

Frequency tables

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What is a frequency table?

- A frequency table is just another way of grouping data to make it easier to visualize what your data really looks like.

Steps to create a frequency table

1. Decide how many classes you want to have.
2. Find the class width and round the number (most of the time you round this number up)
3. Find the lowest data value in the data set, this will be the lowest class limit
4. Add the class width to the lowest class limit (from step 3). This is the second class' lower limit.
5. Repeat step 4 until you exceed the highest value in the data set.
6. Find the upper class limits, add one minus the class width to each lower limit.
7. Fill out the class section of the frequency distribution in the table below.
8. Find the class frequencies (number of values that fall within each class).

Example

- I want to find out how much time students spend at the tutoring center. So I sampled 30 students and found that students spent the following length of time (in minutes) in the tutoring center:

12, 14, 120, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 120, 30, 50, 39, 24, 110, 32, 20, 25

Example

- First
 - Decide how many classes you want to have.
 - I like the number 7 ...So I'll use 7 classes

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Second step: Find the class width

The largest number is 110 and the smallest number is 10 so the range is 100.

$$\text{Range} = \text{largest value} - \text{smallest value} = 110 - 10 = 100$$

The class width is the range (100) divided by the number of classes from step one (7).

$$\text{Class width} = \text{range}/\text{number of classes} = 100/7 = 14.29$$

Since the class width is always rounded up to a whole number the class width 14.29 is rounded to 15

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Class limits

Find the lowest value in the dataset. This will be the lowest class limit. Thus, 10 is the lowest class limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		

Class limits

Add the class width (**15** from the second step) to the lowest class limit (10 from step three).

Lowest limit + class width = $10+15=25$

This is the second class' lower limit.

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		
25		

Class limits

Repeat step 4 until you exceed the highest value in the data set

$$\text{Lower limit} + \text{class width} = 25 + 15 = 40$$

This is the third class' lower limit.

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		
25		
40		

Class limits

Repeat step 4 until you exceed the highest value in the data set

$$\text{Lower limit} + \text{class width} = 40 + 15 = 55$$

This is the fourth class' lower limit.

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		
25		
40		
55		

Class limits

Repeat step 4 until you exceed the highest value in the data set

$$\text{Lower limit} + \text{class width} = 55 + 15 = 70$$

This is the fifth class' lower limit.

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		
25		
40		
55		
70		

Class limits

Repeat step 4 until you exceed the highest value in the data set

$$\text{Lower limit} + \text{class width} = 70 + 15 = 85$$

This is the sixth class' lower limit.

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		
25		
40		
55		
70		
85		

Class limits

Repeat step 4 until you exceed the highest value in the data set

$$\text{Lower limit} + \text{class width} = 85 + 15 = 100$$

This is the seventh class' lower limit.

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		
25		
40		
55		
70		
85		
100		

Class limits

Repeat step 4 until you exceed the highest value in the data set

$$\text{Lower limit} + \text{class width} = 100 + 15 = 115$$

This exceeds the highest value in the data set.

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10		
25		
40		
55		
70		
85		
100		

Class limits

To find the upper class limits
add one minus the class
width to each lower limit.

$$\text{Lower limit} + \text{class width} - 1 \\ = 10 + 15 - 1 = 24$$

This is the first upper class
limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10	24	
25		
40		
55		
70		
85		
100		

Class limits

To find the upper class limits
add one minus the class
width to each lower limit.

$$\text{Lower limit} + \text{class width} - 1 \\ = 25 + 15 - 1 = 39$$

This is the second upper class
limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10	24	
25	39	
40		
55		
70		
85		
100		

Class limits

To find the upper class limits
add one minus the class
width to each lower limit.

$$\text{Lower limit} + \text{class width} - 1 \\ = 40 + 15 - 1 = 54$$

This is the third upper class
limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10	24	
25	39	
40	54	
55		
70		
85		
100		

Class limits

To find the upper class limits
add one minus the class
width to each lower limit.

$$\text{Lower limit} + \text{class width} - 1 \\ = 55 + 15 - 1 = 69$$

This is the third upper class
limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10	24	
25	39	
40	54	
55	69	
70		
85		
100		

Class limits

To find the upper class limits
add one minus the class
width to each lower limit.

$$\text{Lower limit} + \text{class width} - 1 \\ = 70 + 15 - 1 = 84$$

This is the fourth upper class
limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10	24	
25	39	
40	54	
55	69	
70	84	
85		
100		

Class limits

To find the upper class limits
add one minus the class
width to each lower limit.

$$\text{Lower limit} + \text{class width} - 1 \\ = 85 + 15 - 1 = 99$$

This is the fourth upper class
limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10	24	
25	39	
40	54	
55	69	
70	84	
85	99	
100		

Class limits

To find the upper class limits
add one minus the class
width to each lower limit.

$$\text{Lower limit} + \text{class width} - 1 \\ = 100 + 15 - 1 = 114$$

This is the fourth upper class
limit

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

Lower class limits	Upper class limits	Frequency
10	24	
25	39	
40	54	
55	69	
70	84	
85	99	
100	114	

Class Midpoints

Lower class limits	Upper class limits	Midpoints
10	24	
25	39	
40	54	
55	69	
70	84	
85	99	
100	114	

Frequencies

To find the frequencies simply count the number of values that fall between the class limits

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

6 values fall between 10 and 24

7 values fall between 25 and 39

3 values fall between 40 and 54

4 values fall between 55 and 69

3 values fall between 70 and 84

3 values fall between 85 and 99

4 values fall between 100 and 114

Lower class limits	Upper class limits	Frequency
10	24	6
25	39	7
40	54	3
55	69	4
70	84	3
85	99	3
100	114	4

Relative Frequencies

To find the relative frequencies simply divide the individual frequencies by the sample size (the total number of data points)

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

$6/30 = .20$ values fall between 10 and 24

$7/30 = .23$ values fall between 25 and 39

$3/30 = .10$ values fall between 40 and 54

$4/30 = .13$ values fall between 55 and 69

$3/30 = .10$ values fall between 70 and 84

$3/30 = .10$ values fall between 85 and 99

$4/30 = .13$ values fall between 100 and 114

Lower class limits	Upper class limits	Frequency	Relative Frequency
10	24	6	.20
25	39	7	.23
40	54	3	.10
55	69	4	.13
70	84	3	.10
85	99	3	.10
100	114	4	.13

Cumulative Frequencies

To find the cumulative frequencies simply count the number of values that fall below the upper class limits

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

6 values fall below 24

$6 + 7 = 13$ values fall below 39

$6 + 7 + 3 = 16$ values fall below 54

$6 + 7 + 3 + 4 = 20$ values fall below 69

$6 + 7 + 3 + 4 + 3 = 23$ values fall below 84

$6 + 7 + 3 + 4 + 3 + 3 = 26$ values fall below 99

$6 + 7 + 3 + 4 + 3 + 3 + 4 = 30$ values fall below 114

Lower class limits	Upper class limits	Frequency	Cumulative frequency
10	24	6	6
25	39	7	13
40	54	3	16
55	69	4	20
70	84	3	23
85	99	3	26
100	114	4	30

Cumulative Frequencies

To find the cumulative frequencies simply count the number of values that fall below the upper class limits

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

6 values fall below 24

$6 + 7 = 13$ values fall below 39

$6 + 7 + 3 = 16$ values fall below 54

$6 + 7 + 3 + 4 = 20$ values fall below 69

$6 + 7 + 3 + 4 + 3 = 23$ values fall below 84

$6 + 7 + 3 + 4 + 3 + 3 = 26$ values fall below 99

$6 + 7 + 3 + 4 + 3 + 3 + 4 = 30$ values fall below 114

Lower class limits	Upper class limits	Frequency	Cumulative frequency
10	24	6	6
25	39	7	13
40	54	3	16
55	69	4	20
70	84	3	23
85	99	3	26
100	114	4	30

Cumulative Relative Frequencies

To find the cumulative relative frequencies simply divide each cumulative frequency by the sample size (the 30 times people came for tutoring).

Data set:

10, 14, 110, 30, 62, 26, 100, 90, 73, 45,
39, 74, 18, 45, 23, 69, 84, 92, 64, 60,
94, 100, 30, 50, 39, 24, 110, 32, 20, 25

6 values fall below 24
 $6 + 7 = 13$ values fall below 39
 $6 + 7 + 3 = 16$ values fall below 54
 $6 + 7 + 3 + 4 = 20$ values fall below 69
 $6 + 7 + 3 + 4 + 3 = 23$ values fall below 84
 $6 + 7 + 3 + 4 + 3 + 3 = 26$ values fall below 99
 $6 + 7 + 3 + 4 + 3 + 3 + 4 = 30$ values fall below 114

Lower class limits	Upper class limits	Cumulative frequency	Cumulative frequency
10	24	6	$6/30 = .20$
25	39	13	$13/30 = .43$
40	54	16	$16/30 = .53$
55	69	20	$20/30 = .67$
70	84	23	$23/30 = .77$
85	99	26	$26/30 = .87$
100	114	30	$30/30 = 1.00$

Midpoints of classes

To find the class midpoints
average the upper and lower
point for each class

Formula:

$$(\text{Lower limit} + \text{upper limit})/2$$

$$(10 + 24)/2 = 17$$

$$(25 + 39)/2 = 32$$

$$(40 + 54)/2 = 47$$

$$(55 + 69)/2 = 62$$

$$(70 + 84)/2 = 77$$

$$(85 + 99)/2 = 92$$

$$(100 + 114)/2 = 107$$

Lower class limits	Upper class limits	Midpoints
10	24	17
25	39	32
40	54	47
55	69	62
70	84	77
85	99	92
100	114	107

Class Boundaries

To find the class boundaries average the upper and lower consecutive points for each class.

Formula for upper & lower boundaries:
 $(\text{Lower limit} + \text{upper limit})/2$

$$(24 + 25)/2 = 24.5$$

$$(39 + 40)/2 = 39.5$$

$$(54 + 55)/2 = 54.5$$

$$(69 + 70)/2 = 69.5$$

$$(84 + 85)/2 = 84.5$$

$$(99 + 100)/2 = 99.5$$

Note: for the lowest and highest boundaries you'd act as if you were creating another class below & above the classes you currently have

$$\text{Lowest class boundary} : (9+10)/2 = 9.5$$

$$\text{Highest class boundary} (114+ 115)/2 = 114.5$$

Lower class limits	Upper class limits	Lower class boundary	Upper class boundary
10	24	9.5	24.5
25	39	24.5	39.5
40	54	39.5	54.5
55	69	54.5	69.5
70	84	69.5	84.5
85	99	84.5	99.5
100	114	99.5	114.5