

Frequency Distributions

Colby Community College

Definition

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Example 1

The table contains drive-through service times, in seconds, for McDonald's.

107	139	197	209	281	254	163	150	127	308	206	187
169	83	127	133	140	143	130	144	91	113	153	255
252	200	117	167	148	184	123	153	155	154	100	117
101	138	186	196	146	90	144	119	135	151	197	171

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252	200	117	167	148	184	123	153	155	154	100	117
101	138	186	196	146	90	144	119	135	151	197	171

A frequency table for this data is

Time	Frequency	Time	Frequency
75-124	11	225-274	3
125-174	23	275-324	2
175-224	9		

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Class midpoints are the values in the middle of the classes.

Definition

Class width is the difference between two consecutive lower class limits (or two consecutive lower class bounds) in a frequency distribution.

Example 2

Recall the frequency table for McDonalds.

Time	Frequency	Time	Frequency
75-124	11	225-274	3
125-174	23	275-324	2
175-224	9		

What are the lower class limits?

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What are the lower class limits?

75, 125, 175, 225, 275

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What are the upper class limits?

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What are the lower class limits?

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What are the upper class limits?

124, 174, 224, 274, 324

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124, 174, 224, 274, 324

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What are the lower class limits?

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What are the upper class limits?

124, 174, 224, 274, 324

What are the class boundaries?

74.5, 124.5, 174.5, 224.5, 274.5, 324.5

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124, 174, 224, 274, 324

What are the class boundaries?

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99.5, 149.5, 199.5, 249.5, 299.5

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99.5, 149.5, 199.5, 249.5, 299.5

What is the class width?

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What are the class midpoints?

99.5, 149.5, 199.5, 249.5, 299.5

What is the class width?

50

Example 3

The table lists data for the highest seven sources of injuries resulting in a visit to a hospital emergency room visit in a recent year. (Based on CDC data.)

Activity	Frequency
Bicycling	26,212
Football	25,376
Playground	16,706
Basketball	13,987
Soccer	10,436
Baseball	9,634
All-terrain vehicle	6,337

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Notice that the activity names are categorical data at the nominal level of measurement, but we can still create a frequency distribution.

It should also be noted that just because “bicycling” is at the top of the table, doesn’t mean it is the most dangerous. Many more people ride bicycles in a day than play football.

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A **relative frequency distribution** is a variation of the basic frequency distribution in which each class frequency is replaced by a relative frequency.

$$\text{Relative frequency for a class} = \frac{\text{frequency for a class}}{\text{sum of all frequencies}}$$

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Example 4

Let us look at the relative frequency for the McDonald's data.

Time	Frequency	Relative Frequency
75-124	11	23%
125-174	23	48%
175-224	9	19%
225-274	3	6%
275-324	2	4%

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175-224	9	19%
225-274	3	6%
275-324	2	4%

Note

The sum of the percentages must be 100% or very close to 100%.

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A **cumulative frequency distribution** is a variation of the basic frequency distribution in which each class frequency is replaced by the sum of frequencies for that class and all previous.

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Example 5

Time	Cumulative Frequency
Less Than 125	11
Less Than 175	35
Less Than 225	45
Less Than 275	48
Less Than 325	50

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Data have an approximately normal distributions when

- The frequencies start low, then increase to one or two high frequencies, and then the decrease to a low frequency.
- The frequency distribution is approximately symmetric.

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Example 6

Time	Frequency	
75-124	2	Frequencies start low
125-174	8	
175-224	30	Increase to maximum
225-274	8	
275-324	2	Frequencies become low again

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- The frequency distribution is approximately symmetric.

Example 6

Time	Frequency	
75-124	2	Frequencies start low
125-174	8	
175-224	30	Increase to maximum
225-274	8	
275-324	2	Frequencies become low again

Note

Real data are never this perfect, so some discretion is needed to judge if the distribution is “close enough” to satisfying these two conditions.

Gaps

The presence of gaps can suggest that the data are from two or more different populations.

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Example 7

The table contains a frequency distribution of the weights, in grams, of randomly selected pennies.

Weight (grams)	Frequency
2.40-2.49	18
2.50-2.59	19
2.60-2.69	0
2.70-2.79	0
2.80-2.89	0
2.90-2.99	2
3.00-3.09	25
3.10-3.19	8

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Example 7

The table contains a frequency distribution of the weights, in grams, of randomly selected pennies.

Examination reveals a large gap between the lightest pennies and the heaviest pennies.

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2.40-2.49	18
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This difference is explained by:

- Pennies made before 1983 are 95% copper and 5% zinc.
- Pennies made after 1983 are 2.5% copper and 97.5% zinc.

(Zinc is less dense than copper.)

Weight (grams)	Frequency
2.40-2.49	18
2.50-2.59	19
2.60-2.69	0
2.70-2.79	0
2.80-2.89	0
2.90-2.99	2
3.00-3.09	25
3.10-3.19	8

Example 8

Let us compare the service times for McDonald's and Dunkin' Donuts.

Time	McDonald's	Dunkin' Donuts
25-74		22%
75-124	23%	44%
125-174	48%	28%
175-224	19%	6%
225-274	6%	
275-324	4%	

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Time	McDonald's	Dunkin' Donuts
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225-274	6%	
275-324	4%	

We might expect that the difference in menus would lead to very different service times. There are differences, but not a large as you might expect.