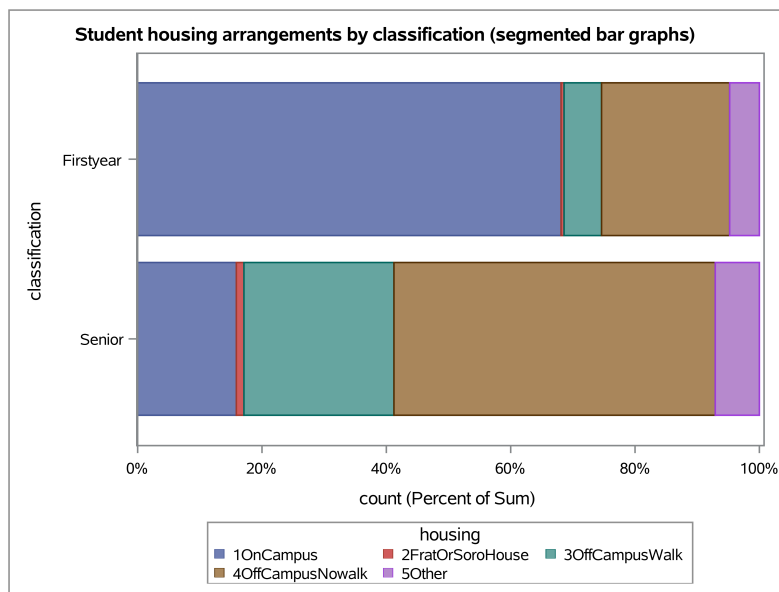
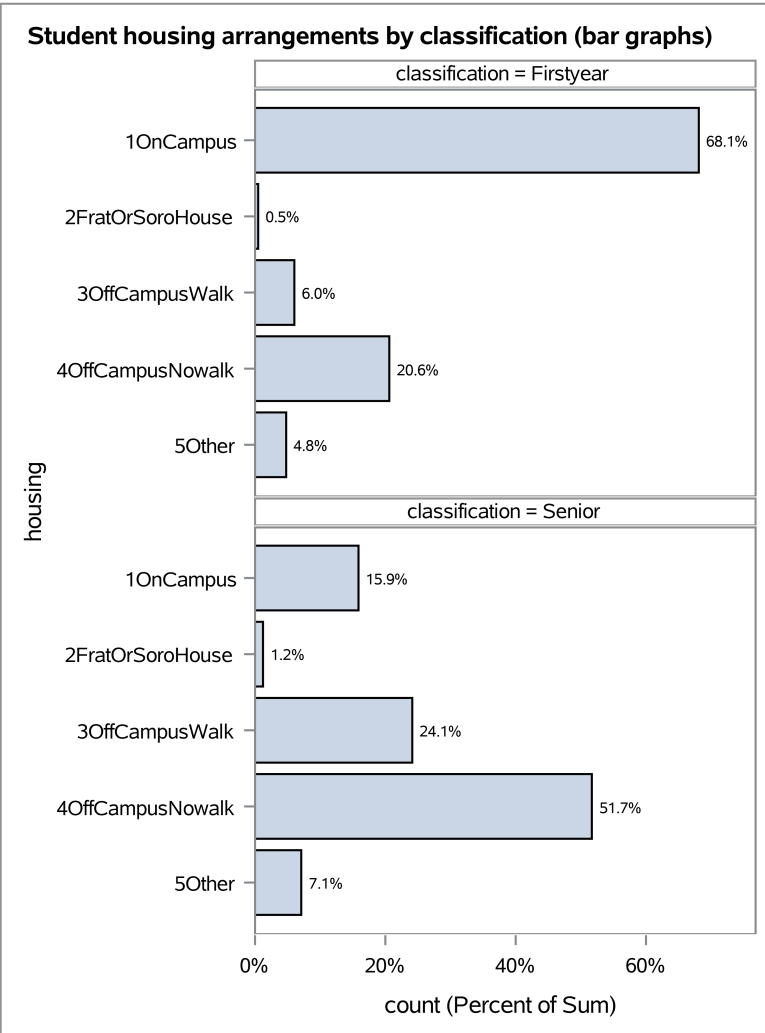


Example. Living arrangements of college students. One of the questions on the 2017 National Survey of Student Engagement is: Which of the following best describes where you are living while attending college?

- i) Residence hall, dormitory, or other campus housing (not fraternity or sorority house)
- ii) Fraternity or sorority house
- iii) Residence (house, apartment, etc.) within walking distance to the institution
- iv) Residence (house, apartment, etc.) farther than walking distance to the institution
- v) None of the above

response	first-year students		seniors	
	count	percent	count	percent
i) On campus housing	86318	68.1	26888	15.9
ii) Fraternity or sorority house	610	.5	2067	1.2
iii) Off campus – within walking	7647	6.0	40866	24.1
iv) Off campus – beyond walking	26115	20.6	87535	51.7
v) None of the above	6055	4.8	12012	7.1
Total	126745	100	169368	100

Note: Through its student survey, The College Student Report, the National Survey of Student Engagement (NSSE) annually collects information at hundreds of four-year colleges and universities about first-year and senior students' participation in programs and activities that institutions provide for their learning and personal development. The results provide an estimate of how undergraduates spend their time and what they gain from attending college. In 2017, 725 colleges and universities participated and 517,850 students completed the survey.

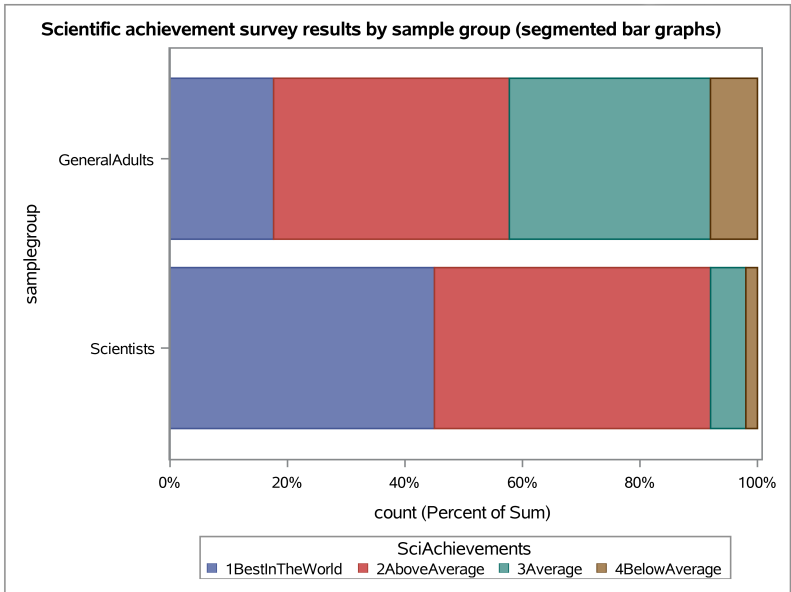
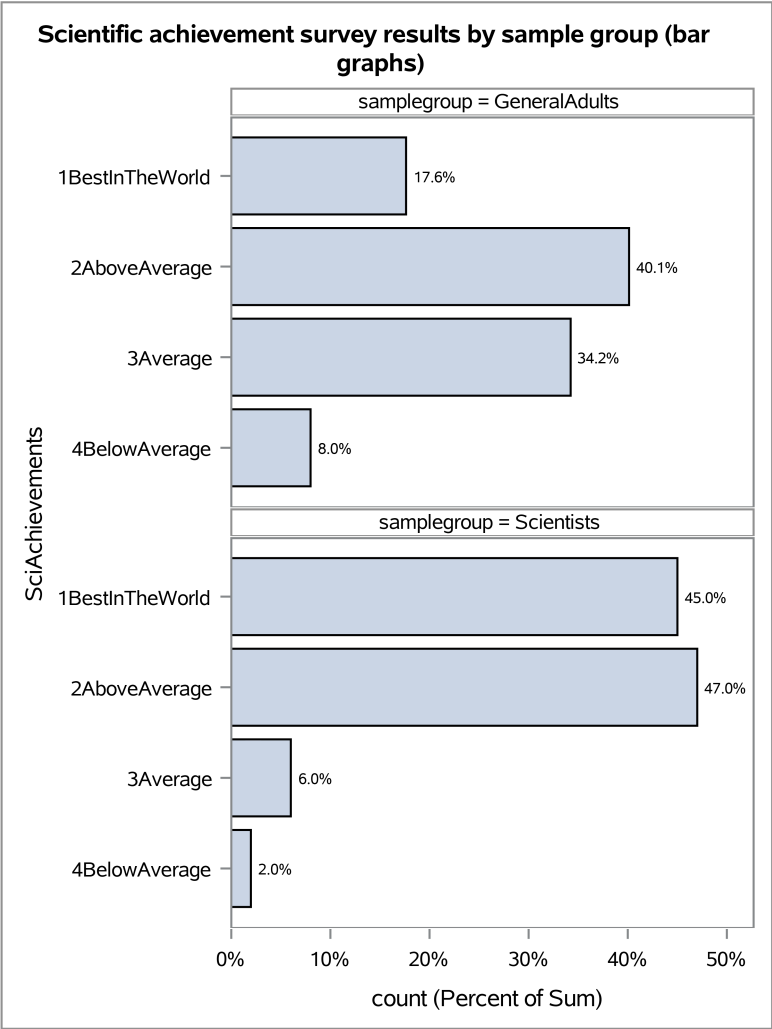


Example. Opinions regarding United States scientific achievements. The data which follow come from a Pew Research Center general public science survey conducted August 15–25, 2014 and an AAAS survey of scientists conducted September 11 – October 13, 2014. The question considered here is:

Do you think the U.S. is the best in the world, above average, average, or below average in its scientific achievements compared to other industrialized countries?

response	U.S. Adults		AAAS Scientists	
	count	percent	count	percent
Best in the world	344	18	1687	45
Above average	783	40	1762	47
Average	668	34	225	6
Below average	156	8	74	2
Total	1951	100	3748	100

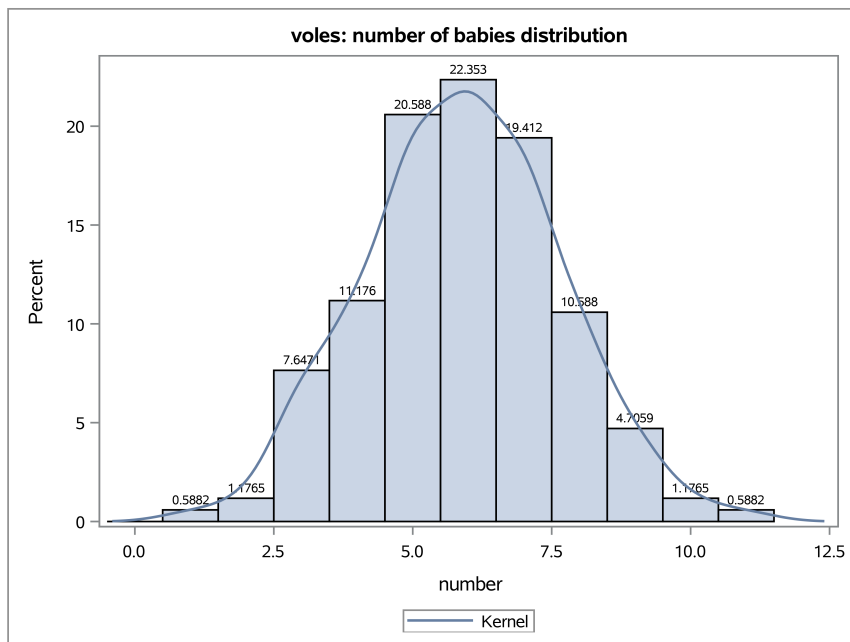
Note: The Pew Research Center is a nonpartisan fact tank that informs the public about the issues, attitudes and trends shaping the world. It conducts public opinion polling, demographic research, media content analysis and other empirical social science research. Pew Research Center does not take policy positions. It is a subsidiary of The Pew Charitable Trusts. The American Association for the Advancement of Science (AAAS) is the world's largest multidisciplinary scientific professional society. Established in 1848, the AAAS publishes Science magazine, one of the most widely circulated peer-reviewed scientific journals in the world. It is an open-member organization that brings together a wide segment of the scientific community.



Example. Vole reproduction. An investigation was conducted to study reproduction in laboratory colonies of voles. This example is taken from Devore and Peck, *Statistics*, (1997), 33; the original reference is the article “Reproduction in laboratory colonies of voles”, *Oikos*, (1983), 184. The data summarized in Table 4 are the numbers of babies in 170 litters born to voles in a particular laboratory.

Table 4. Vole baby frequency distribution.

number of babies	frequency
1	1
2	2
3	13
4	19
5	35
6	38
7	33
8	18
9	8
10	2
11	1
total	170



vole example number of babies in a litter

The FREQ Procedure

number	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	1	0.59	1	0.59
2	2	1.18	3	1.76
3	13	7.65	16	9.41
4	19	11.18	35	20.59
5	35	20.59	70	41.18
6	38	22.35	108	63.53
7	33	19.41	141	82.94
8	18	10.59	159	93.53
9	8	4.71	167	98.24
10	2	1.18	169	99.41
11	1	0.59	170	100.00

vole example number of babies in a litter

The MEANS Procedure

Analysis Variable : number									
N	Minimum	Lower Quartile	Median	Upper Quartile	Maximum	Range	Quartile Range	Mean	Std Dev
170	1.0000	5.0000	6.0000	7.0000	11.0000	10.0000	2.0000	5.8882	1.7488

Analysis Variable : number												
1st Pctl	5th Pctl	10th Pctl	20th Pctl	30th Pctl	40th Pctl	50th Pctl	60th Pctl	70th Pctl	80th Pctl	90th Pctl	95th Pctl	99th Pctl
2.0000	3.0000	4.0000	4.0000	5.0000	5.0000	6.0000	6.0000	7.0000	7.0000	8.0000	9.0000	10.0000

Example. Homophone confusion and Alzheimer’s disease. A study was conducted to investigate the relationship between Alzheimer’s disease and homophone spelling confusion. A homophone pair is a pair of words with the same pronunciation having different meanings and spellings. Twenty patients with Alzheimer’s disease were asked to spell 24 homophone pairs (given in random order) and the number of homophone confusions, *e.g.* spelling *doe* given the context *bake bread dough*, was recorded for each patient. One year later, the same patients were again asked to spell the same 24 homophone pairs and the number of homophone confusions was again recorded. The data given in Table 6 are the numbers of homophone confusions at the two times of measurement for the 20 Alzheimer’s patients. This example comes from Neils, J., D.P. Roeltgen, and F. Constantinidou, “Decline in homophone spelling associated with loss of semantic influence on spelling in Alzheimer’s disease”, *Brain and Language*, **49**, (1995).

Table 6. Alzheimer’s homophone confusion data.

Patient	Time 1	Time 2	Patient	Time 1	Time 2
1	5	5	11	7	10
2	1	3	12	0	3
3	0	0	13	3	9
4	1	1	14	5	8
5	0	1	15	7	12
6	2	1	16	10	16
7	5	6	17	5	5
8	1	2	18	6	3
9	0	9	19	9	6
10	5	8	20	11	8

homophone confusions difference distribution

The FREQ Procedure

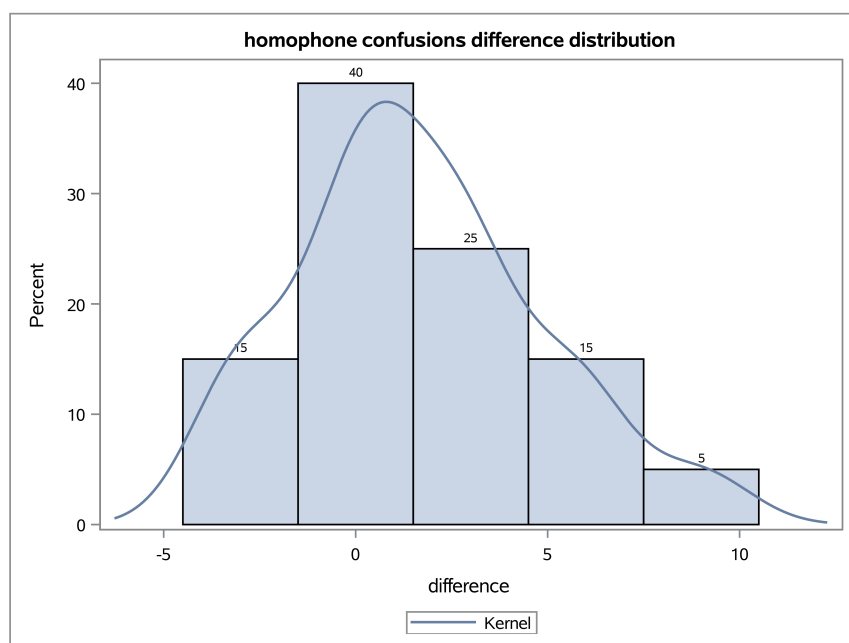
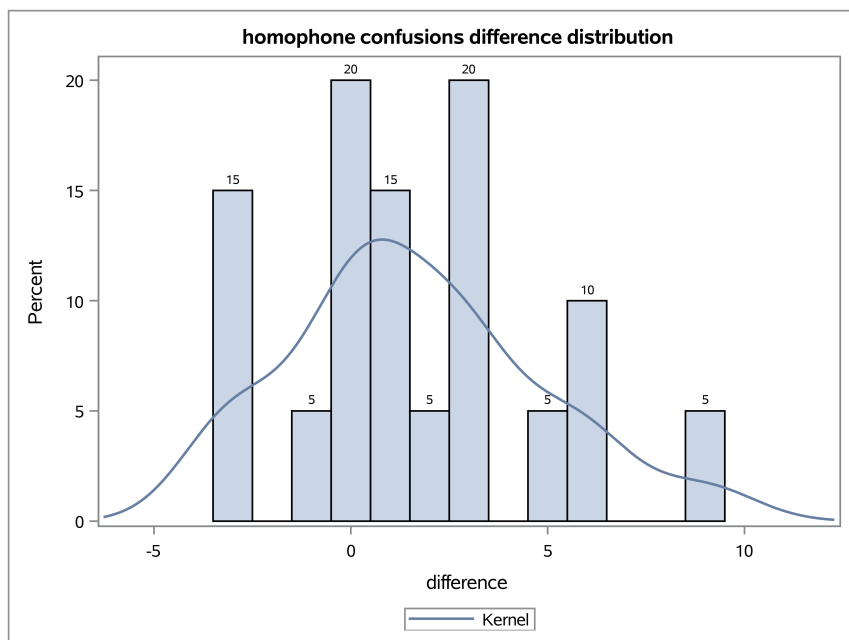
difference	Frequency	Percent	Cumulative Frequency	Cumulative Percent
-3	3	15.00	3	15.00
-1	1	5.00	4	20.00
0	4	20.00	8	40.00
1	3	15.00	11	55.00
2	1	5.00	12	60.00
3	4	20.00	16	80.00
5	1	5.00	17	85.00
6	2	10.00	19	95.00
9	1	5.00	20	100.00

homophone confusions difference distribution

The MEANS Procedure

Analysis Variable : difference									
N	Minimum	Lower Quartile	Median	Upper Quartile	Maximum	Range	Quartile Range	Mean	Std Dev
20	-3.0000	0.0000	1.0000	3.0000	9.0000	12.0000	3.0000	1.6500	3.1999

Analysis Variable : difference												
1st Pctl	5th Pctl	10th Pctl	20th Pctl	30th Pctl	40th Pctl	50th Pctl	60th Pctl	70th Pctl	80th Pctl	90th Pctl	95th Pctl	99th Pctl
-3.0000	-3.0000	-3.0000	-0.5000	0.0000	0.5000	1.0000	2.5000	3.0000	4.0000	6.0000	7.5000	9.0000



Example. Wooly–bear caterpillar cocoons. A study was conducted to investigate the relationship between air temperature and the temperature inside a wooly–bear caterpillar cocoon. It seems quite reasonable to expect the temperature inside a cocoon to be higher than the air temperature (outside the cocoon). The data given in Table 5 are pairs of air and cocoon temperatures made on 12 days at a location in the high arctic region. Each cocoon temperature is actually the average of two cocoon temperatures. This example comes from Kevan, P.C., T.S. Jensen, and J.D. Shorthouse, “Body temperatures and behavioral thermoregulation of high arctic wooly–bear caterpillars and pupae (*Gynaephora rossii*, Lymantridae: Lepidoptera) and the importance of sunshine”, *Arctic and Alpine Research*, **14**, (1982).

Table 5. Wooly–bear temperature data.

Day	Cocoon temp	Air temp	Day	Cocoon temp	Air temp
1	15.1	10.4	7	3.6	1.7
2	14.6	9.2	8	5.3	2.0
3	6.8	2.2	9	7.0	3.0
4	6.8	2.6	10	7.1	3.5
5	8.0	4.1	11	9.6	4.5
6	8.7	3.7	12	9.5	4.4

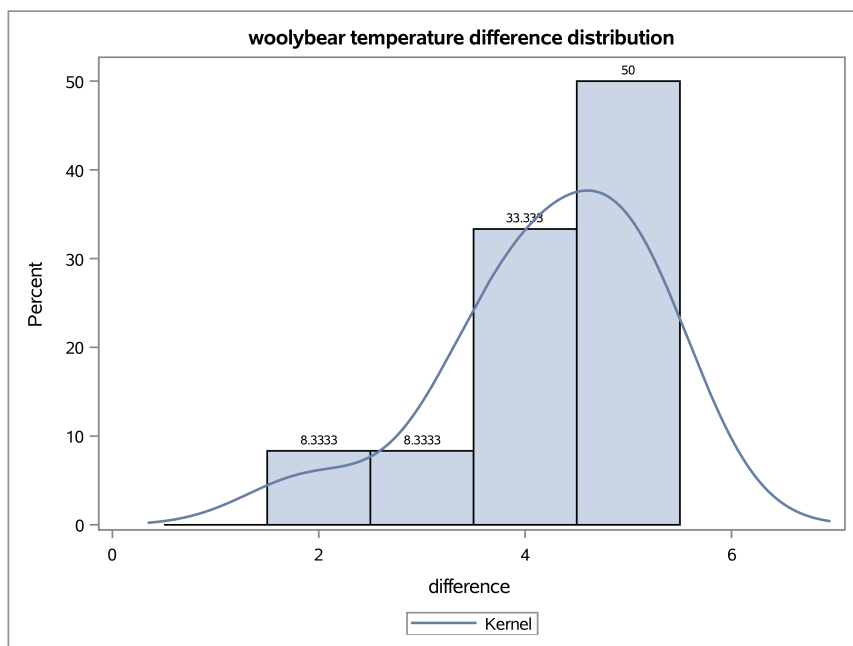
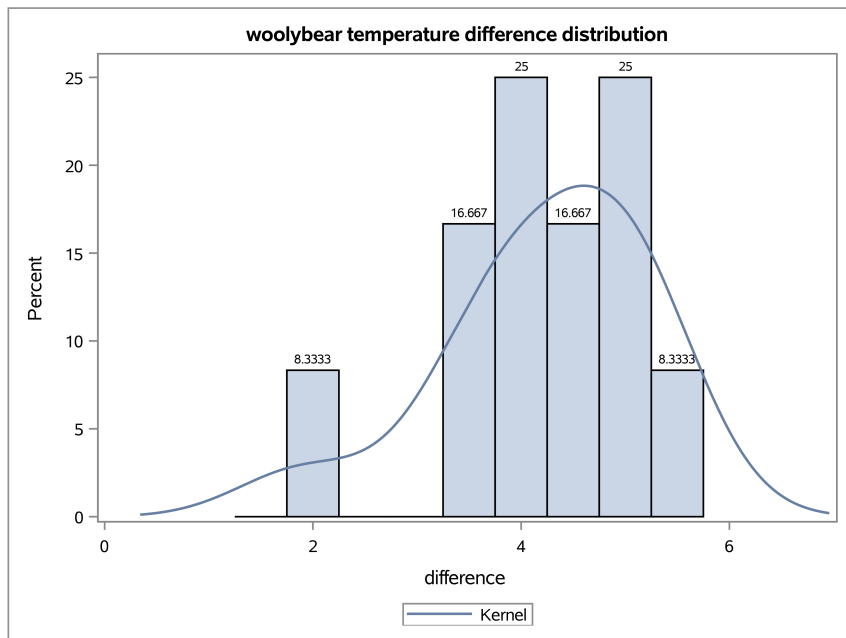
woolybear temperature difference distribution

The FREQ Procedure

difference	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1.9	1	8.33	1	8.33
3.3	1	8.33	2	16.67
3.6	1	8.33	3	25.00
3.9	1	8.33	4	33.33
4	1	8.33	5	41.67
4.2	1	8.33	6	50.00
4.6	1	8.33	7	58.33
4.7	1	8.33	8	66.67
5	1	8.33	9	75.00
5.1	2	16.67	11	91.67
5.4	1	8.33	12	100.00

Analysis Variable : difference									
N	Minimum	Lower Quartile	Median	Upper Quartile	Maximum	Range	Quartile Range	Mean	Std Dev
12	1.9000	3.7500	4.4000	5.0500	5.4000	3.5000	1.3000	4.2333	0.9857

Analysis Variable : difference												
1st Pctl	5th Pctl	10th Pctl	20th Pctl	30th Pctl	40th Pctl	50th Pctl	60th Pctl	70th Pctl	80th Pctl	90th Pctl	95th Pctl	99th Pctl
1.9000	1.9000	3.3000	3.6000	3.9000	4.0000	4.4000	4.7000	5.0000	5.1000	5.1000	5.4000	5.4000



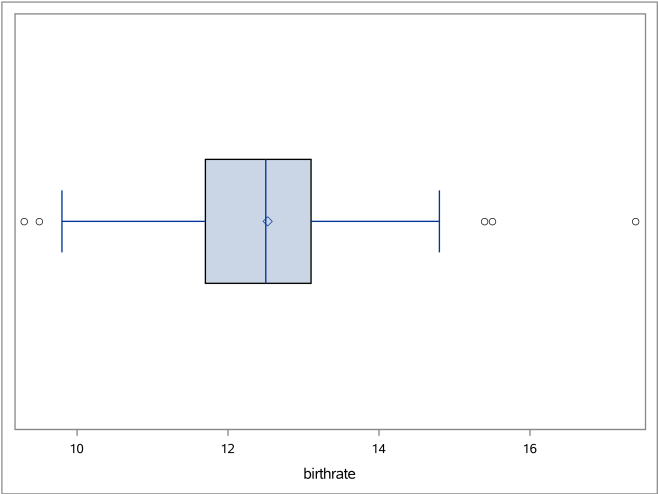
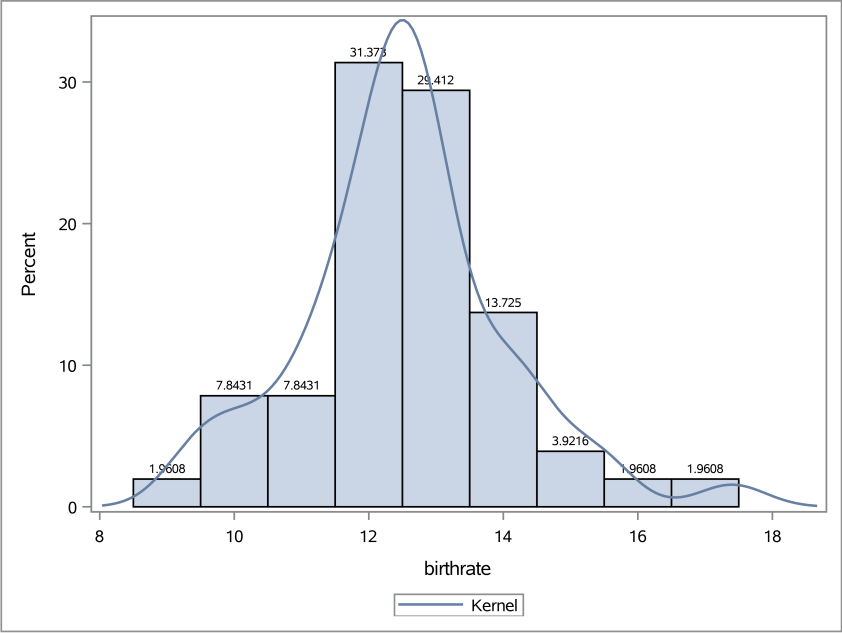
Example. Birth rates for the United States in 2014. The *National Vital Statistics Report* (Vol. 64, No. 12, December 23, 2015) presents 2014 data on U.S. births according to a wide variety of characteristics. The data used in this example are based on 100% of the birth certificates filed in all states and the District of Columbia (DC). These data are provided to the Centers for Disease Control and Prevention’s National Center for Health Statistics (NCHS) through the Vital Statistics Cooperative Program (VSCP).

Table. Birthrates 2014 (births per 1,000 women)

state	birthrate	state	birthrate
Alabama	12.3	Montana	12.1
Alaska	15.5	Nebraska	14.2
Arizona	12.9	Nevada	12.6
Arkansas	13.0	New Hampshire	9.3
California	13.0	New Jersey	11.6
Colorado	12.3	New Mexico	12.5
Connecticut	10.1	New York	12.1
Delaware	11.7	North Carolina	12.2
District of Columbia	14.4	North Dakota	15.4
Florida	11.1	Ohio	12.0
Georgia	13.0	Oklahoma	13.8
Hawaii	13.1	Oregon	11.5
Idaho	14.0	Pennsylvania	11.1
Illinois	12.3	Rhode Island	10.3
Indiana	12.7	South Carolina	11.9
Iowa	12.8	South Dakota	14.4
Kansas	13.5	Tennessee	12.5
Kentucky	12.7	Texas	14.8
Louisiana	13.9	Utah	17.4
Maine	9.5	Vermont	9.8
Maryland	12.4	Virginia	12.4
Massachusetts	10.7	Washington	12.5
Michigan	11.5	West Virginia	11.0
Minnesota	12.8	Wisconsin	11.7
Mississippi	12.9	Wyoming	13.2
Missouri	12.4		

birthrate relative frequency distributions
 binstart is the left endpoint of the interval -- left endpoint is included in frequency
 these intervals are the same as those of the histograms

Obs	binstart	frequency	percentage
1	8.5	1	1.9608
2	9.5	4	7.8431
3	10.5	4	7.8431
4	11.5	16	31.3725
5	12.5	15	29.4118
6	13.5	7	13.7255
7	14.5	2	3.9216
8	15.5	1	1.9608
9	16.5	1	1.9608



Analysis Variable : birthrate									
N	Minimum	Lower Quartile	Median	Upper Quartile	Maximum	Range	Quartile Range	Mean	Std Dev
51	9.3000	11.7000	12.5000	13.1000	17.4000	8.1000	1.4000	12.5255	1.5341

Analysis Variable : birthrate												
1st Pctl	5th Pctl	10th Pctl	20th Pctl	30th Pctl	40th Pctl	50th Pctl	60th Pctl	70th Pctl	80th Pctl	90th Pctl	95th Pctl	99th Pctl
9.3000	9.8000	10.7000	11.5000	12.0000	12.3000	12.5000	12.7000	13.0000	13.5000	14.4000	15.4000	17.4000

Example. Cholesterol levels in Guatemalans. This example is taken from Devore and Peck, *Statistics*, 3 ed., (1997), Duxbury, p. 23. The original source is “The Blood Viscosity of Various Socioeconomic Groups in Guatemala” in *The American Journal of Clinical Nutrition*, Nov., 1964, 303–307. The Institute of Nutrition of Central America and Panama measured the serum total cholesterol levels for a group of 49 adult, low-income rural Guatemalans and for a group of 45 adult, high-income urban Guatemalans. The serum total cholesterol levels (in mg/dL) are provided in Table 9.

Table 9. Guatemalan cholesterol data.

Rural group cholesterol levels (in mg/dL).

95	108	108	114	115	124	129	129	131	131
135	136	136	139	140	142	142	143	143	144
144	145	146	148	152	152	155	157	158	158
162	165	166	171	172	173	174	175	180	181
189	192	194	197	204	220	223	226	231	

Urban group cholesterol levels (in mg/dL).

133	134	155	170	175	179	181	184	188	189
190	196	197	199	200	200	201	201	204	205
205	205	206	214	217	222	222	227	227	228
234	234	236	239	241	242	244	249	252	273
279	284	284	284	330					