Frequency tables

The frequency of a particular data value is the number of times the data value occurs.

The frequency of a data value is denoted by f.

Ex. If 4 students have a score of 90 in mathematics, then the score of 90 is said to have a frequency of 4.

A frequency table is constructed by arranging collected values in some order with their corresponding frequencies.

Frequency table of discrete data

(i.e. without classes)

We find the different categories of the data, partition the dataset by these categories, and find the frequency of each category.

Ex. Consider the following data about blood types:

A, B, AB, A, B, O, A, B, AB, AB, O, A, B, AB, A, O, B, B, A, A, A, O, A, A, A, AB.

Present this information in a frequency table.

Sol

Class	f
A	12 ← the most frequent one.
B	7
AB	5
O	4 ← the least frequent one.
Sum	24

Stem-and-leaf ← (can be skipped).

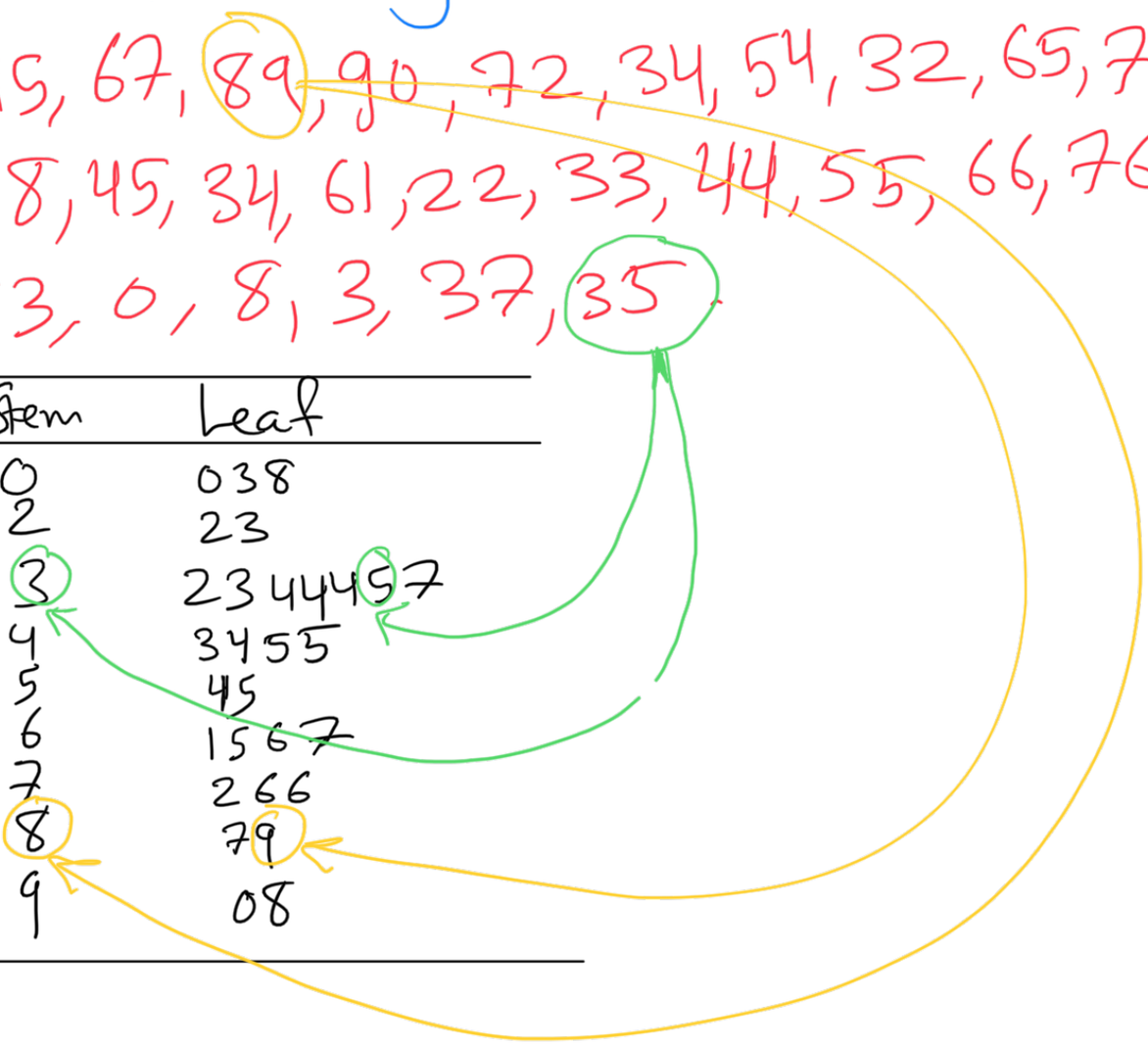
A table where each data value is split into a stem (the first digit or digits) and a leaf (usually the last digit).

Ex. Present a stem-and-leaf table of the following data

23, 45, 67, 89, 90, 72, 34, 54, 32, 65, 76,
87, 98, 45, 34, 61, 22, 33, 44, 55, 66, 76,
34, 43, 0, 8, 3, 37, 35

Sol.

Stem	Leaf
0	038
2	23
3	23444557
4	3455
5	45
6	1567
7	266
8	79
9	08



Remark: The above procedure can be generalized for data of more than two digits.

Ex. Represent the following data in a stem-and-Leaf table.

234, 457, 236, 237, 345, 456, 234, 325, 678, 323, 454, 455, 344, 126, 125, 234.

Sol.

Stem	Leaf
12	56
23	4446
32	*
34	*
45	*
67	*

Exc.

i.e. with classes (grouped data)

Frequency table of continuous data

When the set of data values are spread out, it is difficult to set up a frequency table for every data value as there will be too many rows in the table. So we group the data into class intervals (or groups).

We construct a frequency table of equal class length of continuous data recorded to the nearest natural number.

- We select number of classes

$$k = \lceil \sqrt{n} \rceil$$

($\lceil \cdot \rceil$ is the ceiling)

- We find range of data

R = max. of the data − min. of the data.

- We find the class length

$$l = \lceil R/k \rceil .$$

Ex.(*) Consider the following data

34, 56, 45, 34, 23, 12, 23, 34, 55, 66, 77, 88, 99, 45, 90, 56, 65, 78, 87, 98, 89, 23, 12, 21, 32, 35, 48.

Construct a freq. table of this data in 4 classes of equal length.

Sol. $k = 4$, R = max − min = 99 − 12 = 87.

$$l = \lceil 87/4 \rceil = 22.$$

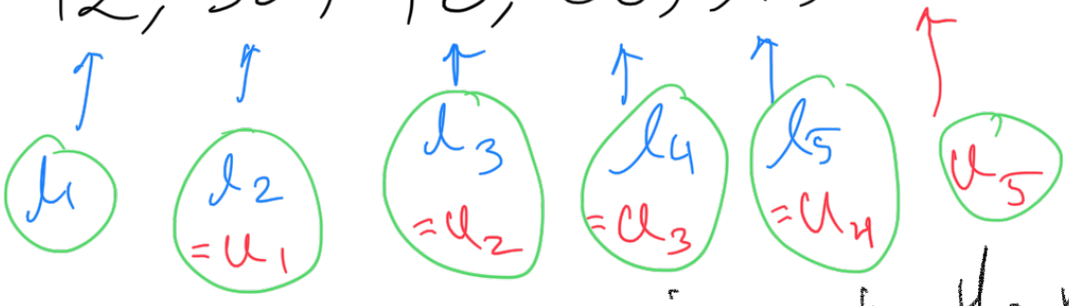
Class	Freq. f
12 − 33	7
34 − 55	8
56 − 77	5
78 − 99	7
Sum	27

Remark: We may construct a freq. table with unequal lengths.

Ex. Consider the data in Example (*). Construct a freq. table with unequal lengths with the following cut points of classes

$$12, 38, 46, 66, 91, 99.$$

Sol.



Since observations are given to the nearest integer, the j^{th} class with be limitted by $l_j - 0.5$ (for $j = 1, 2, \ldots K$) and $u_k + 0.5$.

Also called actual limits

Actual Class	Freq.
11.5 – 37.5	11
37.5 – 45.5	2
45.5 – 65.5	5
65.5 – 90.5	7
90.5 – 99.5	2
Sum	27

Relative Frequency of a Continuous Data

A relative freq. (r.f.) is the fraction of times a data value occurs.

To find the relative freq., divide the freq. by the total number of data values (the sum of frequencies n).

Ex. Based on the data set in Example (*), summerize the data in a relative freq. table.

Sol. Note that $n = 27$.

$$k = \lceil \sqrt{27} \rceil = 6.$$

$$\ell = \left\lceil \frac{99-12}{6} \right\rceil = 15.$$

Class	f	r.f.	C.f.
12-26	6	6/27 = 0.222	6
27-41	5	5/27 = 0.185	6+5 = 11
42-56	6	0.222	11+6 = 17
57-71	2	0.074	17+2 = 19
72-86	2	0.074	21
87-101	6	0.222	27
Sum	27		

Cummulative frequency of continuous data

To find the cummulative frequency (c.f.), add all of the previous frequencies to the frequency for the current row.

Organizing grouped data: Re-visiting.

Recall that:

$$* \text{Class length} = \left\lceil \frac{\text{maximum observation} - \text{minimum observation}}{\text{number of classes}} \right\rceil$$

Ex. Assume that max. observ. = 99
min. observ. = 12
No. of classes = 6

Find the class length.

Sol. Class length $= \left\lceil \frac{99-12}{6} \right\rceil = \lceil 14.5 \rceil = 15.$

* Class length of the class (l, u) is

$$u - l + \text{accuracy unit}$$

- For the data

1, 2, 9, 14, 25, ... accuracy unit is 1

1.2, 3.4, 10.9, ... accuracy unit is 0.1

1.44, 5.06, 70.09, ... accuracy unit is 0.01.

In general,

Number	accuracy unit
*	1
*.d_1	0.1
*.d_1d_2	0.01
*.$d_1d_2d_3$	0.001

Ex. Find the class length of the class 6.1 – 12.6.

Sol. Class length = 12.6 – 6.1 + 0.1 = 6.6.

Ex. The class length of the class 12–33 is 33 – 12 + 1 = 22.

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* The midpoint of the class $l - u$ is

$$\frac{u + l}{2}.$$

Ex. The midpoint of the

Class 6.1 – 12.6 is $\frac{12.6+6.1}{2} = 9.35$.

Class 12 – 33 is $\frac{33+12}{2} = 22.5$.

Searching keywords:

- Frequency tables.
- Relative frequency, cumulative frequency.
- Stem-and-leaf.
- The University of Jordan الجامعة الأردنية
- Principles of Statistics مبادئ الإحصاء
- Baha Alzalg بهاء الزالق

References: See the course website

http://sites.ju.edu.jo/sites/Alzalg/Pages/131.aspx

For any comments or concerns, please use my email to contact me.

د. بهاء محمود الزالق
The University of Jordan
Dr. Baha Alzalg
baha2math@gmail.com