

## 2.5.5: Cumulative Frequency and Relative Frequency

The cumulative frequency of a class interval is the count of all data values less than the right endpoint. The cumulative relative frequency of a class interval is the cumulative frequency divided by the sample size.

### Definition: Cumulative Relative Frequency

**n** = **sample size** - The number of observations in your sample size.

**Cumulative Frequency** - the number of times a particular value is observed in a class interval or in any lower class interval.

**Cumulative Relative Frequency** - The proportion or percentage of times a particular value is observed in a class interval or in any lower class interval.

$$\text{Cumulative Relative Frequency} = \text{Cumulative Frequency} / n$$

### Example: Students browsing the web

Let's again return to the data that represents how much time 30 students spent on a web browser in a 24 hour period. Data is rounded to the nearest minute. Earlier we had made a frequency distribution and so we will now add columns for cumulative frequency and cumulative relative frequency.

Class Interval	Frequency	Relative Frequency	Cumulative Frequency	Cumulative Relative Frequency
67 to 79	3	0.100 or 10.0%	3	0.100 or 10.0%
79 to 91	5	0.167 or 16.7%	8	0.267 or 26.7%
91 to 103	8	0.266 or 26.6%	16	0.533 or 53.3%
103 to 115	9	0.300 or 30.0%	25	0.833 or 83.3%
115 to 127	5	0.167 or 16.7%	30	1.000 or 100%
<b>Total</b>	<b>30</b>	<b>1.000 or 100%</b>		

Note that the last class interval will always have a cumulative relative frequency of 100% of the data.

Some possible ways to interpret cumulative relative frequency: 83.3% of the students are on the internet less than 115 minutes.

The middle value (median) of the data occurs in the interval 91 to 103 minutes since 53.3% of the students are on the internet less than 103 minutes.

### Example: Comparing weights of apples and oranges

The tally feature of Minitab can also be used to find cumulative relative frequencies (called cumulative counts and percentages here):

class interval	Apples Count	Apples Percent	Apples CumCnt	Apples CumPct	Oranges Count	Oranges Percent	Oranges CumCnt	Oranges CumPct
100 to 130	1	1.00	1	1.00	1	1.00	1	1.00
130 to 160	3	3.00	4	4.00	0	0.00	1	1.00
160 to 190	9	9.00	13	13.00	6	6.00	7	7.00
190 to 220	15	15.00	28	28.00	10	10.00	17	17.00
220 to 250	23	23.00	51	51.00	14	14.00	31	31.00
250 to 280	18	18.00	69	69.00	18	18.00	49	49.00
280 to 310	16	16.00	85	85.00	19	19.00	68	68.00
310 to 340	11	11.00	96	96.00	9	9.00	77	77.00
340 to 370	3	3.00	99	99.00	13	13.00	90	90.00
370 to 400	0	0.00	99	99.00	4	4.00	94	94.00
400 to 430	0	0.00	99	99.00	4	4.00	98	98.00
430 to 460	1	1.00	100	100.00	2	2.00	100	100.00
<b>Totals</b>	<b>100</b>	<b>100.00</b>			<b>100</b>	<b>100.00</b>		

Cumulative relative frequency can also be used to find percentiles of quantitative data. A **percentile** is the value of the data below which a given percentage of the data fall.

In our example 280 grams would represent the 69th percentile for apples since 69% of apples have weights lower than 280 grams. The 68th percentile for oranges would be 310 grams since 68% of oranges weigh less than 310 grams.

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