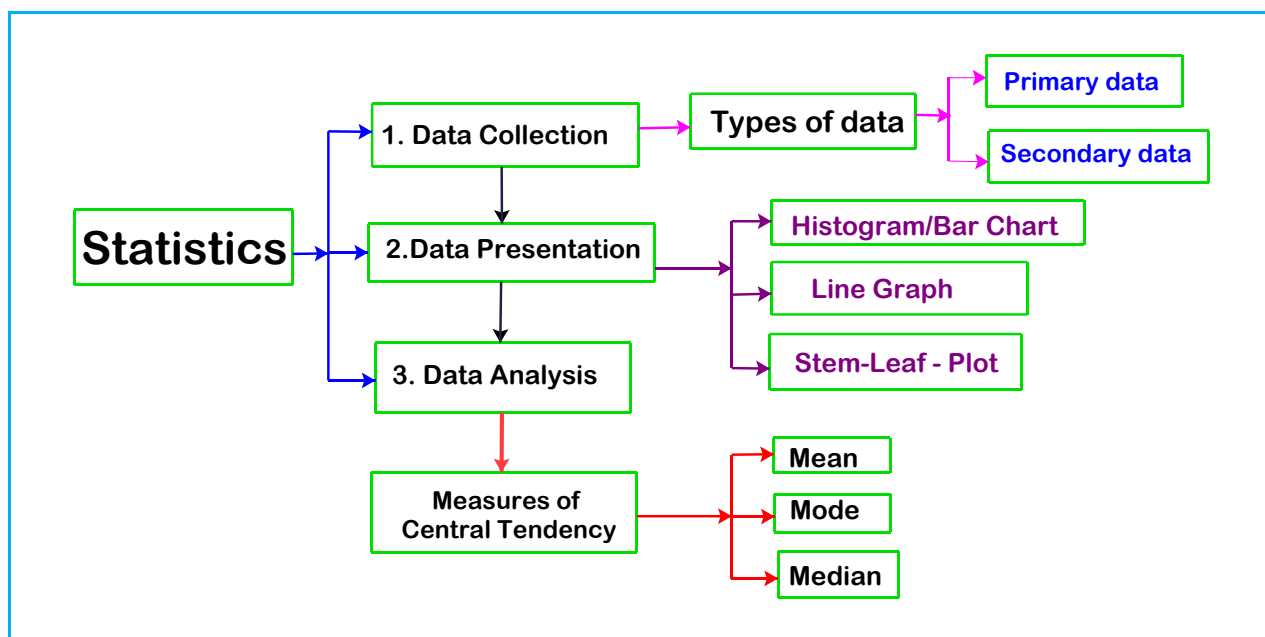


Stem and Leaf Plot

Concept Mapping: Statistics



Stem-and-leaf plot

John Tukey, a mathematical statistician developed the stem-and-leaf plot or stem-and-leaf diagram. Stem-and-leaf plot is a technique for summarizing all of data set collected from the observation. The advantages of the stem-and-leaf plot are that it provides an easy way to sort the data and the stem-and-leaf plot contains the original data.

In order to construct a stem-and leaf plot, we separate the digits of each data into **two** parts. The left group of *leading* digits is called a **stem** and the remaining group of *trailing* digits on the right is called a **leaf**.

For example, the numerical data score 48 will split as 4-8 as shown below.

Stem (Leading digits)	Leaf (Trailing digits)
4	8

The numerical data score 973 might be split as 9-73 or 97-3 as shown.

Stem (Leading digit)	Leaf (Trailing digit)
9	73

or

Stem (Leading digit)	Leaf (Trailing digit)
97	3

Let us construct a stem-and-leaf plot of the mathematics scores of 20 students as follows:

39 44 34 33 46 41 48 35 18 32
45 27 29 39 30 34 25 38 19 46

We can see that the scores are in the 10s, 20s, 30s and 40s. We shall use the **first** digit of each score as the **stem** and the **second** digit as the **leaf**.

Draw a vertical line and place the stems in order to the left of it. Then we place the leaf on its stem by writing the trailing (remaining) digit on the right side of the vertical line opposite its corresponding leading digit.

The first data score is 39, **3** is the stem and **9** is the leaf. Thus, we write 9 next to the stem 3 as shown below.

Stem	Leaf
1	
2	
3	9
4	

The next data score is 44, so we place 4 next to the stem 4. We continue each of the 20 leaves is placed on the diagram. The results of stem-and-leaf plot is as shown below.

Stem	Leaf
1	8 9
2	7 9 5
3	9 4 3 5 2 9 0 4 8
4	4 6 1 8 5 6

We shall rearrange the data to get an **ordered stem-and-leaf plot**.

Stem	Leaf
1	8 9
2	5 7 9
3	0 2 3 4 4 5 8 9 9
4	1 4 5 6 6 8

From the **ordered stem-and-leaf plot**, we can see that the lowest score is 18 and the highest score is 48. Most of the score are between 30 and 39.

The stem-and-leaf plot:

1. The **stem** is the *leading* digit and the **leaf** is the *trailing* digit.

2. Actual value: _____

Stem	Leaf
2	5, 7

Actual value:
25, 27



Example 1

A box containing oranges was examined and each of orange was weighted. The mass in grams were as follows.

104	117	105	113	128
127	108	139	135	111
134	99	125	122	135
98	104	132	138	124
106	114	133	123	122

- Construct a stem-and-leaf plot for these data.
- Calculate the percentage of oranges which had masses at least 120g.

Solution

- Construct a stem-and-leaf plot for the data.**

From the given data,

There are 25 oranges in the box,

the minimum mass = 98 grams

the maximum mass = 139 grams

Draw a vertical line and place the stems in order to the left of it. The first stem is 90.

Stem	Leaf
9	8, 9
10	8, 6, 4, 4, 5
11	7, 4, 3, 1,
12	7, 5, 2, 3, 8, 4, 2
13	9, 4, 2, 3, 5, 8, 5

We shall rearrange the data to get an **ordered stem-and-leaf plot**.

Stem	Leaf
9	8, 9
10	4, 4, 5, 6, 8
11	1, 3, 4, 7
12	2, 2, 3, 4, 5, 7, 8
13	2, 3, 4, 5, 5, 8, 9

b) Calculate the percentage of oranges which had masses at least 120g.

From the stem-and-leaf plot above, we have the mass of oranges at least 120 grams were as follows.

Stem	Leaf
12	2, 2, 3, 4, 5, 7, 8
13	2, 3, 4, 5, 5, 8, 9

The number of oranges which had masses at least 120 grams are 14 oranges and data are 122, 122, 123, 124, 125, 127, 128, 132, 133, 134, 135, 135, 138 and 139 grams.

The percentage of oranges which had masses at least 120grams are

$$\frac{14 \times 100}{25} = 56 \% \quad \square$$

Refined Stem-and -Leaf Plot

When we have too many data and the leaves are lumped into a few stems. We can refine the stem-and-leaf plot by splitting each stem into two parts: *low* and *high*. The stem-and-leaf plot will have two entries for each stem, one for *lower* valued leaves from **0** to **4** and the other stem for *higher* valued leaves from **5** to **9**. This increases the refinement of the graph.

Example 2

The number of pairs of shoes sold in a shop each day for 30 days are as follows:

85	101	94	80	105	89
102	102	93	111	101	87
96	96	103	92	89	85
97	95	86	94	103	106
95	99	84	99	90	112

Construct a refined stem-and -leaf plot for these data.

Solution

Construct a refined stem-and-leaf plot for the data.

From the given data,

The number of pairs of shoes sold in a shop each day for 30 days of a month.

the minimum number = 80 pairs

the maximum number = 112 pairs

Draw a vertical line and place the stems in order to the left of it. The first stem is 80.

Stem	Leaf
8	4, 0
8	5, 5, 6, 9, 9, 7
9	4, 3, 2, 4, 0
9	6, 7, 5, 6, 5, 9, 9
10	2, 1, 2, 3, 1, 3
10	5, 6
11	1, 2

We shall rearrange the data to get an **ordered refined stem-and-leaf plot**.

Stem	Leaf
8	0, 4
8	5, 5, 6, 7, 9, 9
9	0, 2, 3, 4, 4
9	5, 5, 6, 6, 7, 9, 9
10	1, 1, 2, 2, 3, 3
10	5, 6
11	1, 2

Back – to – Back Stem – and – Leaf Plot

Back -to-back stem-and-leaf plot will be used for comparing two set of data. We shall construct a double stem-and-leaf plot by letting the leaves to the right of the stems represent the unit digits for the first group of data and letting the leaves to the left of the stems represent the unit digits for the second group of data.

Example 3

The marks scored of boys and girls in a class were recorded by their mathematics teacher. The tables below show the mark scores of the students.

Boys:

60	41	40	69	62
80	51	76	64	66
55	42	69	52	38
87	61	89	35	45

Girls:

43	73	34	63	73
86	88	75	38	64
64	59	83	44	58
67	67	39	52	37
71	64	54	51	62

Solution

Construct a back-to-back stem-and-leaf plot for the data.

From the given data, there are 45 students in the class: 20 boys and 25 girls.

the minimum mark score = 34 marks

the maximum mark score = 89 marks

Draw a vertical line and place the stems, the leaves are on the left and the right of the stems. The first stem is 30.

The back-to-back stem-and-leaf below shows the marks obtained by the students of a class.

Boys (Leaf)	Stem	Girls (Leaf)
5, 8	3	4, 9, 8, 7
1, 2, 0, 5	4	3, 4
5, 1, 2	5	9, 4, 2, 1, 8,
0, 1, 9, 9, 4, 2, 6	6	4, 7, 7, 4, 3, 4, 2
6	7	1, 3, 5, 3
0, 7, 9	8	6, 8, 3

We shall rearrange the data to get an **ordered refined back- to- back stem-and-leaf plot** as follows.

Boys (Leaf)	Stem	Girls (Leaf)
8, 5	3	4, 7, 8, 9
5, 2, 1, 0	4	3, 4
5, 2, 1	5	1, 2, 4, 8, 9
9, 9, 6, 4, 2, 1, 0	6	2, 3, 4, 4, 4, 7, 7
6	7	1, 3, 3, 5
9, 7, 0	8	3, 6, 8

Example 4

The following is a record of times in minutes. Miss Linda and Mr. John used their mobile phone per day for the past 20 days.

Mr. John (Leaf)	Stem	Miss Linda (Leaf)
5, 0	1	2
5	2	5
5, 7, 2, 3, 1, 0, 0, 2, 2	3	4
1	4	6
5	5	7, 8
5	6	3, 3
0	7	0, 9
4, 2, 1	8	9, 8, 9, 3, 3, 1, 1, 4
9	9	1, 7

- Who used the mobile phone for the longest time in a day?
- Who used the mobile phone for the shortest time in a day?
- How would you judge which person used his / her mobile phone more frequently than the other?

Solution

We shall rearrange the data to get an **ordered refined back- to- back stem-and-leaf plot** as follows.

Mr. John (Leaf)	Stem	Miss Linda (Leaf)
5, 0	1	2
5	2	5
7, 5, 3, 2, 2, 2, 1, 0, 0	3	4
1	4	6
5	5	7, 8
5	6	3, 3
0	7	0, 9
4, 2, 1	8	1, 1, 3, 3, 4, 8, 9, 9
9	9	1, 7

- a) Who used the mobile phone for the longest time in a day?

Mr. John



- b) Who used the mobile phone for the shortest time in a day?

Mr. John



- c) How would you judge which person used his / her mobile phone more frequently than the other?

Miss Linda. She used mobile phone more than 80 min/day for 10 days while Mr. John used his mobile phone more than 80 min/day for only 4 days.



Exercise

- 1.** The number of minute a salesman had to spend on each of his clients is as follows:

40 50 42 40 41 54 47 55 30 45
 21 70 60 31 45 50 54 50 30 35
 30 19 50 52 29 25 60 60 34 47
 50 45 60 55 30 35 40 48 43 56
 70 58 50 65 32 41 48 40 55 53
 51 66 65 85 49 75 45 52 40 42
 47 66 58 20 48 37 69 55 65 53
 49 46 40 51 55 73 20 50 75 52

Construct a stem-and-leaf plot of these data.

- 2.** The following data are the systolic blood pressures of thirty patients:

160 129 183 150 189 154
 121 158 148 153 160 162
 131 145 161 149 123 151
 165 135 159 199 185 198
 173 139 151 198 180 170

Construct a stem-and-leaf plot of these data with one-digit leaves.

3. A box of raisin is supposed to include 200 raisins in each box. The company selected the boxes of raisins at random to observe for the quality control. A sample of 50 boxes produced yesterday showed the following number of raisins in each box. Construct a stem-and-leaf plot from the data. Summarize your conclusion.

201	196	195	206	198	205	195	201
193	199	194	204	203	201	203	203
198	203	200	199	202	200	202	200
199	202	198	191	199	198	204	199
200	201	203	197	200	197	198	202

4. Many airline passengers carry hand luggage. Below is a stem-and-leaf plot for the mass (in kg) of hand luggage of a group of passengers returning from a vacation.

hand luggage (in kg.)	
4	1
5	5, 6
6	9, 4, 3, 6, 6, 7
7	4, 3, 2, 1, 0, 0, 2, 2, 0
8	5, 3, 4, 3, 2, 1, 1

Remark:

4	1	Represent	4.1 kg
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- a) How many passengers were observed?
 b) If the lightest hand luggage was 4.1 kg, what was the heaviest hand luggage?
 c) Find the percentage of customers which carried the hand luggage more than 7.0 kg.
5. The students were assigned to collect data about the time which elapsed between one taxi and the next that passed the point where they stationed. The data which they obtained are given below.

	Time in seconds							
Taxis without passengers	60,	71,	62,	50,	86,	86,	87,	82,
	91,	83,	81,	82,	83,	87,	81,	85,
	83,	82,	87					
Taxis with passengers	49,	35,	38,	27,	18,	41,	23,	93,
	26,	15,	23,	77,	64,	15,	48,	57,
	34,	67,	35,	72,	81,	73,	62,	83,

Construct a back to back stem-and- leaf plot from the data collected by the students.