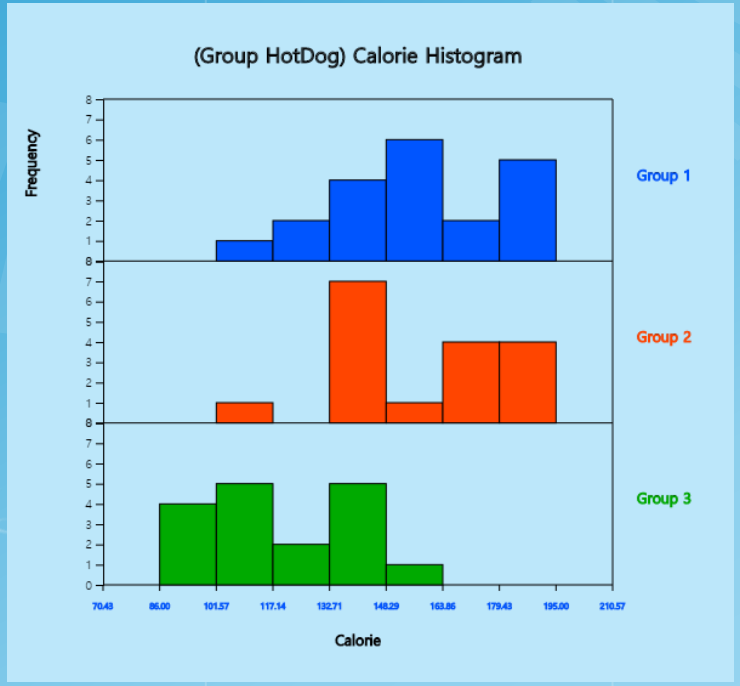
[Example 3.2.3] (comparison of calories – three groups)

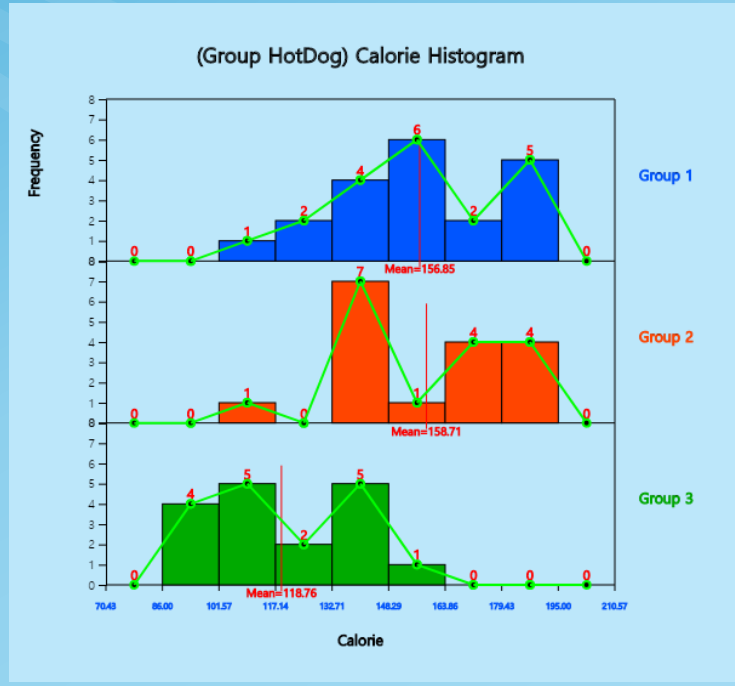




3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.3] (comparison of calories – three groups)





Histogram Frequency Table	Group Name	(HotDog)		
Interval (Calorie)	Group 1 (Group 1)	Group 2 (Group 2)	Group 3 (Group 3)	Total
1 [86.00, 101.57)	0 (0.0%)	0 (0.0%)	4 (23.5%)	4 (7.4%)
2 [101.57, 117.14)	1 (5.0%)	1 (5.9%)	5 (29.4%)	7 (13.0%)
3 [117.14, 132.71)	2 (10.0%)	0 (0.0%)	2 (11.8%)	4 (7.4%)
4 [132.71, 148.29)	4 (20.0%)	7 (41.2%)	5 (29.4%)	16 (29.6%)
5 [148.29, 163.86)	6 (30.0%)	1 (5.9%)	1 (5.9%)	8 (14.8%)
6 [163.86, 179.43)	2 (10.0%)	4 (23.5%)	0 (0.0%)	6 (11.1%)
7 [179.43, 195.00)	5 (25.0%)	4 (23.5%)	0 (0.0%)	9 (16.7%)
Total	20 (100%)	17 (100%)	17 (100%)	54 (100%)

3.2 Visualization of Quantitative Data with Single Variable

[Example 3.2.3] (comparison of calories – three groups)

(Group HotDog) Calorie Stem and Leaf Plot

Stem	Group 1 Leaf
8	
9	
10	
11	1
12	
13	1259
14	1899
15	2378
16	
17	56
18	146
19	00

Stem	Group 2 Leaf
8	
9	
10	7
11	
12	
13	5689
14	067
15	3
16	
17	2359
18	2
19	015

Stem	Group 3 Leaf

3.3 Visualization of Quantitative Data with Two Variables

- Generally, if data are collected for one observation, information about one or more variables is collected.
  => elementary school student may be examined for height and weight together with his or her gender.
- Data measuring two Quantitative variables can be analyzed using a scatter plot.
- Scatter plot is a display of data on a two-dimensional plane, with values for one variable being x-axis and for the other being y-axis.
- If categorical variables such as gender are also measured, a scatter plot can be drawn by separating the colors of each group.
- Correlation and regression analysis of the two Quantitative variables are discussed in detail in Chapter 12.

3.3 Visualization of Quantitative Data with Two Variables

[Example 3.3.1] (Height and Weight – Two Quantitative variables)
Data on the gender, height and weight of 10 elementary school students are stored in

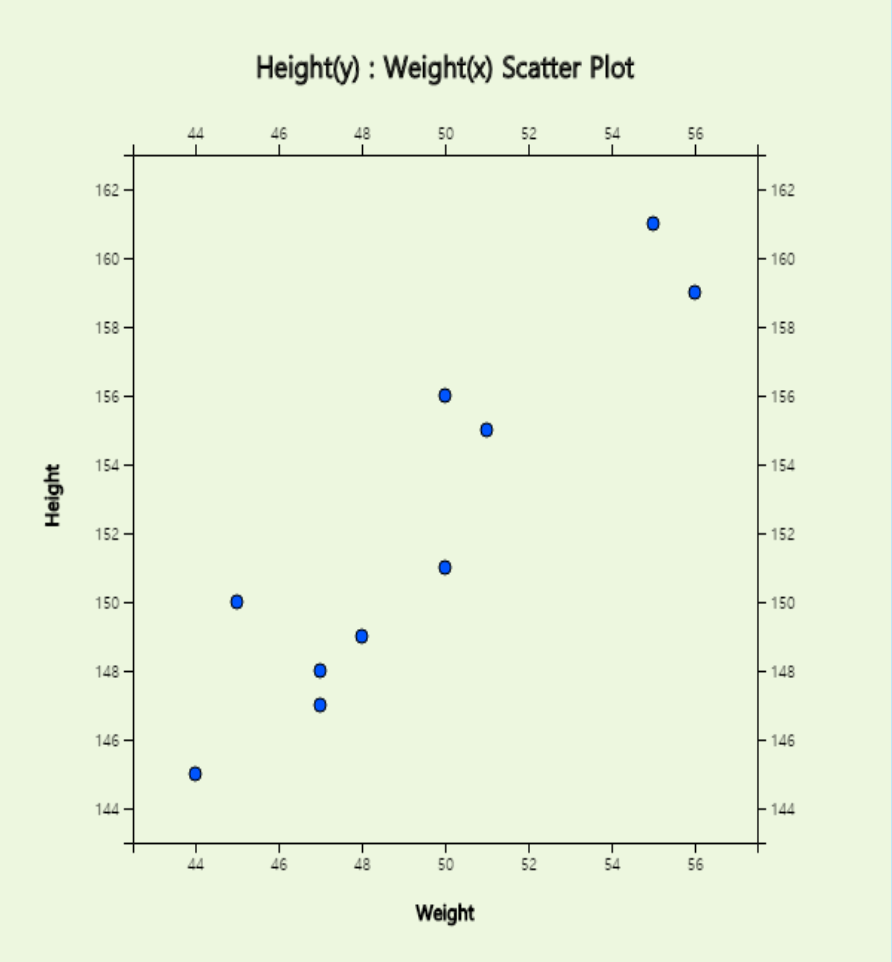
EX ⇨ eBook ⇨ Ex030301Continuous_HeightWeightByGender.csv.

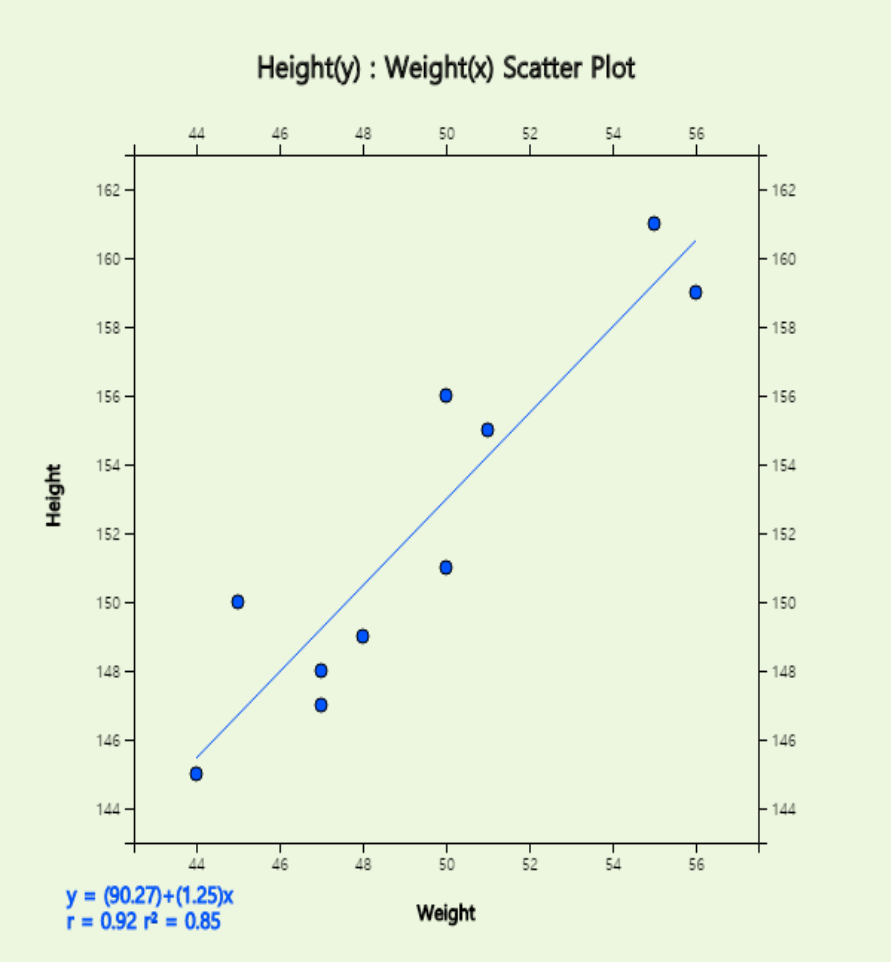
Draw the following graph by using the 『eStat』.
1) Draw a scatter plot of height and weight.
2) Draw a scatter plot of height and weight by gender group.

	Gender	Height	Weight
1	1	150	45
2	2	147	47
3	1	145	44
4	2	151	50
5	1	149	48
6	2	148	47
7	1	155	51
8	2	156	50
9	1	161	55
10	2	159	56

3.3 Visualization of Quantitative Data with Two Variables

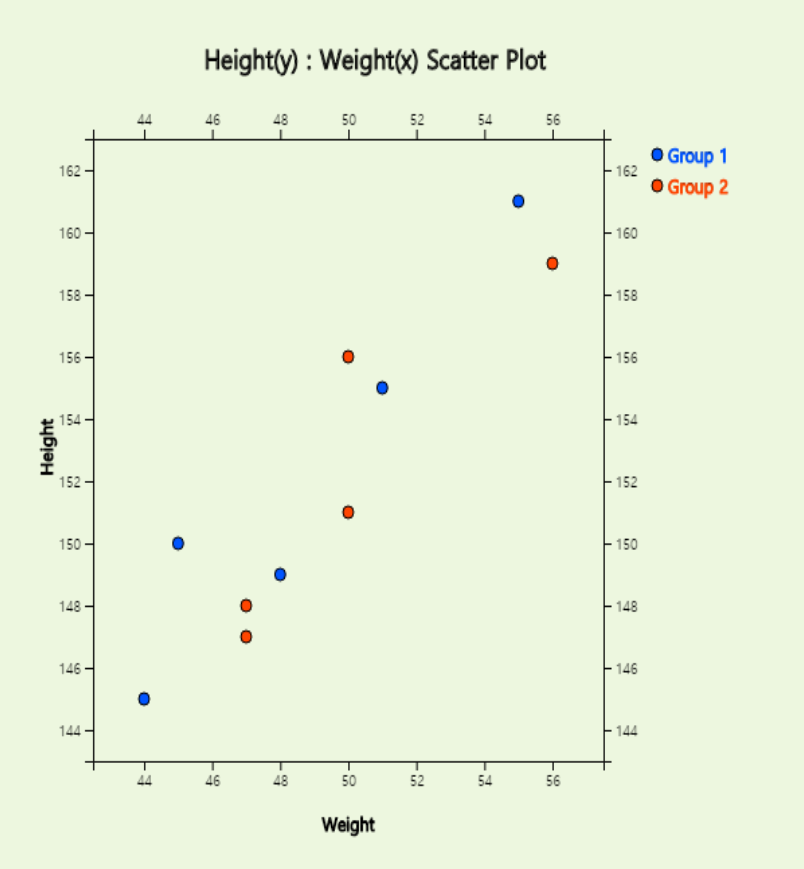
[Example 3.3.1] (Height and Weight – Two Quantitative variables)

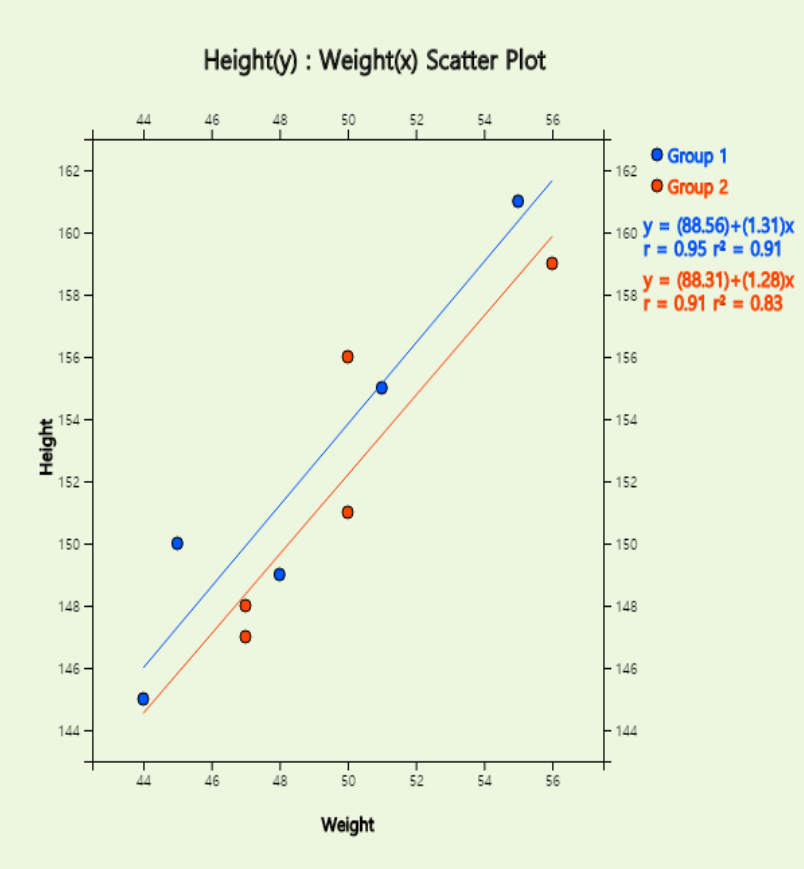


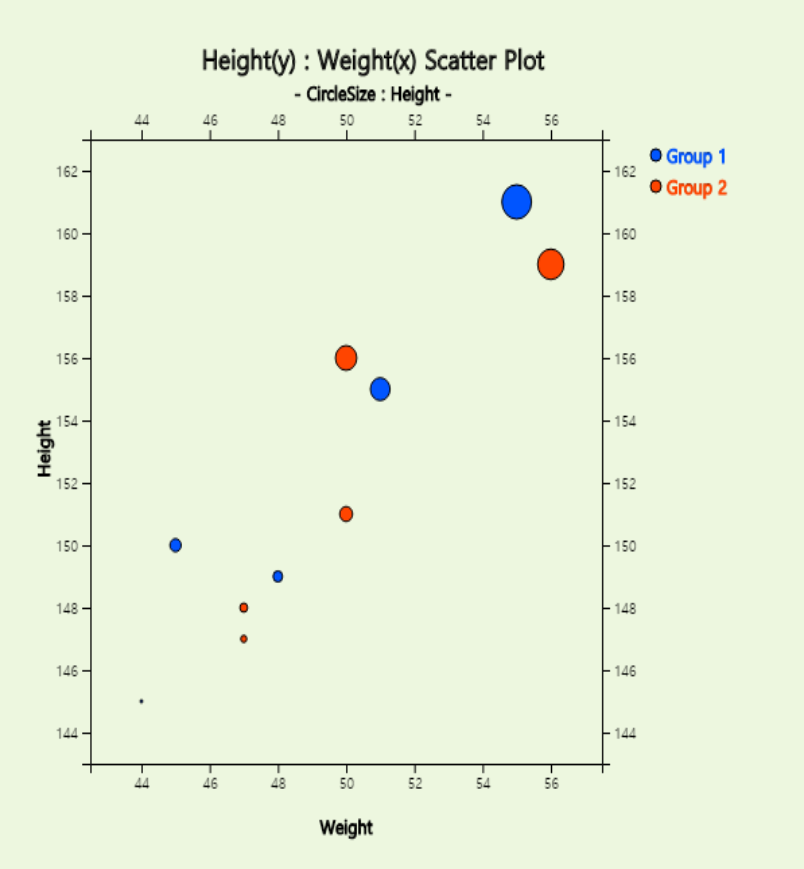


3.3 Visualization of Quantitative Data with Two Variables

[Example 3.3.1] (Height and Weight – Two Quantitative variables)







3.4 Summary

- Visualization of single Quantitative variable
  - Dot Graph, Histogram, Stem and Leaf Plot
- Visualization of two Quantitative variables
  - Scatter Plot
  - Coloring by group variable
  - Sizing by size variable

Thank you