99 randomly generated example problems

March 12, 2020

Questions

Here are 99 random practice questions followed by their answers.

1) Suppose babies and movies come in 2 varieties: loose and second-hand. Let's find 28 babies and 18 movies and count how many fall into each variety. This generates the following table:

observed frequencies		
	babies	movies
loose	19	7
second-hand	9	11

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.01, test the hypothesis that the babies and movies are distributed independently across the varieties of loose and second-hand.

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2) Suppose the news of iPods has a population that is normally distributed with a standard deviation of 5. Your boss makes you sample 88 iPods from this population and obtain a mean news of 75.54 and a standard deviation of 5.0424.
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly different than an expected news of 75?

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3) For some reason you measure the advice of 22 cooperative and 98 agreeable mountains and obtain for cooperative mountains a mean advice of 67.41 and a standard deviation of 2.969, and for agreeable mountains a mean of 68.18 and a standard deviation of 3.1597.
Make a bar graph of the means with error bars representing the standard error of the means

Using an alpha value of 0.01, is the mean advice of cooperative mountains significantly different than for the agreeable mountains?
What is the effect size?
What is the observed power of this test?

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4) Your friend gets you to sample 90 iPhones and 90 economists from their populations and measure both their baggage and their quantity. You calculate that for iPhones their baggage correlates with quantity with -0.2 and for economists the correlation is 0.31.

Using an alpha value of $\alpha = 0.01$, is the observed correlation for iPhones significantly less than for economists?

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5) I'd like you to sample 87 fingers and 79 hair styles from their populations and measure both their pain threshold and their liberty. You calculate that for fingers their pain threshold correlates with liberty with 0.07 and for hair styles the correlation is -0.41.

Using an alpha value of $\alpha = 0.05$, is the observed correlation for fingers significantly greater than for hair styles?

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6) In your spare time you sample 13 smiling Americans from a population and measure both their machinery and their age.
You acquire the following measurements:

machinery	age
0.7	0.16
0.97	2.03
0.41	0.75
0.22	-1.26
-0.1	-0.22
1.22	0.63
0.68	-0.34
1.29	-0.17
0.27	-1.15
-0.56	0.23
0.32	0.47
-1.64	-0.24
-0.76	0.14

Calculate the regression line

Using an alpha value of $\alpha = 0.01$, is this observed correlation significantly different than zero?

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7) We decide to sample 10 cows from a population and measure both their amount and their taste.
You acquire the following measurements:

amount	taste
0.17	-0.37
0.19	0.18
0.75	-1.56
-0.7	-0.43
1.46	-1.64
2.24	-0.91
-0.01	-1
-0.12	0.88
-1.55	0.97
0.67	-0.16

Using an alpha value of $\alpha = 0.05$, is this observed correlation significantly different than zero?

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8) In the pursuit of science, you sample 9 secret teams from a population and measure both their value and their chaos.
You acquire the following measurements:

value	chaos
-0.25	0.39
0.29	-0.53
1.02	1.04
-1.65	-0.9
-0.11	0.87
-0.31	-0.85
0.01	-0.29
0.21	0.98
0.18	-0.38

Calculate the regression line
Using an alpha value of $\alpha = 0.05$, is this observed correlation significantly different than zero?

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9) Suppose the rain of permissible fingerprints has a population that is normally distributed with a standard deviation of 9. Let's sample 48 permissible fingerprints from this population and obtain a mean rain of 2.09 and a standard deviation of 9.1809.
Using an alpha value of $\alpha = 0.01$, is this observed mean significantly different than an expected rain of 3?

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10) Because you don't have anything better to do you sample the arousal of 37 baseballs from a population and obtain a mean arousal of 8.86 and a standard deviation of 0.6882 .
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly less than an expected arousal of 9?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

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11) Just for fun, you sample 78 elbows and 81 beer from their populations and measure both their duration and their time. You calculate that for elbows their duration correlates with time with -0.77 and for beer the correlation is -0.72.

Using an alpha value of $\alpha = 0.05$, is the observed correlation for elbows significantly less than for beer?

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12) You measure the work of 47 near and 15 striped fathers and obtain for near fathers a mean work of 35.22 and a standard deviation of 8.0085, and for striped fathers a mean of 40.17 and a standard deviation of 7.9323.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.01, is the mean work of near fathers significantly less than for the striped fathers?
What is the effect size?
What is the observed power of this test?

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13) Suppose bananas, hair styles and UW undergraduates come in 2 varieties: scarce and zealous. You find 30 bananas, 24 hair styles and 32 UW undergraduates and count how many fall into each variety. This generates the following table:

observed frequencies			
	bananas	hair styles	UW undergraduates
scarce	6	7	17
zealous	24	17	15

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.05, test the hypothesis that the bananas, hair styles and UW undergraduates are distributed independently across the varieties of scarce and zealous.

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14) You get a grant to sample the gravity of 31 alike dinosaurs from a population and obtain a mean gravity of 54.17 and a standard deviation of 2.8256 .
Using an alpha value of $\alpha = 0.01$, is this observed mean significantly less than an expected gravity of 55?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

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15) Suppose the safety of daughters has a population that is normally distributed with a standard deviation of 5. Because you don't have anything better to do you sample 41 daughters from this population and obtain a mean safety of 28.03 and a standard deviation of 5.4138.
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly greater than an expected safety of 28?

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16) Your friend gets you to measure the machinery of 96 certain and 36 placid Seattleites and obtain for certain Seattleites a mean machinery of 95.49 and a standard deviation of 4.9039, and for placid Seattleites a mean of 96.42 and a standard deviation of 4.8021.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.05, is the mean machinery of certain Seattleites significantly less than for the placid Seattleites?
What is the effect size?
What is the observed power of this test?

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17) For some reason you sample 21 imported psych 315 students from a population and measure both their cost and their recognition.
You acquire the following measurements:

cost	recognition
1.8	0.48
-1.35	-0.49
-1.29	-0.02
0.03	-2.05
-0.69	0.11
-0.69	0.1
0.35	-1.07
0.91	-1.77
0.86	-0.29
0.78	-0.31
-0.64	1.35
-2.81	-1.06
-1.17	-1.35
-0.11	-0.52
1.32	1.93
0.88	1.05
-1.02	-0.82
-0.78	0.35
0.53	0.24
1.06	1.6
-0.02	1.13

Calculate the regression line
Using an alpha value of $\alpha = 0.05$, is this observed correlation significantly greater than zero?

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18) You go out and sample the traffic of 104 vast statistics problems from a population and obtain a mean traffic of 77.12 and a standard deviation of 0.3995 .
Using an alpha value of $\alpha = 0.01$, is this observed mean significantly different than an expected traffic of 77?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

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19) Suppose web sites come in 7 varieties: five, cooperative, irritating, languid, long, well-off and chubby. On a dare, you find 159 web sites and count how many fall into each variety. This generates the following table:

observed frequencies of web sites						
five	cooperative	irritating	languid	long	well-off	chubby
36	24	30	15	30	10	14

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 159 web sites are distributed evenly across the 7 varieties of five, cooperative, irritating, languid, long, well-off and chubby.

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20) Without anything better to do, you measure the traffic of 20 evasive and 66 puffy brains and obtain for evasive brains a mean traffic of 91.48 and a standard deviation of 6.2959, and for puffy brains a mean of 91.55 and a standard deviation of 6.8945.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.01, is the mean traffic of evasive brains significantly less than for the puffy brains?
What is the effect size?
What is the observed power of this test?

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21) You want to sample 12 monkeys from a population and measure both their softness and their speed.
You calculate that their softness correlates with speed with r = 0.1.
Using an alpha value of $\alpha = 0.05$, is this observed correlation significantly greater than zero?

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22) You get a grant to measure the test scores of 30 fingerprints under two conditions: 'nauseating' and 'ordinary'. You then subtract the test scores of the 'nauseating' from the 'ordinary' conditions for each fingerprints and obtain a mean pair-wise difference of 3.19 with a standard deviation is 15.2095.
Using an alpha value of 0.01, is the test scores from the 'nauseating' condition significantly different than from the 'ordinary' condition?
What is the effect size?
What is the observed power of this test?

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23) Suppose dollars and friends come in 3 varieties: gleaming, six and puzzled. On a dare, you find 38 dollars and 43 friends and count how many fall into each variety. This generates the following table:

observed frequencies		
	dollars	friends
gleaming	8	6
six	15	13
puzzled	15	24

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.05, test the hypothesis that the dollars and friends are distributed independently across the varieties of gleaming, six and puzzled.

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24) Let's pretend that you measure the jewelry of 9 laboratory rats under two conditions: 'gifted' and 'political'. You then subtract the jewelry of the 'gifted' from the 'political' conditions for each laboratory rats and obtain a mean pair-wise difference of -4 with a standard deviation is 11.5985.
Using an alpha value of 0.05, is the jewelry from the 'gifted' condition significantly greater than from the 'political' condition?
What is the effect size?
What is the observed power of this test?

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25) Suppose Americans, bus riders and telephones come in 2 varieties: repulsive and gigantic. You find 44 Americans, 38 bus riders and 49 telephones and count how many fall into each variety. This generates the following table:

observed frequencies			
	Americans	bus riders	telephones
repulsive	19	16	30
gigantic	25	22	19

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.01, test the hypothesis that the Americans, bus riders and telephones are distributed independently across the varieties of repulsive and gigantic.

26) In the pursuit of science, you sample the scenery of 45 sponges from a population and obtain a mean scenery of 54.46 and a standard deviation of 5.3657 .
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly different than an expected scenery of 53?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

27) Your friend gets you to measure the leisure of 49 bananas under two conditions: 'wet' and 'reminiscent'. You then subtract the leisure of the 'wet' from the 'reminiscent' conditions for each bananas and obtain a mean pair-wise difference of -0.36 with a standard deviation is 10.9679.
Using an alpha value of 0.01, is the leisure from the 'wet' condition significantly greater than from the 'reminiscent' condition?
What is the effect size?
What is the observed power of this test?

28) Suppose the soap of common republicans has a population that is normally distributed with a standard deviation of 10. For your first year project you sample 56 common republicans from this population and obtain a mean soap of 29.3 and a standard deviation of 10.0995.
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly different than an expected soap of 26?

29) Your boss makes you sample the conductivity of 55 bananas from a population and obtain a mean conductivity of 99.26 and a standard deviation of 5.8519 .
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly less than an expected conductivity of 102?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

30) Suppose personality disorders and eggs come in 3 varieties: panicky, eager and stable.

You find 87 personality disorders and 65 eggs and count how many fall into each variety. This generates the following table:

observed frequencies		
	personality disorders	eggs
panicky	27	26
eager	27	7
stable	33	32

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.05, test the hypothesis that the personality disorders and eggs are distributed independently across the varieties of panicky, eager and stable.

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31) Let's test the hypothesis that the weight of oceans differs across 6 groups: venomous, intelligent, discreet, dead, exclusive and periodic. You generate the following table:

venomous	intelligent	discreet	dead	exclusive	periodic
30.3	3.5	79.8	10.2	22.8	55.3
-14.7	50.4	32.6	51.7	-3.2	-10
-26.3	-12.3	20.2	-13.4	-32.1	14
-19.1	-7.9	12.8	-43.9	50.5	30.7
-6.2	32.2	22.3	69.5	-30.2	0.1
-49.1	33.8	7.8	4.7	10.1	8
37.5	24	-9.5	-10.6	19.5	-11.9
-20.4	45.4	59.1	14.9	18.7	-47.6
-23.4	12.6	29.7	-11.4	8.9	-6.7
-17.5	35.6	-2.7	42.5	-24.4	22.6
-10.3	33.1	36.6	25.3	19.1	15.8
12.4	-25.1	-11.5	40.8	41.2	-17.8
-26.6	-4.3	17.9	28.3	18.7	20.2
-58.8	18.2	-0.1	23.5	5.7	5.1
14.8	2.1	2.1	-10.1	54.6	36.8
27.5	9.2	-14.9	-19.9	-2.1	-33.9
-34.2	26.4	-38.6	56.7	-20.4	28.3
3.5	34.7	2.5	-15.3	29.4	-48.9
19.7	7.7	77.1	0.2	-2.9	-11
19.5	-7.9	17.3	-46.9	4.5	54.9
2.7	1.4	24	34.3	-37.3	27.2
3.9	62.8	5.5	-0.9	4.1	-19.3
9.9	-11.4	41.6	-5.5	14.2	2.3

Calculate the means and standard errors of the mean for each of the 6 groups.
Make a bar graph of the means for each of the 6 groups with error bars as the standard error of the means.
Using an alpha value of α =0.05, is there difference in weight across the 6 groups of oceans?

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32) For a 499 project you sample the softness of 81 neurons from a population and obtain a mean softness of 49.39 and a standard deviation of 8.9882 .
Using an alpha value of α = 0.05, is this observed mean significantly different than an expected softness of 46?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

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33) Without anything better to do, you measure the soap of 51 sponges under two conditions: 'weary' and 'gabby'. You then subtract the soap of the 'weary' from the 'gabby' conditions for each sponges and obtain a mean pair-wise difference of 0.84 with a standard deviation is 3.4729.
Using an alpha value of 0.05, is the soap from the 'weary' condition significantly different than from the 'gabby' condition?
What is the effect size?
What is the observed power of this test?

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34) On a dare, you sample the taste of 57 apartments from a population and obtain a mean taste of 30.92 and a standard deviation of 8.1161 .
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly different than an expected taste of 27?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

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35) Suppose the price of fathers has a population that is normally distributed with a standard deviation of 10. Without anything better to do, you sample 97 fathers from this population and obtain a mean price of 3.77 and a standard deviation of 10.6671.
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly greater than an expected price of 1?

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36) Suppose cell phones and monkeys come in 2 varieties: bright and blue. You find 42 cell phones and 33 monkeys and count how many fall into each variety. This generates the following table:

observed frequencies		
	cell phones	monkeys
bright	26	17
blue	16	16

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.

Using an alpha value of α=0.05, test the hypothesis that the cell phones and monkeys are distributed independently across the varieties of bright and blue.

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37) You sample 71 grandmothers and 89 computers from their populations and measure both their response time and their happiness. You calculate that for grandmothers their response time correlates with happiness with -0.07 and for computers the correlation is -0.61.

Using an alpha value of $\alpha = 0.01$, is the observed correlation for grandmothers significantly different than for computers?

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38) You ask a friend to sample the work of 51 monkeys from a population and obtain a mean work of 92.24 and a standard deviation of 5.863 .
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly greater than an expected work of 91?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

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39) Suppose the information of balloons has a population that is normally distributed with a standard deviation of 2. Your advsor asks you to sample 9 balloons from this population and obtain a mean information of 27.65 and a standard deviation of 2.4686.
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly different than an expected information of 27?

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40) Your stats professor asks you to test the hypothesis that the peace of bus riders differs across 4 groups: bewildered, powerful, poised and noxious. You generate the following table:

	bewildered	powerful	poised	noxious
n	13	11	12	13
mean	78.89	94.08	92.84	93.25
SS	1831.6693	3579.0164	2848.0092	5048.0525

The grand mean is 89.53.

Calculate the standard errors of the mean for each of the 4 groups.
Make a bar graph of the means for each of the 4 groups with error bars as the standard error of the means.
Using an alpha value of α =0.05, is there difference in peace across the 4 groups of bus riders?

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41) Without anything better to do, you measure the rain of 86 acoustic and 98 stable iPods and obtain for acoustic iPods a mean rain of 56.4 and a standard deviation of 7.8515, and for stable iPods a mean of 56.59 and a standard deviation of 8.8517.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.05, is the mean rain of acoustic iPods significantly less than for the stable iPods?
What is the effect size?
What is the observed power of this test?

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42) Because you don't have anything better to do you measure the time of 15 eggs under two conditions: 'pretty' and 'protective'. You then subtract the time of the 'pretty' from the 'protective' conditions for each eggs and obtain a mean pair-wise difference of 1.31 with a standard deviation is 11.808.
Using an alpha value of 0.01, is the time from the 'pretty' condition significantly less than from the 'protective' condition?
What is the effect size?
What is the observed power of this test?

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43) Let's pretend that you test the hypothesis that the softness of planets differs across 2 groups: puzzled and bumpy. You generate the following table:

puzzled	bumpy
15.9	32.6
61.6	37
43.1	36
26.8	44
12.9	26.3
26.8	20.7
28.2	60.1
30.5	27.6
62	51.4
27.2	36.3
49.9	51.7
16.3	63.1
42.9	55.4

Calculate the means and standard errors of the mean for each of the 2 groups.
Make a bar graph of the means for each of the 2 groups with error bars as the standard error of the means.
Using an alpha value of α =0.01, is there difference in softness across the 2 groups of planets?

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44) You want to sample 34 ping pong balls and 78 psychologists from their populations and measure both their pain threshold and their equipment. You calculate that for ping pong balls their pain threshold correlates with equipment with 0.92 and for psychologists the correlation is 0.65.

Using an alpha value of α = 0.01, is the observed correlation for ping pong balls significantly different than for psychologists?

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45) Your friend gets you to test the hypothesis that the anxiety of response times differs across 5 groups: furry, bouncy, calm, blue and tasty. You generate the following table:

	furry	bouncy	calm	blue	tasty
n	16	16	16	15	17
mean	67.52	70.03	72.01	70.56	83.95
SS	5596.6104	5106.9544	3200.1096	4203.916	4823.9825

n_{total}	80
grand mean	72.9825
SS_{total}	25696.7155

Calculate the standard errors of the mean for each of the 5 groups.
Make a bar graph of the means for each of the 5 groups with error bars as the standard error of the means.
Using an alpha value of α =0.01, is there difference in anxiety across the 5 groups of response times?

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46) For your first year project you test the hypothesis that the music of fingers differs across 6 groups: wholesale, fragile, abstracted, unknown, nutty and tested. You generate the following table:

wholesale	fragile	abstracted	unknown	nutty	tested
-2.8	-9.3	18.9	16.9	41.4	23.5
-8.5	-29.6	14.8	-10.5	20.7	3.4
-4	32	1.1	0	-5.4	6.1
5.8	26.9	13.7	-42.5	21.8	2.1
2.3	-9.3	47	22.4	25.7	18.8
19	3.1	15.3	-39.8	-36.6	41.9
37.1	-23.1	29.2	-5.1	-10.4	-24.3
-4.3	-24.8	6	3.6	16.9	41.6
9.4	12.3	-12.3	-11.3	40	-4.9
19.6	16.4	42.7	-19.9	3.2	8.5
0.9	-7.3	-5.3	0.4	24.2	31.1
10.8	-14.4	3.7	30	-6.6	40.4
34.3	29.7	4.6	-28.6	56.7	7.1
38.2	3.2	15.9	25.3	9.6	-32
-28.6	11.5	46.7	18.6	-14.2	38.5
6.7	34.5	15.5	30.7	-5.2	16.9
7.9	-2	16.1	10.8	-39.3	18.1
38.3	-16.6	9.7	1.3	-19.4	25.8
8.9	58.1	21.7	22.7	0.2	1.7
6.2	-25.8	42.9	1.5	13.8	13.2
14	16.1	3.4	11	68.2	2.1
-11.6	1.4	20.6	9.7	-13.9	-8.5
4.4	-2.3	22.5	-11	32.4	-3.1
1.5	-4.1	13.5	-9	-1.6	-29.4
-19.2	26.6	-20.3	10.7	-9.3	7
40.5	0.8	34.9	49.2	38.2	27.9
54.2	25.2	13.6	43.7	9.5	-36.1

Calculate the means and standard errors of the mean for each of the 6 groups.
Make a bar graph of the means for each of the 6 groups with error bars as the standard error of the means.
Using an alpha value of α =0.01, is there difference in music across the 6 groups of fingers?

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47) Suppose iPhones come in 3 varieties: inexpensive, short and jolly. You are walking down the street and find 109 iPhones and count how many fall into each variety. This generates the following table:

observed frequencies of iPhones		
inexpensive	short	jolly
43	31	35

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.05$ test the null hypothesis that the 109 iPhones are distributed evenly across the 3 varieties of inexpensive, short and jolly.

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48) Suppose monkeys come in 4 varieties: undesirable, certain, mountainous and energetic. On a dare, you find 106 monkeys and count how many fall into each variety. This generates the following table:

observed frequencies of monkeys			
undesirable	certain	mountainous	energetic
36	29	13	28

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 106 monkeys are distributed evenly across the 4 varieties of undesirable, certain, mountainous and energetic.

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49) Because you don't have anything better to do you measure the progress of 59 personalities under two conditions: 'sleepy' and 'royal'. You then subtract the progress of the 'sleepy' from the 'royal' conditions for each personalities and obtain a mean pair-wise difference of 1.78 with a standard deviation is 8.9176.
Using an alpha value of 0.05, is the progress from the 'sleepy' condition significantly different than from the 'royal' condition?
What is the effect size?
What is the observed power of this test?

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50) Suppose interest rates, oceans and grandmothers come in 2 varieties: stingy and uptight. You go out and find 29 interest rates, 39 oceans and 42 grandmothers and count how many fall into each variety. This generates the following table:

observed frequencies			
	interest rates	oceans	grandmothers
stingy	6	20	15
uptight	23	19	27

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.05, test the hypothesis that the interest rates, oceans and grandmothers are distributed independently across the varieties of stingy and uptight.

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51) Your advsor asks you to test the hypothesis that the test scores of salmon differs across 5 groups: glossy, tangible, statuesque, purring and curly. You generate the following table:

glossy	tangible	statuesque	purring	curly
70.3	68.3	59.7	48	73.6
70.8	59.2	53.6	59.7	64.3
56	61.5	56.4	52.9	54.2
64.2	62.4	65.4	68	59.5
61	71	56	64.3	73.1
62.4	58.7	61.7	62.8	60.7
62.5	71.2	51.4	60.6	56.6
61.5	62.6	61.6	59	55.2
67.3	64.2	48.8	61.4	61
81.2	75.1	54.7	54.5	52.1
52.5	68.1	57.2	56.8	66.7
69.6	55	68.3	65.3	57.8
62.4	65.4	56.1	61.1	58.5
59.9	69.6	61.9	59.1	64.6
62.6	63.7	60.2	64.1	68.2
71.1	68	60.8	59.5	54.7
69.1	63	51.4	57.1	58.6
66.2	63	58.2	58	53.6
53.7	63.6	66.8	57.2	59.7
57.8	56.5	59.2	69.4	54.4
60.4	60.9	52.5	48.2	67.5
63.5	67.4	70.5	56.9	58.9
72.1	68.3	64.4	57	62.8
71.6	67.8			64.1
71.5				57.3
65.1				

Calculate the means and standard errors of the mean for each of the 5 groups.
Make a bar graph of the means for each of the 5 groups with error bars as the standard error of the means.
Using an alpha value of α =0.05, is there difference in test scores across the 5 groups of salmon?

---

52) Suppose colors come in 5 varieties: melodic, gentle, heartbreaking, spiteful and wrong. You go out and find 139 colors and count how many fall into each variety. This generates the following table:

observed frequencies of colors				
melodic	gentle	heartbreaking	spiteful	wrong
17	26	35	29	32

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.05$ test the null hypothesis that the 139 colors are distributed evenly across the 5 varieties of melodic, gentle, heartbreaking, spiteful and wrong.

---

53) Suppose you sample 72 Asian food and 23 baby names from their populations and measure both their information and their smell. You calculate that for Asian food their information correlates with smell with -0.25 and for baby names the correlation is 0.37.

Using an alpha value of $\alpha = 0.01$, is the observed correlation for Asian food significantly different than for baby names?

---

54) Because you don't have anything better to do you test the hypothesis that the span of flowers differs across 6 groups: belligerent, public, sparkling, different, tart and tasty. You generate the following table:

	belligerent	public	sparkling	different	tart	tasty
n	12	10	9	11	13	9
mean	46.22	53.57	46.06	36.04	36.11	36.14
SS	2211.7368	5083.821	1587.2024	6024.8256	6479.5893	3997.6424

n_{total}	64
grand mean	42.1234
SS_{total}	28235.0348

Calculate the standard errors of the mean for each of the 6 groups.
Make a bar graph of the means for each of the 6 groups with error bars as the standard error of the means.
Using an alpha value of α =0.05, is there difference in span across the 6 groups of flowers?

---

55) Suppose the farts of fingerprints has a population that is normally distributed with a standard deviation of 4. Your advsor asks you to sample 96 fingerprints from this population

and obtain a mean farts of 65.17 and a standard deviation of 4.2578.
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly less than an expected farts of 66?

---

56) You want to measure the depth of 26 glib and 32 green hair styles and obtain for glib hair styles a mean depth of 82.14 and a standard deviation of 11.068, and for green hair styles a mean of 76.98 and a standard deviation of 9.4327.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.05, is the mean depth of glib hair styles significantly different than for the green hair styles?
What is the effect size?
What is the observed power of this test?

---

57) For your first year project you measure the hospitality of 20 changeable and 108 hateful cats and obtain for changeable cats a mean hospitality of 69.43 and a standard deviation of 5.7426, and for hateful cats a mean of 67.44 and a standard deviation of 5.2567.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.01, is the mean hospitality of changeable cats significantly different than for the hateful cats?
What is the effect size?
What is the observed power of this test?

---

58) You measure the smell of 27 clean and 75 future children and obtain for clean children a mean smell of 24.36 and a standard deviation of 4.3358, and for future children a mean of 26.21 and a standard deviation of 3.9223.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.05, is the mean smell of clean children significantly less than for the future children?
What is the effect size?
What is the observed power of this test?

---

59) Suppose the distance of weather events has a population that is normally distributed with a standard deviation of 7. Your friend gets you to sample 83 weather events from this population and obtain a mean distance of 25.66 and a standard deviation of 7.8483.
Using an alpha value of $\alpha = 0.01$, is this observed mean significantly different than an expected distance of 25?

---

60) Without anything better to do, you sample the morality of 65 luxuriant potatoes from a population and obtain a mean morality of 66.31 and a standard deviation of 1.6569 .
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly less than an expected morality of 67?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

---

61) Suppose elements, baby names and laboratory rats come in 2 varieties: eatable and robust. Your boss makes you find 35 elements, 46 baby names and 50 laboratory rats and count how many fall into each variety. This generates the following table:

observed frequencies			
	elements	baby names	laboratory rats
eatable	8	16	23
robust	27	30	27

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.01, test the hypothesis that the elements, baby names and laboratory rats are distributed independently across the varieties of eatable and robust.

---

62) Just for fun, you sample the health of 41 beers from a population and obtain a mean health of 25.57 and a standard deviation of 8.5298 .
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly different than an expected health of 30?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

---

63) Suppose pants come in 2 varieties: tenuous and hapless. I find 22 pants and count how many fall into each variety. This generates the following table:

observed frequencies of pants	
tenuous	hapless
6	16

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 22 pants are distributed evenly across the 2 varieties of tenuous and hapless.

---

64) Suppose children come in 3 varieties: fertile, lying and freezing. I'd like you to find 96 children and count how many fall into each variety. This generates the following table:

observed frequencies of children		
fertile	lying	freezing
39	31	26

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 96 children are distributed evenly across the 3 varieties of fertile, lying and freezing.

---

65) Suppose UW undergraduates and skittles come in 3 varieties: half, curved and domineering. You ask a friend to find 52 UW undergraduates and 46 skittles and count how many fall into each variety. This generates the following table:

observed frequencies		
	UW undergraduates	skittles
half	5	16
curved	33	12
domineering	14	18

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.05, test the hypothesis that the UW undergraduates and skittles are distributed independently across the varieties of half, curved and domineering.

---

66) You measure the farts of 14 elements under two conditions: 'huge' and 'daily'. You

then subtract the farts of the 'huge' from the 'daily' conditions for each elements and obtain a mean pair-wise difference of 2.7 with a standard deviation is 2.3879.
Using an alpha value of 0.05, is the farts from the 'huge' condition significantly less than from the 'daily' condition?
What is the effect size?
What is the observed power of this test?

---

67) Suppose you test the hypothesis that the conductivity of candy bars differs across 2 groups: spotted and used. You generate the following table:

	spotted	used
n	19	19
mean	2.43	9.69
SS	1657.5971	1192.0099

n_{total}	38
grand mean	6.0605
SS_{total}	3351.4908

Calculate the standard errors of the mean for each of the 2 groups.
Make a bar graph of the means for each of the 2 groups with error bars as the standard error of the means.
Using an alpha value of α =0.05, is there difference in conductivity across the 2 groups of candy bars?

---

68) Suppose you test the hypothesis that the grief of diseases differs across 5 groups: safe, homely, scary, flaky and tearful. You generate the following table:

	safe	homely	scary	flaky	tearful
n	10	10	10	10	10
mean	41.89	24.27	34.1	33.68	37.48
SS	557.909	764.201	1051.34	655.016	966.336

n_{total}	50
grand mean	34.284
SS_{total}	5682.2472

Calculate the standard errors of the mean for each of the 5 groups.

Make a bar graph of the means for each of the 5 groups with error bars as the standard error of the means.
Using an alpha value of α =0.01, is there difference in grief across the 5 groups of diseases?

---

69) Your friend gets you to sample 80 proctologists and 15 UW undergraduates from their populations and measure both their courage and their baggage. You calculate that for proctologists their courage correlates with baggage with -0.39 and for UW undergraduates the correlation is -0.14.

Using an alpha value of α = 0.01, is the observed correlation for proctologists significantly less than for UW undergraduates?

---

70) You sample 23 chickens and 16 Europeans from their populations and measure both their courage and their damage. You calculate that for chickens their courage correlates with damage with 0.87 and for Europeans the correlation is 0.42.

Using an alpha value of α = 0.05, is the observed correlation for chickens significantly greater than for Europeans?

---

71) Suppose chickens come in 4 varieties: cagey, silly, itchy and uneven. Your stats professor asks you to find 72 chickens and count how many fall into each variety. This generates the following table:

observed frequencies of chickens			
cagey	silly	itchy	uneven
20	17	29	6

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 72 chickens are distributed evenly across the 4 varieties of cagey, silly, itchy and uneven.

---

72) Your advsor asks you to sample 24 video games from a population and measure both their pain threshold and their news.
You calculate that their pain threshold correlates with news with r = 0.15.

Using an alpha value of $\alpha = 0.05$, is this observed correlation significantly greater than zero?

---

73) Suppose elbows come in 3 varieties: nervous, mysterious and chivalrous. We find 82 elbows and count how many fall into each variety. This generates the following table:

observed frequencies of elbows		
nervous	mysterious	chivalrous
32	20	30

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 82 elbows are distributed evenly across the 3 varieties of nervous, mysterious and chivalrous.

---

74) Suppose the leisure of professors has a population that is normally distributed with a standard deviation of 9. We decide to sample 14 professors from this population and obtain a mean leisure of 45.99 and a standard deviation of 8.9676.
Using an alpha value of $\alpha = 0.01$, is this observed mean significantly greater than an expected leisure of 43?

---

75) You sample 20 Seattleites and 28 sponges from their populations and measure both their violance and their duration. You calculate that for Seattleites their violance correlates with duration with 0.42 and for sponges the correlation is 0.09.

Using an alpha value of $\alpha = 0.05$, is the observed correlation for Seattleites significantly different than for sponges?

---

76) Your boss makes you measure the heaviness of 62 fair and 27 second-hand facial expressions and obtain for fair facial expressions a mean heaviness of 80.53 and a standard deviation of 8.9243, and for second-hand facial expressions a mean of 82.01 and a standard deviation of 8.8634.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.05, is the mean heaviness of fair facial expressions significantly less than for the second-hand facial expressions?
What is the effect size?
What is the observed power of this test?

77) Tomorrow you sample 8 brave balloons from a population and measure both their visual acuity and their knowledge.
You calculate that their visual acuity correlates with knowledge with r = -0.27.
Using an alpha value of $\alpha = 0.01$, is this observed correlation significantly less than zero?

---

78) Suppose iPhones come in 2 varieties: near and spiky. You decide to find 19 iPhones and count how many fall into each variety. This generates the following table:

observed frequencies of iPhones	
near	spiky
13	6

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 19 iPhones are distributed evenly across the 2 varieties of near and spiky.

---

79) Suppose examples, baseballs and video games come in 2 varieties: limping and boiling. Let's find 67 examples, 38 baseballs and 39 video games and count how many fall into each variety. This generates the following table:

observed frequencies			
	examples	baseballs	video games
limping	38	26	12
boiling	29	12	27

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.05, test the hypothesis that the examples, baseballs and video games are distributed independently across the varieties of limping and boiling.

---

80) Let's measure the news of 10 amygdalas under two conditions: 'far' and 'imaginary'. You then subtract the news of the 'far' from the 'imaginary' conditions for each amygdalas and obtain a mean pair-wise difference of 1.2 with a standard deviation is 5.0455.

Using an alpha value of 0.01, is the news from the 'far' condition significantly less than from the 'imaginary' condition?
What is the effect size?
What is the observed power of this test?

---

81) Suppose brain images come in 4 varieties: slippery, steadfast, private and unable. You find 73 brain images and count how many fall into each variety. This generates the following table:

observed frequencies of brain images			
slippery	steadfast	private	unable
15	22	9	27

Make a table of the expected frequencies.
Using an alpha value of $\alpha = 0.01$ test the null hypothesis that the 73 brain images are distributed evenly across the 4 varieties of slippery, steadfast, private and unable.

---

82) You ask a friend to sample 22 undergraduates from a population and measure both their speed and their size.
You acquire the following measurements:

speed	size
-1.36	1.26
2.05	-0.87
1.13	-0.38
0.21	1.28
0.6	-0.07
0.97	-0.41
0.1	1.7
1.72	-0.69
-0.8	-0.58
0.41	-1.03
-1.96	0.92
-0.76	1.33
1.77	-0.72
0.76	-0.78
-0.91	0.31
-0.67	0.38
0.39	0.06
0.64	0.19
-0.09	0.51
1.83	-0.89
-0.73	-0.08
1.78	-1.57

Using an alpha value of $\alpha = 0.01$, is this observed correlation significantly different than zero?

---

83) In your spare time you sample 24 examples and 32 antidepressants from their populations and measure both their sadness and their trouble. You calculate that for examples their sadness correlates with trouble with 0.47 and for antidepressants the correlation is 0.23.

Using an alpha value of $\alpha = 0.01$, is the observed correlation for examples significantly greater than for antidepressants?

---

84) Your advsor asks you to measure the work of 23 students under two conditions: 'sharp' and 'icy'. You then subtract the work of the 'sharp' from the 'icy' conditions for each students and obtain a mean pair-wise difference of 3.84 with a standard deviation is 8.3394. Using an alpha value of 0.05, is the work from the 'sharp' condition significantly less than from the 'icy' condition?
What is the effect size?
What is the observed power of this test?

85) For some reason you test the hypothesis that the democracy of chickens differs across 5 groups: jumbled, high, pricey, hot and purple. You generate the following table:

jumbled	high	pricey	hot	purple
81.2	85.2	71.6	90.6	73.6
67.4	60.9	71.9	93.7	50.6
58.5	101.2	65.9	72.8	63.7
68.8	71.1	57.7	87.4	81.8
86.5	79.8	54.3	89.3	73.2
44.2	63.5	49.3	51.4	71.9
85.5	66.4	70.5	48.5	88
82.8	64.9	53	62.2	56.8
84.1	68.4	80.1	100.8	65
80.9	74.8	104.2	88	82.5
55.5	49.9	85.4	85.4	64.1
66.2	64.7	92.2	106.2	78
67.6	76.4	49.9	60.2	79.4
71.4	83.7	106.3	88.2	93.2
61.7	71.1	90	76.8	51.7
68.4	80.1	62.7	84.7	87.9
53.6	74.1	57.4	86.9	70.7
64.3	59.4	78.7	92.9	87.5
76.6	89.1	68.6	67.7	79.5
60.1	53.6	56.9	111.5	62.2
36.1	96.6		58.7	74.5
116.7				
78.2				

Calculate the means and standard errors of the mean for each of the 5 groups.
Make a bar graph of the means for each of the 5 groups with error bars as the standard error of the means.
Using an alpha value of α =0.05, is there difference in democracy across the 5 groups of chickens?

---

86) Suppose balloons, cartoon characters and fingerprints come in 2 varieties: messy and absurd. Your stats professor asks you to find 27 balloons, 24 cartoon characters and 16 fingerprints and count how many fall into each variety. This generates the following table:

observed frequencies			
	balloons	cartoon characters	fingerprints
messy	15	17	8
absurd	12	7	8

Make a bar graph showing the frequencies for all varieties.

Make a table of the expected frequencies.
Using an alpha value of α=0.05, test the hypothesis that the balloons, cartoon characters and fingerprints are distributed independently across the varieties of messy and absurd.

---

87) You want to measure the damage of 108 politicians under two conditions: 'tired' and 'enchanting'. You then subtract the damage of the 'tired' from the 'enchanting' conditions for each politicians and obtain a mean pair-wise difference of 1.2 with a standard deviation is 11.0806.
Using an alpha value of 0.01, is the damage from the 'tired' condition significantly different than from the 'enchanting' condition?
What is the effect size?
What is the observed power of this test?

---

88) Let's pretend that you sample 45 fraternities and 80 elections from their populations and measure both their pain threshold and their weight. You calculate that for fraternities their pain threshold correlates with weight with -0.17 and for elections the correlation is -0.38.

Using an alpha value of α = 0.01, is the observed correlation for fraternities significantly different than for elections?

---

89) Suppose you measure the speed of 33 receptive and 43 soggy British people and obtain for receptive British people a mean speed of 59.71 and a standard deviation of 8.6335, and for soggy British people a mean of 54.57 and a standard deviation of 8.7028.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.05, is the mean speed of receptive British people significantly different than for the soggy British people?

What is the effect size?
What is the observed power of this test?

---

90) You measure the duration of 105 Martians under two conditions: 'yummy ' and 'disagreeable'. You then subtract the duration of the 'yummy ' from the 'disagreeable' conditions for each Martians and obtain a mean pair-wise difference of 1.93 with a standard deviation is 6.8915.
Using an alpha value of 0.05, is the duration from the 'yummy ' condition significantly different than from the 'disagreeable' condition?
What is the effect size?
What is the observed power of this test?

---

91) Suppose the happiness of fathers has a population that is normally distributed with a standard deviation of 9. Because you don't have anything better to do you sample 94 fathers from this population and obtain a mean happiness of 56.59 and a standard deviation of 9.0465.
Using an alpha value of $\alpha = 0.05$, is this observed mean significantly less than an expected happiness of 59?

---

92) You sample 18 humdrum oranges from a population and measure both their liberty and their rain.
You acquire the following measurements:

liberty	rain
-0.68	0.69
0.39	0.2
1.13	-0.12
2.01	-0.24
1.79	-0.44
0.95	0.39
0.79	1.23
-0.17	0.07
0.22	-0.26
-0.72	-0.55
1	0.61
0.84	-1.44
-1.58	-0.84
-0.27	-0.96
0.87	0.87
-0.01	0.17
-0.14	0.77
0.9	0.06

Calculate the regression line
Using an alpha value of $\alpha = 0.01$, is this observed correlation significantly greater than zero?

---

93) I'd like you to sample the importance of 87 bitter exams from a population and obtain a mean importance of 37.79 and a standard deviation of 5.7928 .
Using an alpha value of $\alpha = 0.01$, is this observed mean significantly less than an expected importance of 40?
What is the effect size?
Is the effect size small, medium or large?
What is the observed power?

---

94) Just for fun, you measure the rain of 14 third and 44 embarrassed movies and obtain for third movies a mean rain of 7.51 and a standard deviation of 2.9874, and for embarrassed movies a mean of 11.8 and a standard deviation of 3.2467.
Make a bar graph of the means with error bars representing the standard error of the means
Using an alpha value of 0.01, is the mean rain of third movies significantly different than for the embarrassed movies?
What is the effect size?
What is the observed power of this test?

---

95) Because you don't have anything better to do you sample 15 acoustic fraternities from a population and measure both their liberty and their hospitality.
You acquire the following measurements:

liberty	hospitality
-0.24	1.2
0.88	-0.01
-1.89	0.37
-1.55	-0.54
0.88	-1.36
0.75	-0.63
-1.49	1.21
1.76	-1.02
-0.05	1.25
1.57	0.51
-0.26	-0.87
0.04	-0.46
-0.57	1.69
-0.18	-1.69
0.13	-0.73

Using an alpha value of $\alpha = 0.05$, is this observed correlation significantly different than zero?

---

96) For your first year project you sample 10 cartoon characters from a population and measure both their evil and their width.
You calculate that their evil correlates with width with r = 0.42.
Using an alpha value of $\alpha = 0.05$, is this observed correlation significantly greater than zero?

---

97) Suppose the density of laboratory rats has a population that is normally distributed with a standard deviation of 9. Your friend gets you to sample 64 laboratory rats from this population and obtain a mean density of 13.71 and a standard deviation of 10.5635.
Using an alpha value of $\alpha = 0.01$, is this observed mean significantly different than an expected density of 18?

---

98) You are walking down the street and test the hypothesis that the scenery of telephones differs across 3 groups: vacuous, volatile and frequent. You generate the following table:

	vacuous	volatile	frequent
n	21	20	20
mean	13.82	12.46	18.3
SS	2385.7984	1975.59	3463.68

n_{total}	61
grand mean	14.8426
SS_{total}	8199.9492

Calculate the standard errors of the mean for each of the 3 groups.
Make a bar graph of the means for each of the 3 groups with error bars as the standard error of the means.
Using an alpha value of α =0.05, is there difference in scenery across the 3 groups of telephones?

---

99) Suppose beer come in 6 varieties: large, quirky, unkempt, medical, parsimonious and stupid. Your friend gets you to find 137 beer and count how many fall into each variety. This generates the following table:

observed frequencies of beer					
large	quirky	unkempt	medical	parsimonious	stupid
19	16	16	20	35	31

Make a table of the expected frequencies.
Using an alpha value of α = 0.01 test the null hypothesis that the 137 beer are distributed evenly across the 6 varieties of large, quirky, unkempt, medical, parsimonious and stupid.

Answers

1) χ^2 test for independence

Sums and expected frequencies			
	babies	movies	sum
loose	$\frac{(26)(28)}{46} = 15.8261$	$\frac{(26)(18)}{46} = 10.1739$	26
second-hand	$\frac{(20)(28)}{46} = 12.1739$	$\frac{(20)(18)}{46} = 7.8261$	20
sum	28	18	46

$$\chi 2 = \frac{(19-15.8261)^2}{15.8261} + \frac{(9-12.1739)^2}{12.1739} + \frac{(7-10.1739)^2}{10.1739} + \frac{(11-7.8261)^2}{7.8261} =$$

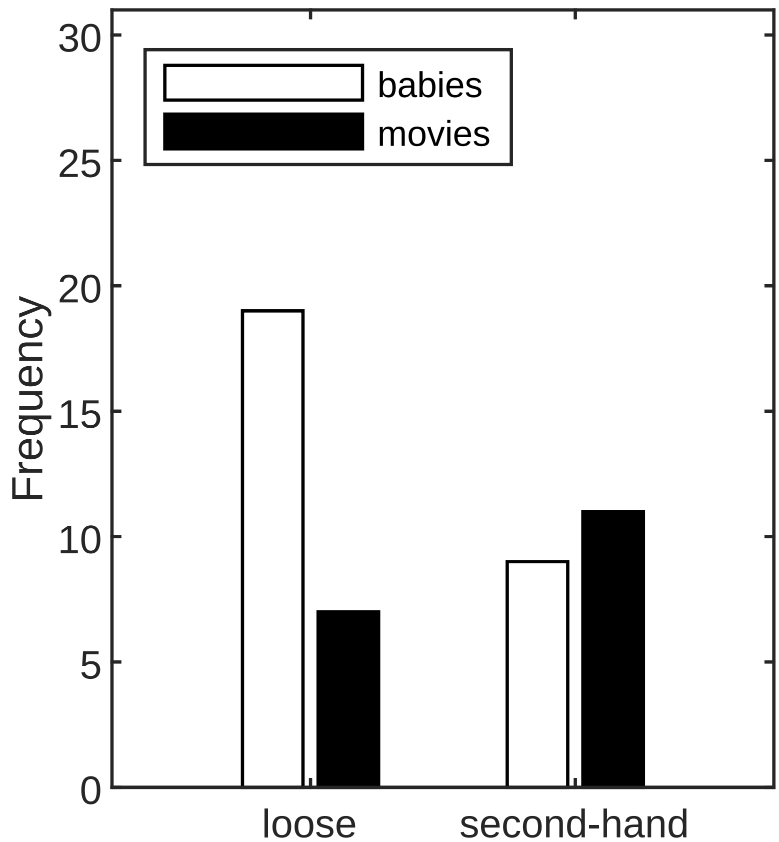
$0.6365 + 0.8275 + 0.9901 + 1.2872 = 3.7413$

df = (2-1)(2-1) = 1

$\chi^2_{crit} = 6.63$

We fail to reject H_0.

The babies and movies are distributed independently of the varieties of loose and second-hand, χ^2(1, N=46)=3.7413, p=0.0531.


babies
movies
Frequency
0
5
10
15
20
25
30
loose
second-hand

2) Two tailed z-test for one mean

$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{5}{\sqrt{88}} = 0.533$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(75.54 - 75)}{0.533} = 1.01$

z_{crit} for $\alpha = 0.05$ (Two tailed) is ± 1.96

We fail to reject H_0.

The news of iPods (M = 75.54) is not significantly different than 75, z=1.01, p = 0.3125.

3) Two tailed independent measures t-test

$$s_p = \sqrt{\frac{(22-1)2.969^2+(98-1)3.1597^2}{(22-1)+(98-1)}} = 3.1266$$

$$s_{\bar{x}-\bar{y}} = 3.1266\sqrt{\frac{1}{22}+\frac{1}{98}} = 0.7376$$

$$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{67.41-68.18}{0.7376} = -1.04$$

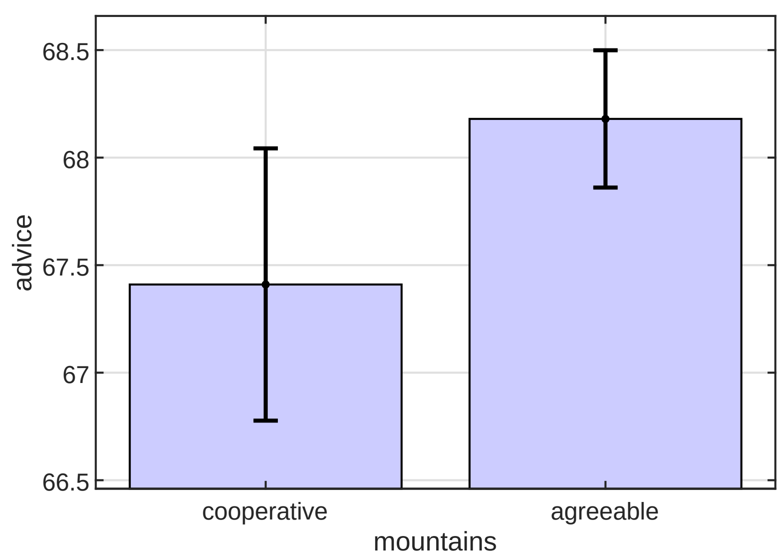
$$t_{crit} = \pm 2.62(df = 118)$$

We fail to reject H_0.

The advice of cooperative mountains (M = 67.41, SD = 2.969) is not significantly different than the advice of agreeable mountains (M = 68.18, SD = 3.1597) t(118) = -1.04, p = 0.3005.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|67.41-68.18|}{3.1266} = 0.25$
This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.25, n = $\frac{(22+98)}{2}$ = 60 and $\alpha = 0.01$ is 0.1100.



4) One tailed t-test for $\rho_1 = \rho_2$

$z_1 = -0.2027$

$z_2 = 0.3205$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{90-3} + \frac{1}{90-3}} = 0.1516$

$z = \frac{-0.2027 - 0.3205}{0.1516} = -3.4512$

$z_{crit} = -2.326$

We reject H_0.

The correlation between the baggage and quantity for iPhones (-0.2) is significantly less than the correlation for economists (0.31), z = -3.4512, p = 0.0003.

5) One tailed t-test for $\rho_1 = \rho_2$

$z_1 = 0.0701$

$z_2 = -0.4356$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{87-3} + \frac{1}{79-3}} = 0.1583$

$z = \frac{0.0701+0.4356}{0.1583} = 3.1946$

$z_{crit} = 1.645$

We reject H_0.

The correlation between the pain threshold and liberty for fingers (0.07) is significantly greater than the correlation for hair styles (-0.41), z = 3.1946, p = 0.0007.

6) Two tailed t-test for ρ =0

$\bar{x} = \frac{3.02}{13} = 0.23$
$\Sigma(X^2) = 0.49 + 0.9409 + ... + 0.5776 = 3.02$
$\Sigma y = 0.16 + 2.03 + ... + 0.14 = 1.03$
$\bar{y} = \frac{1.03}{13} = 0.08$
$\Sigma(Y^2) = 0.0256 + 4.1209 + ... + 0.0196 = 3.02$
$\Sigma xy = 0.112 + 1.9691 + ... - 0.1064 = 2.4498$
$SS_x = (0.7 - 0.23)^2 + (0.97 - 0.23)^2 + (-0.76 - 0.23)^2 = 8.33$
$s_x = \sqrt{\frac{8.3269}{13-1}} = 0.833$
$SS_y = (0.16 - 0.08)^2 + (2.03 - 0.08)^2 + ... + (0.14 - 0.08)^2 = 8.48$
$s_y = \sqrt{\frac{8.4783}{13-1}} = 0.8406$

$$r = \frac{2.4498 - \frac{(3.02)(1.03)}{13}}{\sqrt{\left(9.0284 - \frac{(3.02)^2}{13}\right)\left(8.5599 - \frac{(1.03)^2}{13}\right)}} = 0.26$$

Regression line: $Y' = 0.26(X - 0.23) + 0.08 = 0.26X + 0.02$
$t_{crit} = \pm 3.11(df = 11)$

or $r_{crit} = \pm 0.68$

We fail to reject H_0.

The correlation between machinery and age for smiling Americans is not significantly different than zero, r(11) = 0.26, p = 0.391.

7) Two tailed t-test for ρ =0

$\bar{x} = \frac{3.1}{10} = 0.31$
$\Sigma(X^2) = 0.0289 + 0.0361 + ... + 0.4489 = 3.1$
$\Sigma y = -0.37 + 0.18 - ... - 0.16 = -4.04$
$\bar{y} = \frac{-4.04}{10} = -0.4$
$\Sigma(Y^2) = 0.1369 + 0.0324 + ... + 0.0256 = 3.1$
$\Sigma xy = -0.0629 + 0.0342 - ... - 0.1072 = -7.0368$
$SS_x = (0.17 - 0.31)^2 + (0.19 - 0.31)^2 + ... + (0.67 - 0.31)^2 = 10.17$
$s_x = \sqrt{\frac{10.1716}{10-1}} = 1.0631$
$SS_y = (-0.37 + 0.4)^2 + (0.18 + 0.4)^2 + (-0.16 + 0.4)^2 = 7.41$
$s_y = \sqrt{\frac{7.4144}{10-1}} = 0.9076$

$$r = \frac{-7.0368 - \frac{(3.1)(-4.04)}{10}}{\sqrt{\left(11.1326 - \frac{(3.1)^2}{10}\right)\left(9.0464 - \frac{(-4.04)^2}{10}\right)}} = -0.67$$

$t_{crit} = \pm 2.31 (df = 8)$

or $r_{crit} = \pm 0.63$

We reject H_0.

The correlation between amount and taste for cows is significantly different than zero, r(8) = -0.67, p = 0.034.

8) Two tailed t-test for ρ =0

$\bar{x} = \frac{-0.61}{9} = -0.07$
$\Sigma(X^2) = 0.0625 + 0.0841 + ... + 0.0324 = -0.61$
$\Sigma y = 0.39 - 0.53 + ... - 0.38 = 0.33$
$\bar{y} = \frac{0.33}{9} = 0.04$
$\Sigma(Y^2) = 0.1521 + 0.2809 + ... + 0.1444 = -0.61$
$\Sigma xy = -0.0975 - 0.1537 + ... - 0.0684 = 2.5969$
$SS_x = (-0.25 + 0.07)^2 + (0.29 + 0.07)^2 + ... + (0.18 + 0.07)^2 = 4.05$
$s_x = \sqrt{\frac{4.053}{9-1}} = 0.7118$
$SS_y = (0.39 - 0.04)^2 + (-0.53 - 0.04)^2 + (-0.38 - 0.04)^2 = 4.98$
$s_y = \sqrt{\frac{4.9809}{9-1}} = 0.7891$
$$r = \frac{2.5969 - \frac{(-0.61)(0.33)}{9}}{\sqrt{\left(4.0943 - \frac{(-0.61)^2}{9}\right)\left(4.9929 - \frac{(0.33)^2}{9}\right)}} = 0.58$$
Regression line: $Y' = 0.64(X - -0.07) + 0.04 = 0.64X + 0.08$
$t_{crit} = \pm 2.36 (df = 7)$

or $r_{crit} = \pm 0.67$

We fail to reject H_0.

The correlation between value and chaos for secret teams is not significantly different than zero, r(7) = 0.58, p = 0.1016.

9) Two tailed z-test for one mean

$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{9}{\sqrt{48}} = 1.299$

$z_{obs} = \frac{\bar{x}-\mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(2.09-3)}{1.299} = -0.70$

z_{crit} for $\alpha = 0.01$ (Two tailed) is ± 2.58

We fail to reject H_0.

The rain of permissible fingerprints (M = 2.09) is not significantly different than 3, z=-0.7, p = 0.4839.

10) One tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{0.6882}{\sqrt{37}} = 0.1131$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{8.86 - 9}{0.1131} = -1.2$

df = (n-1) = (37-1) = 36

$t_{crit} = -1.69$

We fail to reject H_0.

The arousal of baseballs (M = 8.86, SD = 0.69) is not significantly less than 9 , t(36) = -1.2, p=0.1193.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|8.86 - 9|}{0.6882} = 0.197$

This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.197, n = 37 and $\alpha = 0.05$ is 0.3136.

11) One tailed t-test for $\rho_1 = \rho_2$

$z_1 = -1.0203$

$z_2 = -0.9076$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{78-3} + \frac{1}{81-3}} = 0.1617$

$z = \frac{-1.0203+0.9076}{0.1617} = -0.697$

$z_{crit} = -1.645$

We fail to reject H_0.

The correlation between the duration and time for elbows (-0.77) is not significantly less than the correlation for beer (-0.72), z = -0.697, p = 0.2429.

12) One tailed independent measures t-test

$s_p = \sqrt{\frac{(47-1)8.0085^2+(15-1)7.9323^2}{(47-1)+(15-1)}} = 7.9908$

$s_{\bar{x}-\bar{y}} = 7.9908\sqrt{\frac{1}{47}+\frac{1}{15}} = 2.3697$

$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{35.22-40.17}{2.3697} = -2.09$

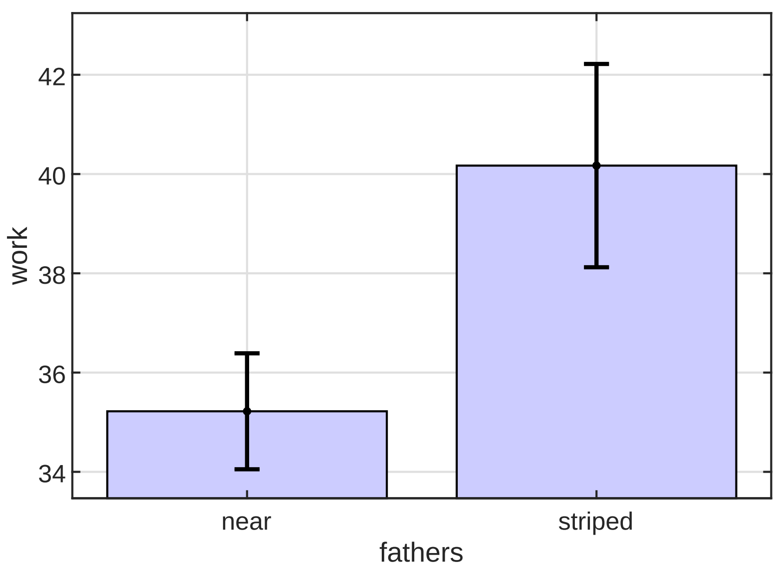
$t_{crit} = -2.39(df = 60)$

We fail to reject H_0.

The work of near fathers (M = 35.22, SD = 8.0085) is not significantly less than the work of striped fathers (M = 40.17, SD = 7.9323) t(60) = -2.09, p = 0.0204.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|35.22-40.17|}{7.9908} = 0.62$
This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.62, n = $\frac{(47+15)}{2}$ = 31 and $\alpha = 0.01$ is 0.5200.



13) χ^2 test for independence

Sums and expected frequencies				
	bananas	hair styles	UW undergraduates	sum
scarce	$\frac{(30)(30)}{86} = 10.4651$	$\frac{(30)(24)}{86} = 8.3721$	$\frac{(30)(32)}{86} = 11.1628$	30
zealous	$\frac{(56)(30)}{86} = 19.5349$	$\frac{(56)(24)}{86} = 15.6279$	$\frac{(56)(32)}{86} = 20.8372$	56
sum	30	24	32	86

$\chi 2 = \frac{(6-10.4651)^2}{10.4651} + \frac{(24-19.5349)^2}{19.5349} + \frac{(7-8.3721)^2}{8.3721} + \frac{(17-15.6279)^2}{15.6279} + \frac{(17-11.1628)^2}{11.1628} + \frac{(15-20.8372)^2}{20.8372} =$

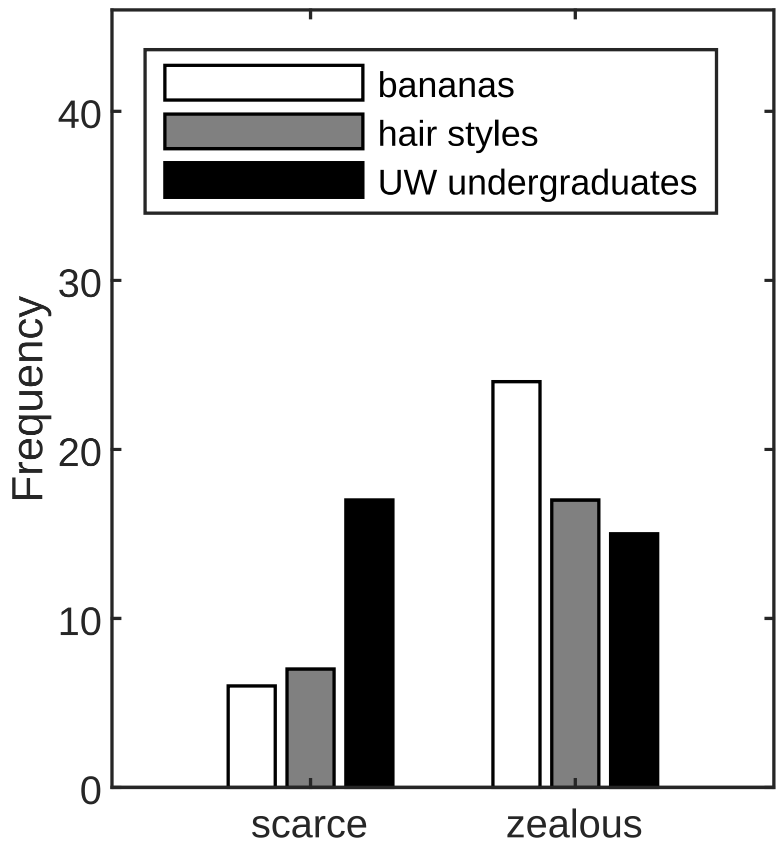
$1.9051 + 1.0206 + 0.2249 + 0.1205 + 3.0524 + 1.6352 = 7.9587$

df = (2-1)(3-1) = 2

$\chi^2_{crit} = 5.99$

We reject H_0.

The bananas, hair styles and UW undergraduates are not distributed independently of the varieties of scarce and zealous, χ^2(2, N=86)=7.9587, p=0.0187.


bananas
hair styles
UW undergraduates
Frequency
0
10
20
30
40
scarce
zealous

14) One tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{2.8256}{\sqrt{31}} = 0.5075$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{54.17 - 55}{0.5075} = -1.64$

df = (n-1) = (31-1) = 30

$t_{crit} = -2.46$

We fail to reject H_0.

The gravity of alike dinosaurs (M = 54.17, SD = 2.83) is not significantly less than 55 , t(30) = -1.64, p=0.0556.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|54.17 - 55|}{2.8256} = 0.2948$

This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.2948, n = 31 and $\alpha = 0.01$ is 0.2105.

15) One tailed z-test for one mean
$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{5}{\sqrt{41}} = 0.7809$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(28.03 - 28)}{0.7809} = 0.04$

z_{crit} for $\alpha = 0.05$ (One tailed) is 1.64

We fail to reject H_0.

The safety of daughters (M = 28.03) is not significantly greater than 28, z=0.04, p = 0.484.

16) One tailed independent measures t-test

$s_p = \sqrt{\frac{(96-1)4.9039^2+(36-1)4.8021^2}{(96-1)+(36-1)}} = 4.8767$

$s_{\bar{x}-\bar{y}} = 4.8767\sqrt{\frac{1}{96} + \frac{1}{36}} = 0.9531$

$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{95.49-96.42}{0.9531} = -0.98$

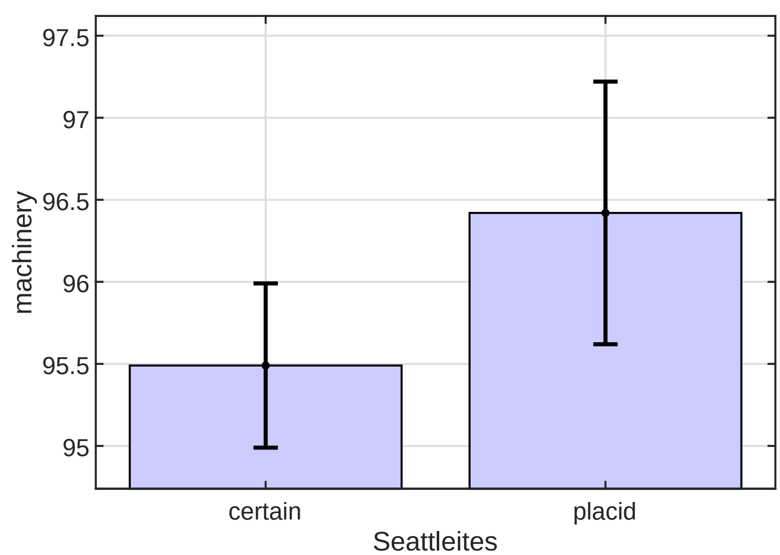
$t_{crit} = -1.66(df = 130)$

We fail to reject H_0.

The machinery of certain Seattleites (M = 95.49, SD = 4.9039) is not significantly less than the machinery of placid Seattleites (M = 96.42, SD = 4.8021) t(130) = -0.98, p = 0.1645.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|95.49-96.42|}{4.8767} = 0.19$
This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.19, n = $\frac{(96+36)}{2}$ = 66 and α = 0.05 is 0.2900.



17) One tailed t-test for ρ =0

$\bar{x} = \frac{-2.05}{21} = -0.1$
$\Sigma(X^2) = 3.24 + 1.8225 + ... + 0.0004 = -2.05$
$\Sigma y = 0.48 - 0.49 - ... + 1.13 = -1.41$
$\bar{y} = \frac{-1.41}{21} = -0.07$
$\Sigma(Y^2) = 0.2304 + 0.2401 + ... + 1.2769 = -2.05$
$\Sigma xy = 0.864 + 0.6615 + ... - 0.0226 = 8.4554$
$SS_x = (1.8 + 0.1)^2 + (-1.35 + 0.1)^2 + (-0.02 + 0.1)^2 = 25.04$
$s_x = \sqrt{\frac{25.0355}{21-1}} = 1.1188$
$SS_y = (0.48 + 0.07)^2 + (-0.49 + 0.07)^2 + ... + (1.13 + 0.07)^2 = 23.61$
$s_y = \sqrt{\frac{23.6148}{21-1}} = 1.0866$

$$r = \frac{8.4554 - \frac{(-2.05)(-1.41)}{21}}{\sqrt{\left(25.2355 - \frac{(-2.05)^2}{21}\right)\left(23.7093 - \frac{(-1.41)^2}{21}\right)}} = 0.34$$

Regression line: $Y' = 0.33(X - -0.1) + -0.07 = 0.33X + -0.04$
$t_{crit} = 1.73(df = 19)$

or $r_{crit} = 0.37$

We fail to reject H_0.

The correlation between cost and recognition for imported psych 315 students is not significantly greater than zero, r(19) = 0.34, p = 0.0658.

18) Two tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{0.3995}{\sqrt{104}} = 0.0392$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{77.12 - 77}{0.0392} = 2.99$

df = (n-1) = (104-1) = 103

$t_{crit} = \pm 2.63$

We reject H_0.

The traffic of vast statistics problems (M = 77.12, SD = 0.4) is significantly different than 77 , t(103) = 2.99, p=0.0035.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|77.12 - 77|}{0.3995} = 0.2934$

This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.2934, n = 104 and $\alpha = 0.01$ is 0.6431.

19) χ^2 test on one dimension

$$\chi 2 = \frac{(36-22.7143)^2}{22.7143} + \frac{(24-22.7143)^2}{22.7143} + \frac{(30-22.7143)^2}{22.7143} + \frac{(15-22.7143)^2}{22.7143} + \frac{(30-22.7143)^2}{22.7143} + \frac{(10-22.7143)^2}{22.7143} + \frac{(14-22.7143)^2}{22.7143} =$$

$7.7709 + 0.0728 + 2.3369 + 2.62 + 2.3369 + 7.1168 + 3.3432 = 25.5975$

χ^2 for each cell						
five	cooperative	irritating	languid	long	well-off	chubby
7.7709	0.0728	2.3369	2.62	2.3369	7.1168	3.3432

df = (7-1) = 6

$\chi^2_{crit} = 16.81$

We reject H_0.

The frequency of 159 web sites is not distributed as expected across the 7 varieties of five, cooperative, irritating, languid, long, well-off and chubby, χ^2(6, N=159)=25.60, p = 0.0003.

20) One tailed independent measures t-test

$$s_p = \sqrt{\frac{(20-1)6.2959^2+(66-1)6.8945^2}{(20-1)+(66-1)}} = 6.7637$$

$$s_{\bar{x}-\bar{y}} = 6.7637\sqrt{\frac{1}{20}+\frac{1}{66}} = 1.7264$$

$$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{91.48-91.55}{1.7264} = -0.04$$

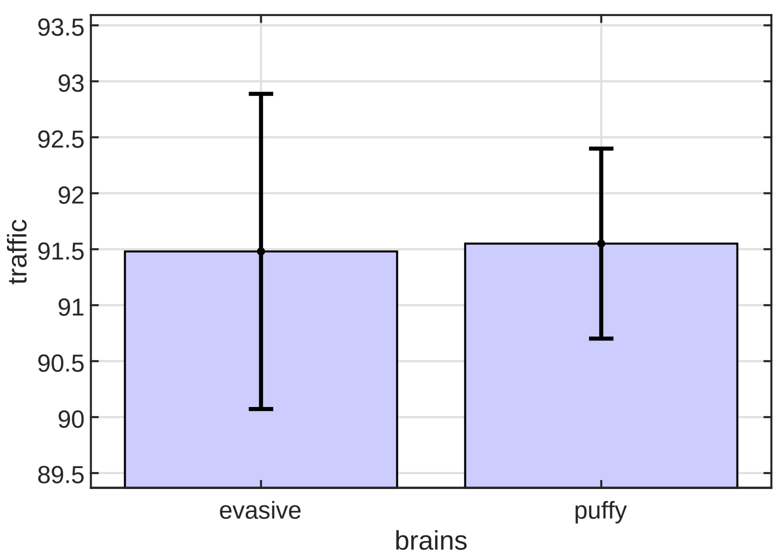
$$t_{crit} = -2.37(df = 84)$$

We fail to reject H_0.

The traffic of evasive brains (M = 91.48, SD = 6.2959) is not significantly less than the traffic of puffy brains (M = 91.55, SD = 6.8945) t(84) = -0.04, p = 0.4841.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|91.48-91.55|}{6.7637} = 0.01$
This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.01, n = $\frac{(20+66)}{2}$ = 43 and $\alpha = 0.01$ is 0.0100.



21) One tailed t-test for ρ =0

$t = 0.3178$
$t_{crit} = 1.81 (df = 10)$

or $r_{crit} = 0.50$

We fail to reject H_0.

The correlation between softness and speed for monkeys is not significantly greater than zero, r(10) = 0.1, p = 0.3786.

22) Two tailed repeated measures t-test

$s_{\bar{D}} = \frac{15.2095}{\sqrt{30}} = 2.78$

df = 30-1 = 29

$t = \frac{3.19}{2.78} = 1.1475$

$t_{crit} = \pm 2.76$

We fail to reject H_0.

The test scores of nauseating fingerprints (M = 86.41, SD = 10.1872) is not significantly different than the test scores of ordinary fingerprints (M=89.6, SD = 7.9889), t(29) = 1.1475, p = 0.2606.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{3.19}{15.2095} = 0.21$ This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.21, n = 30 and $\alpha = 0.01$ is 0.0598.

23) χ^2 test for independence

Sums and expected frequencies			
	dollars	friends	sum
gleaming	$\frac{(14)(38)}{81} = 6.5679$	$\frac{(14)(43)}{81} = 7.4321$	14
six	$\frac{(28)(38)}{81} = 13.1358$	$\frac{(28)(43)}{81} = 14.8642$	28
puzzled	$\frac{(39)(38)}{81} = 18.2963$	$\frac{(39)(43)}{81} = 20.7037$	39
sum	38	43	81

$\chi 2 = \frac{(8-6.5679)^2}{6.5679} + \frac{(15-13.1358)^2}{13.1358} + \frac{(15-18.2963)^2}{18.2963} + \frac{(6-7.4321)^2}{7.4321} + \frac{(13-14.8642)^2}{14.8642} + \frac{(24-20.7037)^2}{20.7037} =$

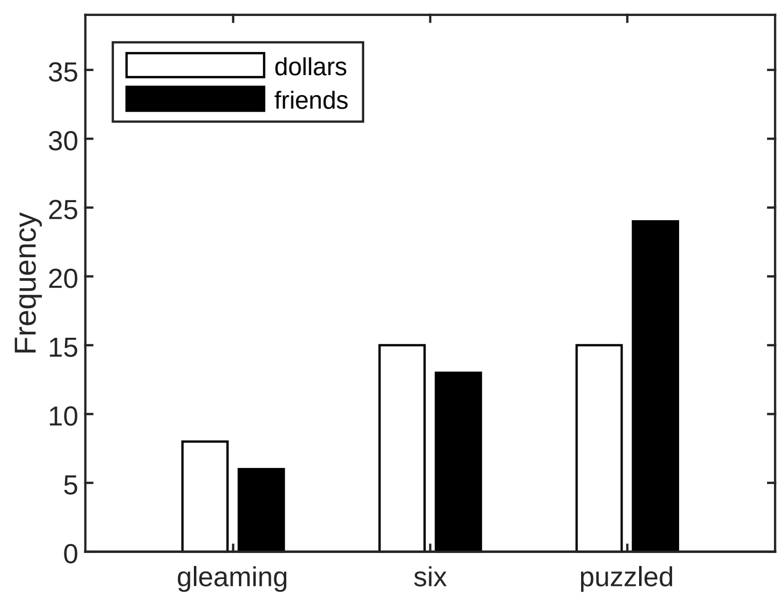
$0.3123 + 0.2646 + 0.5939 + 0.276 + 0.2338 + 0.5248 = 2.2054$

df = (3-1)(2-1) = 2

$\chi^2_{crit} = 5.99$

We fail to reject H_0.

The dollars and friends are distributed independently of the varieties of gleaming, six and puzzled, χ^2(2, N=81)=2.2054, p=0.332.



24) One tailed repeated measures t-test

$s_{\bar{D}} = \frac{11.5985}{\sqrt{9}} = 3.87$

df = 9-1 = 8

$t = \frac{-4}{3.87} = -1.0336$

$t_{crit} = -1.86$

We fail to reject H_0.

The jewelry of gifted laboratory rats (M = 57.34, SD = 13.6834) is not significantly greater than the jewelry of political laboratory rats (M=53.34, SD = 5.6786), t(8) = -1.0336, p = 0.1658.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{-4}{11.5985} = 0.34$ This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.34, n = 9 and α = 0.05 is 0.2128.

25) χ^2 test for independence

Sums and expected frequencies				
	Americans	bus riders	telephones	sum
repulsive	$\frac{(65)(44)}{131} =$ 21.8321	$\frac{(65)(38)}{131} =$ 18.855	$\frac{(65)(49)}{131} =$ 24.313	65
gigantic	$\frac{(66)(44)}{131} =$ 22.1679	$\frac{(66)(38)}{131} =$ 19.145	$\frac{(66)(49)}{131} =$ 24.687	66
sum	44	38	49	131

$\chi 2 = \frac{(19-21.8321)^2}{21.8321} + \frac{(25-22.1679)^2}{22.1679} + \frac{(16-18.855)^2}{18.855} + \frac{(22-19.145)^2}{19.145} + \frac{(30-24.313)^2}{24.313} + \frac{(19-24.687)^2}{24.687} =$

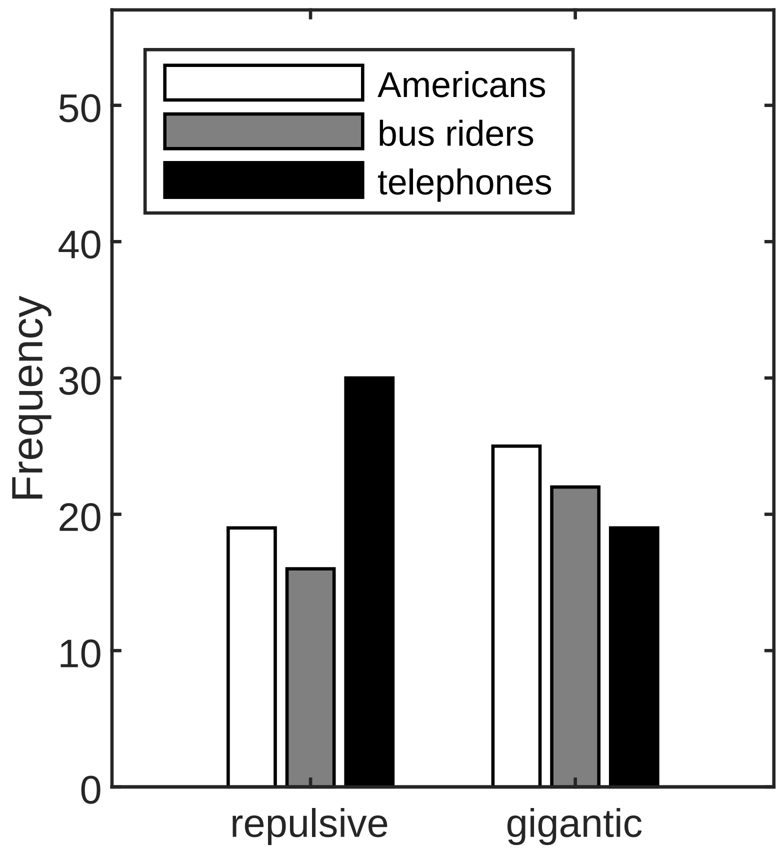
$0.3674 + 0.3618 + 0.4323 + 0.4258 + 1.3302 + 1.3101 = 4.2276$

df = (2-1)(3-1) = 2

$\chi^2_{crit} = 9.21$

We fail to reject H_0.

The Americans, bus riders and telephones are distributed independently of the varieties of repulsive and gigantic, χ^2(2, N=131)=4.2276, p=0.1208.


Americans
bus riders
telephones
Frequency
0
10
20
30
40
50
repulsive
gigantic

26) Two tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{5.3657}{\sqrt{45}} = 0.7999$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{54.46 - 53}{0.7999} = 1.82$

df = (n-1) = (45-1) = 44

$t_{crit} = \pm 2.02$

We fail to reject H_0.

The scenery of sponges (M = 54.46, SD = 5.37) is not significantly different than 53 , t(44) = 1.82, p=0.0749.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|54.46 - 53|}{5.3657} = 0.272$

This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.272, n = 45 and $\alpha = 0.05$ is 0.4250.

27) One tailed repeated measures t-test

$s_{\bar{D}} = \frac{10.9679}{\sqrt{49}} = 1.57$

df = 49-1 = 48

$t = \frac{-0.36}{1.57} = -0.2293$

$t_{crit} = -2.41$

We fail to reject H_0.

The leisure of wet bananas (M = 20.42, SD = 7.9326) is not significantly greater than the leisure of reminiscent bananas (M=20.07, SD = 7.2153), t(48) = -0.2293, p = 0.4098.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{-0.36}{10.9679} = 0.03$ This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.03, n = 49 and $\alpha = 0.01$ is 0.0165.

28) Two tailed z-test for one mean
$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{10}{\sqrt{56}} = 1.3363$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(29.3 - 26)}{1.3363} = 2.47$

z_{crit} for $\alpha = 0.05$ (Two tailed) is ± 1.96

We reject H_0.

The soap of common republicans (M = 29.3) is significantly different than 26, z=2.47, p = 0.0135.

29) One tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{5.8519}{\sqrt{55}} = 0.7891$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{99.26 - 102}{0.7891} = -3.47$

df = (n-1) = (55-1) = 54

$t_{crit} = -1.67$

We reject H_0.

The conductivity of bananas (M = 99.26, SD = 5.85) is significantly less than 102 , t(54) = -3.47, p=0.0005.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|99.26 - 102|}{5.8519} = 0.4674$

This is a medium effect size.

The observed power for one tailed test with an effect size of d = 0.4674, n = 55 and $\alpha = 0.05$ is 0.9607.

30) χ^2 test for independence

Sums and expected frequencies			
	personality disorders	eggs	sum
panicky	$\frac{(53)(87)}{152} = 30.3355$	$\frac{(53)(65)}{152} = 22.6645$	53
eager	$\frac{(34)(87)}{152} = 19.4605$	$\frac{(34)(65)}{152} = 14.5395$	34
stable	$\frac{(65)(87)}{152} = 37.2039$	$\frac{(65)(65)}{152} = 27.7961$	65
sum	87	65	152

$$\chi 2 = \frac{(27-30.3355)^2}{30.3355} + \frac{(27-19.4605)^2}{19.4605} + \frac{(33-37.2039)^2}{37.2039} + \frac{(26-22.6645)^2}{22.6645} + \frac{(7-14.5395)^2}{14.5395} + \frac{(32-27.7961)^2}{27.7961} =$$

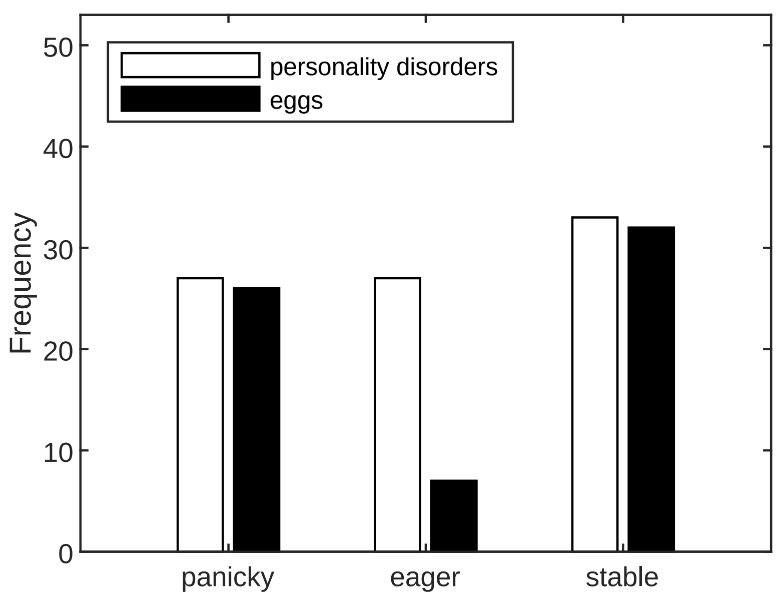
$0.3668 + 2.921 + 0.475 + 0.4909 + 3.9096 + 0.6358 = 8.7991$

df = (3-1)(2-1) = 2

$\chi^2_{crit} = 5.99$

We reject H_0.

The personality disorders and eggs are not distributed independently of the varieties of panicky, eager and stable, χ^2(2, N=152)=8.7991, p=0.0123.



31) 1-factor ANOVA

$MS_{bet} = \frac{8082.8095}{5} = 1616.5619$

$SS_w = SS_{total} - SS_{bet} = 103619 - 8082.81 = 95535.4$

$MS_w = \frac{95535.4055}{132} = 723.75$

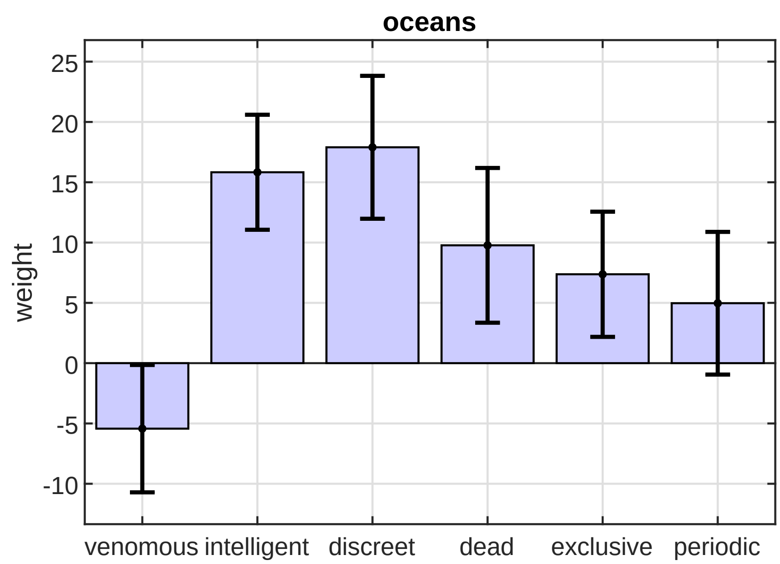
$F = \frac{1616.5619}{723.7531} = 2.23$

$F_{crit} = 2.29$ (with $df_{bet} = 5$, $df_w = 125$ and $\alpha = 0.05$)

	SS	df	MS	F	F_{crit}	p-value
Between	8082.8095	5	1616.5619	2.2336	2.29	0.0546
Within	95535.4055	132	723.7531			
Total	103619.18	137				

We fail to reject H_0.

There is not a significant difference in mean weight across the 6 groups of oceans, F(5,132) = 2.23, p = 0.0546.



32) Two tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{8.9882}{\sqrt{81}} = 0.9987$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{49.39 - 46}{0.9987} = 3.4$

df = (n-1) = (81-1) = 80

$t_{crit} = \pm 1.99$

We reject H_0.

The softness of neurons (M = 49.39, SD = 8.99) is significantly different than 46 , t(80) = 3.4, p=0.0011.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|49.39 - 46|}{8.9882} = 0.3775$

This is a medium effect size.

The observed power for two tailed test with an effect size of d = 0.3775, n = 81 and $\alpha = 0.05$ is 0.9184.

33) Two tailed repeated measures t-test

$s_{\bar{D}} = \frac{3.4729}{\sqrt{51}} = 0.49$

df = 51-1 = 50

$t = \frac{0.84}{0.49} = 1.7143$

$t_{crit} = \pm 2.01$

We fail to reject H_0.

The soap of weary sponges (M = 19.47, SD = 2.7847) is not significantly different than the soap of gabby sponges (M=20.32, SD = 2.186), t(50) = 1.7143, p = 0.0927.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{0.84}{3.4729} = 0.24$ This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.24, n = 51 and $\alpha = 0.05$ is 0.3850.

34) Two tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{8.1161}{\sqrt{57}} = 1.075$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{30.92 - 27}{1.075} = 3.65$

df = (n-1) = (57-1) = 56

$t_{crit} = \pm 2.00$

We reject H_0.

The taste of apartments (M = 30.92, SD = 8.12) is significantly different than 27 , t(56) = 3.65, p=0.0006.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|30.92 - 27|}{8.1161} = 0.4831$

This is a medium effect size.

The observed power for two tailed test with an effect size of d = 0.4831, n = 57 and $\alpha = 0.05$ is 0.9471.

35) One tailed z-test for one mean
$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{10}{\sqrt{97}} = 1.0153$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(3.77-1)}{1.0153} = 2.73$

z_{crit} for $\alpha = 0.05$ (One tailed) is 1.64

We reject H_0.

The price of fathers (M = 3.77) is significantly greater than 1, z=2.73, p = 0.0032.

36) χ^2 test for independence

Sums and expected frequencies			
	cell phones	monkeys	sum
bright	$\frac{(43)(42)}{75} = 24.08$	$\frac{(43)(33)}{75} = 18.92$	43
blue	$\frac{(32)(42)}{75} = 17.92$	$\frac{(32)(33)}{75} = 14.08$	32
sum	42	33	75

$\chi 2 = \frac{(26-24.08)^2}{24.08} + \frac{(16-17.92)^2}{17.92} + \frac{(17-18.92)^2}{18.92} + \frac{(16-14.08)^2}{14.08} =$

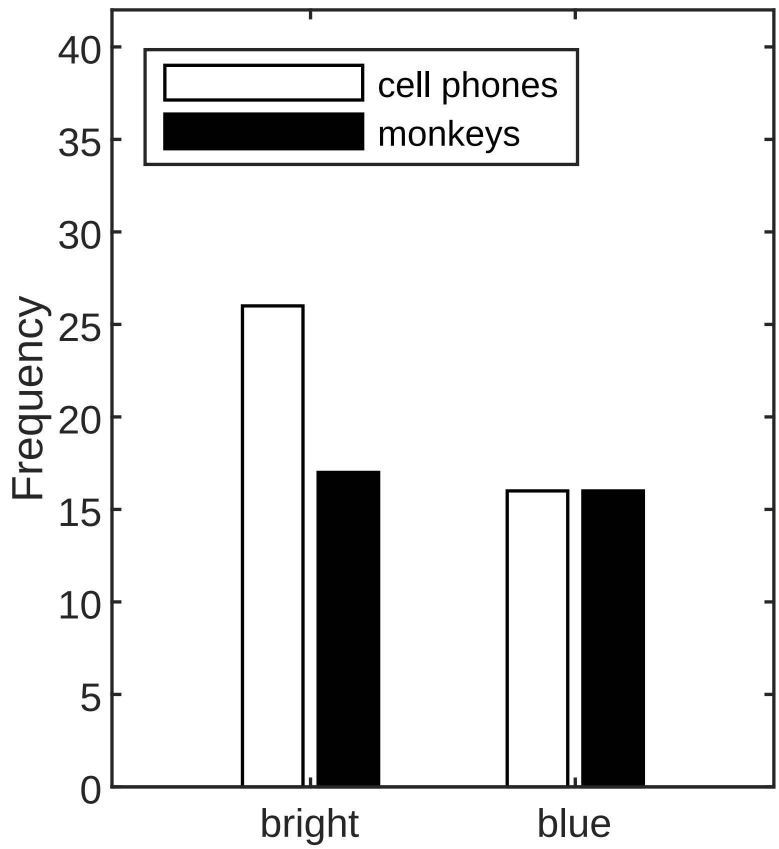
$0.1531 + 0.2057 + 0.1948 + 0.2618 = 0.8154$

df = (2-1)(2-1) = 1

$\chi^2_{crit} = 3.84$

We fail to reject H_0.

The cell phones and monkeys are distributed independently of the varieties of bright and blue, χ^2(1, N=75)=0.8154, p=0.3665.


cell phones
monkeys
Frequency
40
35
30
25
20
15
10
5
0
bright
blue

37) Two tailed t-test for $\rho_1 = \rho_2$

$z_1 = -0.0701$

$z_2 = -0.7089$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{71-3} + \frac{1}{89-3}} = 0.1623$

$z = \frac{-0.0701+0.7089}{0.1623} = 3.9359$

$z_{crit} = \pm 2.576$

We reject H_0.

The correlation between the response time and happiness for grandmothers (-0.07) is significantly different than the correlation for computers (-0.61), z = 3.9359, p = 0.0001.

38) One tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{5.863}{\sqrt{51}} = 0.821$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{92.24-91}{0.821} = 1.51$

df = (n-1) = (51-1) = 50

$t_{crit} = 1.68$

We fail to reject H_0.

The work of monkeys (M = 92.24, SD = 5.86) is not significantly greater than 91 , t(50) = 1.51, p=0.0687.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|92.24-91|}{5.863} = 0.2114$

This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.2114, n = 51 and $\alpha = 0.05$ is 0.4343.

39) Two tailed z-test for one mean

$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{2}{\sqrt{9}} = 0.6667$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(27.65 - 27)}{0.6667} = 0.97$

z_{crit} for $\alpha = 0.05$ (Two tailed) is ± 1.96

We fail to reject H_0.

The information of balloons (M = 27.65) is not significantly different than 27, z=0.97, p = 0.332.

40) 1-factor ANOVA

$MS_{bet} = \frac{2010.824}{3} = 670.2747$

$SS_w = SS_{total} - SS_{bet} = 15316.9 - 2010.82 = 13306.7$

$MS_w = \frac{13306.7474}{45} = 295.71$

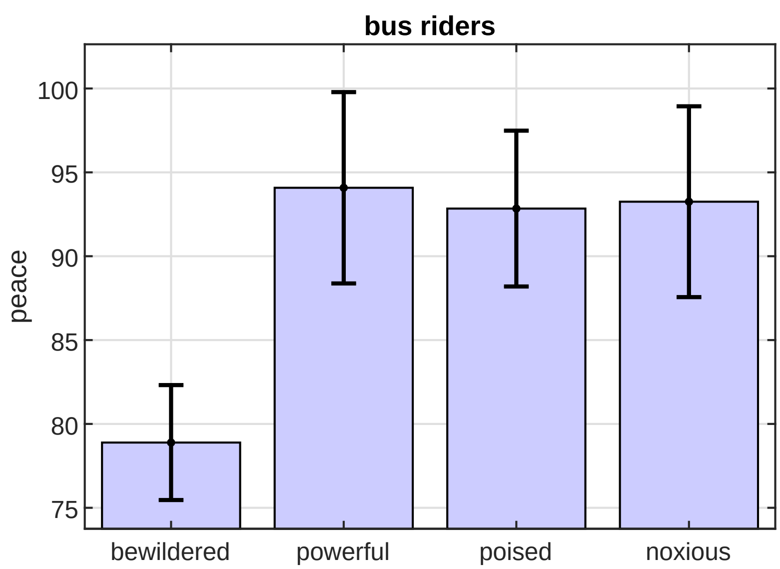
$F = \frac{670.2747}{295.7055} = 2.27$

$F_{crit} = 2.82$ (with $df_{bet} = 3$, $df_w = 44$ and $\alpha = 0.05$)

	SS	df	MS	F	F_{crit}	p-value
Between	2010.824	3	670.2747	2.2667	2.82	0.0936
Within	13306.7474	45	295.7055			
Total	15316.8755	48				

We fail to reject H_0.

There is not a significant difference in mean peace across the 4 groups of bus riders, F(3,45) = 2.27, p = 0.0936.



41) One tailed independent measures t-test

$s_p = \sqrt{\frac{(86-1)7.8515^2+(98-1)8.8517^2}{(86-1)+(98-1)}} = 8.3994$

$s_{\bar{x}-\bar{y}} = 8.3994\sqrt{\frac{1}{86}+\frac{1}{98}} = 1.2411$

$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{56.4-56.59}{1.2411} = -0.15$

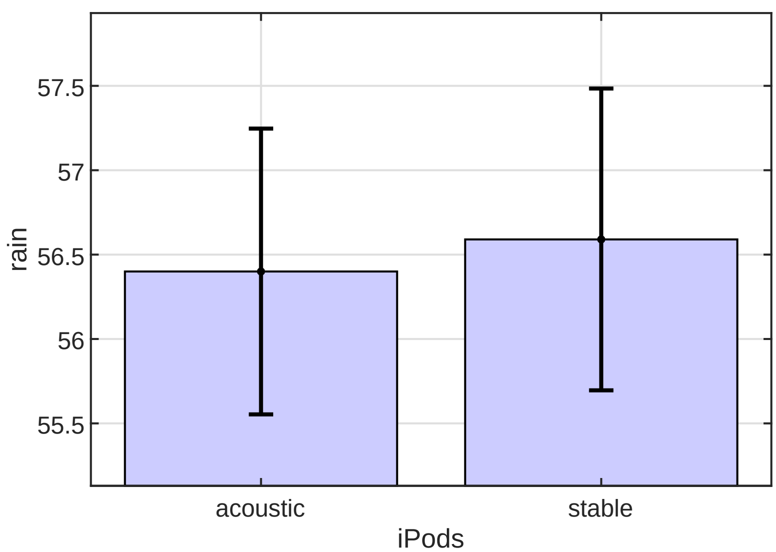
$t_{crit} = -1.65(df = 182)$

We fail to reject H_0.

The rain of acoustic iPods (M = 56.4, SD = 7.8515) is not significantly less than the rain of stable iPods (M = 56.59, SD = 8.8517) t(182) = -0.15, p = 0.4405.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|56.4-56.59|}{8.3994} = 0.02$
This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.02, n = $\frac{(86+98)}{2}$ = 92 and $\alpha = 0.05$ is 0.0700.



42) One tailed repeated measures t-test

$s_{\bar{D}} = \frac{11.808}{\sqrt{15}} = 3.05$

df = 15-1 = 14

$t = \frac{1.31}{3.05} = 0.4295$

$t_{crit} = 2.62$

We fail to reject H_0.

The time of pretty eggs (M = 9.16, SD = 8.8958) is not significantly less than the time of protective eggs (M=10.47, SD = 6.8086), t(14) = 0.4295, p = 0.337.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{1.31}{11.808} = 0.11$ This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.11, n = 15 and $\alpha = 0.01$ is 0.0226.

43) 1-factor ANOVA

$MS_{bet} = \frac{370.5163}{1} = 370.5163$

$SS_w = SS_{total} - SS_{bet} = 5839.42 - 370.516 = 5469.28$

$MS_w = \frac{5469.2801}{24} = 227.89$

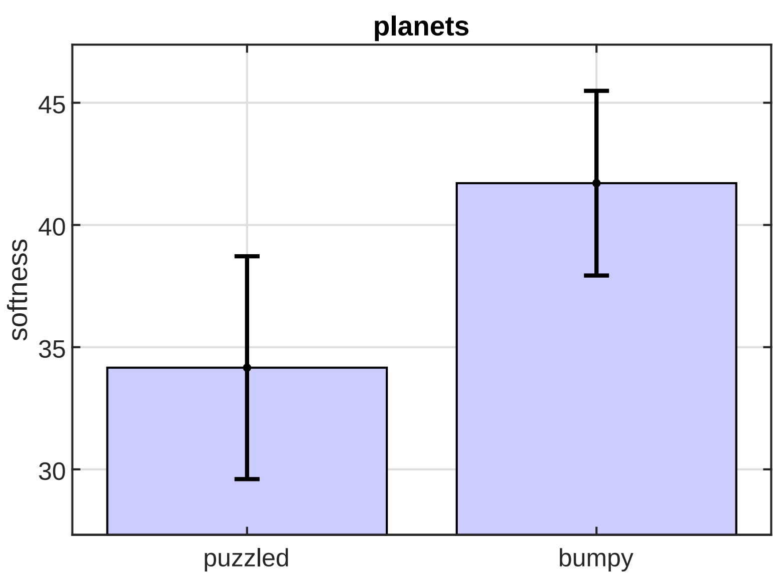
$F = \frac{370.5163}{227.8867} = 1.63$

$F_{crit} = 7.82$ (with $df_{bet} = 1$, $df_w = 24$ and $\alpha = 0.01$)

	SS	df	MS	F	F_{crit}	p-value
Between	370.5163	1	370.5163	1.6259	7.82	0.2145
Within	5469.2801	24	227.8867			
Total	5839.4188	25				

We fail to reject H_0.

There is not a significant difference in mean softness across the 2 groups of planets, F(1,24) = 1.63, p = 0.2145.



44) Two tailed t-test for $\rho_1 = \rho_2$

$z_1 = 1.589$

$z_2 = 0.7753$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{34-3} + \frac{1}{78-3}} = 0.2135$

$z = \frac{1.589 - 0.7753}{0.2135} = 3.8112$

$z_{crit} = \pm 2.576$

We reject H_0.

The correlation between the pain threshold and equipment for ping pong balls (0.92) is significantly different than the correlation for psychologists (0.65), z = 3.8112, p = 0.0001.

45) 1-factor ANOVA

$MS_{bet} = \frac{2764.9213}{4} = 691.2303$

$SS_w = SS_{total} - SS_{bet} = 25696.7 - 2764.92 = 22931.6$

$MS_w = \frac{22931.5729}{75} = 305.75$

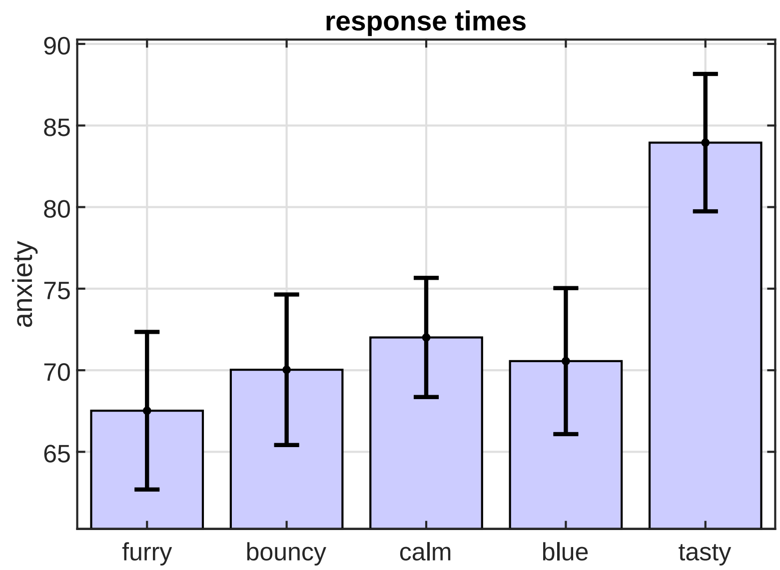
$F = \frac{691.2303}{305.7543} = 2.26$

$F_{crit} = 3.60$ (with $df_{bet} = 4$, $df_w = 70$ and $\alpha = 0.01$)

	SS	df	MS	F	F_{crit}	p-value
Between	2764.9213	4	691.2303	2.2607	3.6	0.0705
Within	22931.5729	75	305.7543			
Total	25696.7155	79				

We fail to reject H_0.

There is not a significant difference in mean anxiety across the 5 groups of response times, F(4,75) = 2.26, p = 0.0705.



46) 1-factor ANOVA

$MS_{bet} = \frac{2390.6003}{5} = 478.1201$

$SS_w = SS_{total} - SS_{bet} = 75984 - 2390.6 = 73592.8$

$MS_w = \frac{73592.7743}{156} = 471.75$

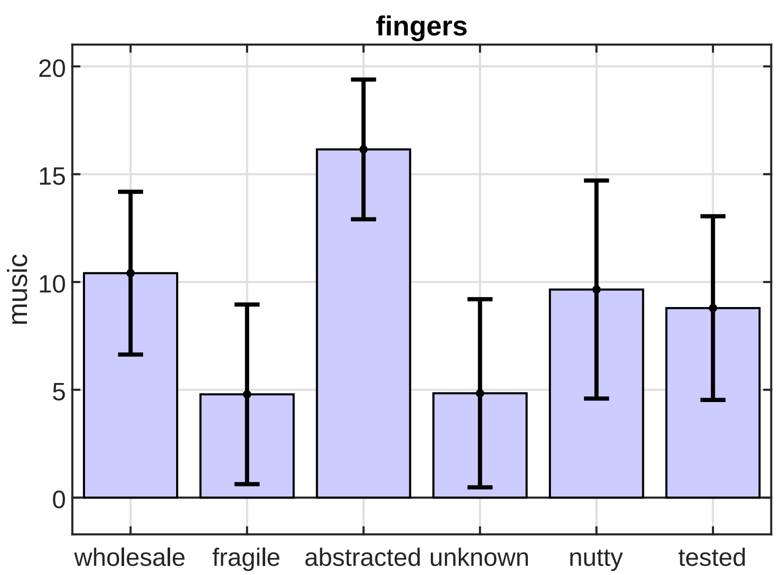
$F = \frac{478.1201}{471.7486} = 1.01$

$F_{crit} = 3.14$ (with $df_{bet} = 5$, $df_w = 150$ and $\alpha = 0.01$)

	SS	df	MS	F	F_{crit}	p-value
Between	2390.6003	5	478.1201	1.0135	3.14	0.4117
Within	73592.7743	156	471.7486			
Total	75984.005	161				

We fail to reject H_0.

There is not a significant difference in mean music across the 6 groups of fingers, F(5,156) = 1.01, p = 0.4117.



47) χ^2 test on one dimension

$$\chi 2 = \frac{(43-36.3333)^2}{36.3333} + \frac{(31-36.3333)^2}{36.3333} + \frac{(35-36.3333)^2}{36.3333} =$$

$1.2233 + 0.7829 + 0.0489 = 2.0551$

χ^2 for each cell		
inexpensive	short	jolly
1.2233	0.7829	0.0489

df = (3-1) = 2

$\chi^2_{crit} = 5.99$

We fail to reject H_0.

The frequency of 109 iPhones is distributed as expected across the 3 varieties of inexpensive, short and jolly, χ^2(2, N=109)= 2.06, p = 0.357.

48) χ^2 test on one dimension

$$\chi 2 = \frac{(36-26.5)^2}{26.5} + \frac{(29-26.5)^2}{26.5} + \frac{(13-26.5)^2}{26.5} + \frac{(28-26.5)^2}{26.5} =$$

$3.4057 + 0.2358 + 6.8774 + 0.0849 = 10.6038$

χ^2 for each cell			
undesirable	certain	mountainous	energetic
3.4057	0.2358	6.8774	0.0849

df = (4-1) = 3

$\chi^2_{crit} = 11.34$

We fail to reject H_0.

The frequency of 106 monkeys is distributed as expected across the 4 varieties of undesirable, certain, mountainous and energetic, χ^2(3, N=106)=10.60, p = 0.0141.

49) Two tailed repeated measures t-test

$s_{\bar{D}} = \frac{8.9176}{\sqrt{59}} = 1.16$

df = 59-1 = 58

$t = \frac{1.78}{1.16} = 1.5345$

$t_{crit} = \pm 2.00$

We fail to reject H_0.

The progress of sleepy personalities (M = 22.75, SD = 7.2355) is not significantly different than the progress of royal personalities (M=24.54, SD = 6.6015), t(58) = 1.5345, p = 0.1303.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{1.78}{8.9176} = 0.2$ This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.2, n = 59 and α = 0.05 is 0.3221.

50) χ^2 test for independence

Sums and expected frequencies				
	interest rates	oceans	grandmothers	sum
stingy	$\frac{(41)(29)}{110} = 10.8091$	$\frac{(41)(39)}{110} = 14.5364$	$\frac{(41)(42)}{110} = 15.6545$	41
uptight	$\frac{(69)(29)}{110} = 18.1909$	$\frac{(69)(39)}{110} = 24.4636$	$\frac{(69)(42)}{110} = 26.3455$	69
sum	29	39	42	110

$$\chi 2 = \frac{(6-10.8091)^2}{10.8091} + \frac{(23-18.1909)^2}{18.1909} + \frac{(20-14.5364)^2}{14.5364} + \frac{(19-24.4636)^2}{24.4636} + \frac{(15-15.6545)^2}{15.6545} + \frac{(27-26.3455)^2}{26.3455} =$$

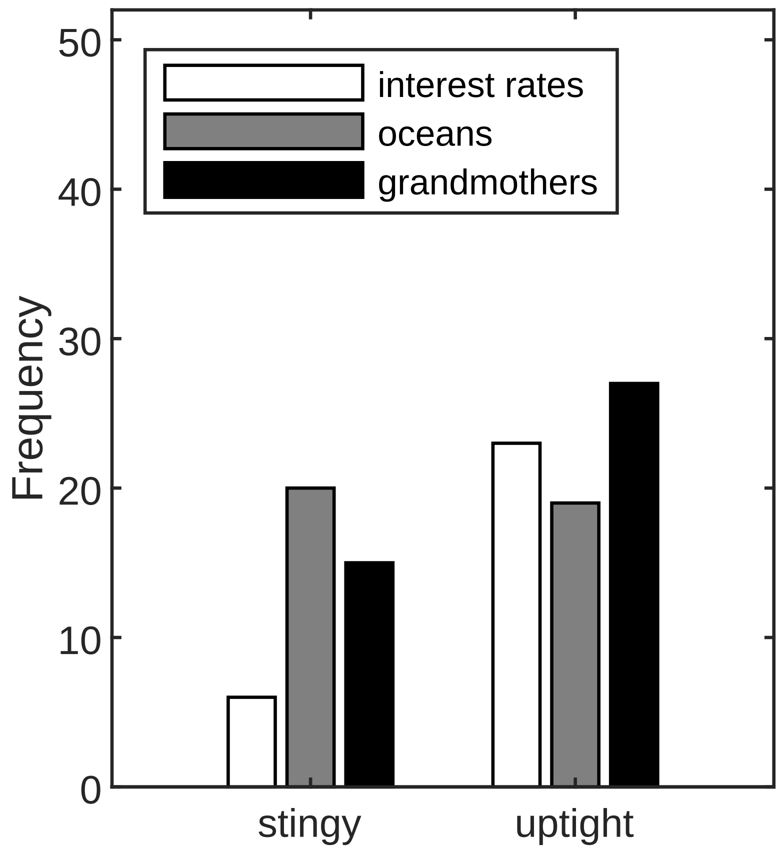
$2.1396 + 1.2714 + 2.0535 + 1.2202 + 0.0274 + 0.0163 = 6.7284$

df = (2-1)(3-1) = 2

$\chi^2_{crit} = 5.99$

We reject H_0.

The interest rates, oceans and grandmothers are not distributed independently of the varieties of stingy and uptight, χ^2(2, N=110)=6.7284, p=0.0346.



interest rates
oceans
grandmothers
Frequency
0
10
20
30
40
50
stingy
uptight

51) 1-factor ANOVA

$MS_{bet} = \frac{825.5374}{4} = 206.3844$

$SS_w = SS_{total} - SS_{bet} = 4606.08 - 825.537 = 3780.8$

$MS_w = \frac{3780.7987}{116} = 32.59$

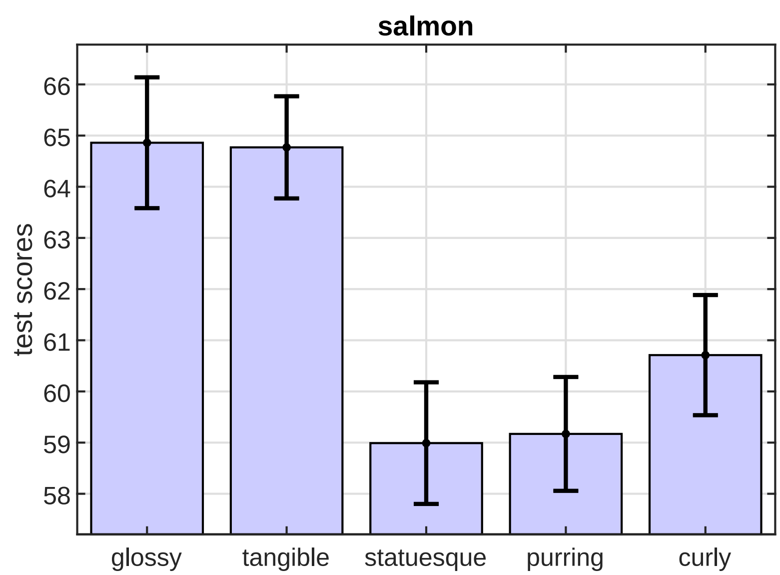
$F = \frac{206.3844}{32.5931} = 6.33$

$F_{crit} = 2.46$ (with $df_{bet} = 4$, $df_w = 100$ and $\alpha = 0.05$)

	SS	df	MS	F	F_{crit}	p-value
Between	825.5374	4	206.3844	6.3322	2.46	0.0001
Within	3780.7987	116	32.5931			
Total	4606.0788	120				

We reject H_0.

There is a significant difference in mean test scores across the 5 groups of salmon, F(4,116) = 6.33, p = 0.0001.



52) χ^2 test on one dimension

$$\chi 2 = \frac{(17-27.8)^2}{27.8} + \frac{(26-27.8)^2}{27.8} + \frac{(35-27.8)^2}{27.8} + \frac{(29-27.8)^2}{27.8} + \frac{(32-27.8)^2}{27.8} =$$

$4.1957 + 0.1165 + 1.8647 + 0.0518 + 0.6345 = 6.8632$

χ^2 for each cell				
melodic	gentle	heartbreaking	spiteful	wrong
4.1957	0.1165	1.8647	0.0518	0.6345

df = (5-1) = 4

$\chi^2_{crit} = 9.49$

We fail to reject H_0.

The frequency of 139 colors is distributed as expected across the 5 varieties of melodic, gentle, heartbreaking, spiteful and wrong, χ^2(4, N=139)= 6.86, p = 0.1435.

53) Two tailed t-test for $\rho_1 = \rho_2$

$z_1 = -0.2554$

$z_2 = 0.3884$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{72-3} + \frac{1}{23-3}} = 0.254$

$z = \frac{-0.2554 - 0.3884}{0.254} = -2.5346$

$z_{crit} = \pm 2.576$

We fail to reject H_0.

The correlation between the information and smell for Asian food (-0.25) is not significantly different than the correlation for baby names (0.37), z = -2.5346, p = 0.0113.

54) 1-factor ANOVA

$MS_{bet} = \frac{2850.4912}{5} = 570.0982$

$SS_w = SS_{total} - SS_{bet} = 28235 - 2850.49 = 25384.8$

$MS_w = \frac{25384.8175}{58} = 437.67$

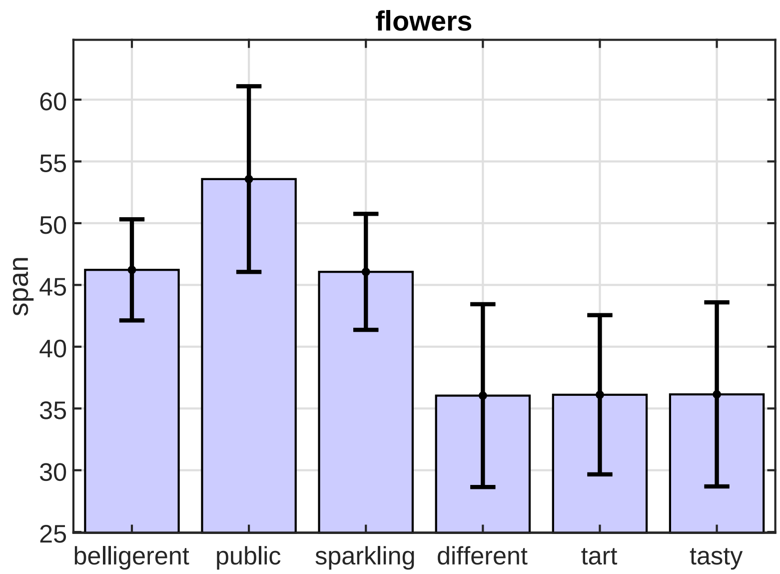
$F = \frac{570.0982}{437.6693} = 1.3$

$F_{crit} = 2.38$ (with $df_{bet} = 5$, $df_w = 55$ and $\alpha = 0.05$)

	SS	df	MS	F	F_{crit}	p-value
Between	2850.4912	5	570.0982	1.3026	2.38	0.2755
Within	25384.8175	58	437.6693			
Total	28235.0348	63				

We fail to reject H_0.

There is not a significant difference in mean span across the 6 groups of flowers, F(5,58) = 1.3, p = 0.2755.



55) One tailed z-test for one mean
$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{4}{\sqrt{96}} = 0.4082$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(65.17 - 66)}{0.4082} = -2.03$

z_{crit} for $\alpha = 0.05$ (One tailed) is -1.64

We reject H_0.

The farts of fingerprints (M = 65.17) is significantly less than 66, z=-2.03, p = 0.0212.

56) Two tailed independent measures t-test

$$s_p = \sqrt{\frac{(26-1)11.068^2+(32-1)9.4327^2}{(26-1)+(32-1)}} = 10.1952$$

$$s_{\bar{x}-\bar{y}} = 10.1952\sqrt{\frac{1}{26}+\frac{1}{32}} = 2.6918$$

$$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{82.14-76.98}{2.6918} = 1.92$$

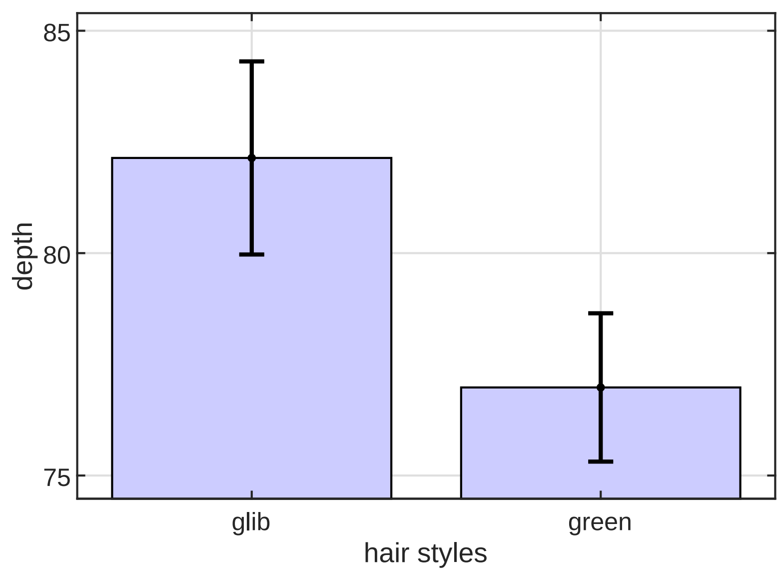
$$t_{crit} = \pm 2.00 (df = 56)$$

We fail to reject H_0.

The depth of glib hair styles (M = 82.14, SD = 11.068) is not significantly different than the depth of green hair styles (M = 76.98, SD = 9.4327) t(56) = 1.92, p = 0.06.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|82.14-76.98|}{10.1952} = 0.51$
This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.51, n = $\frac{(26+32)}{2}$ = 29 and $\alpha = 0.05$ is 0.4800.



57) Two tailed independent measures t-test

$$s_p = \sqrt{\frac{(20-1)5.7426^2+(108-1)5.2567^2}{(20-1)+(108-1)}} = 5.3328$$

$$s_{\bar{x}-\bar{y}} = 5.3328\sqrt{\frac{1}{20}+\frac{1}{108}} = 1.2982$$

$$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{69.43-67.44}{1.2982} = 1.53$$

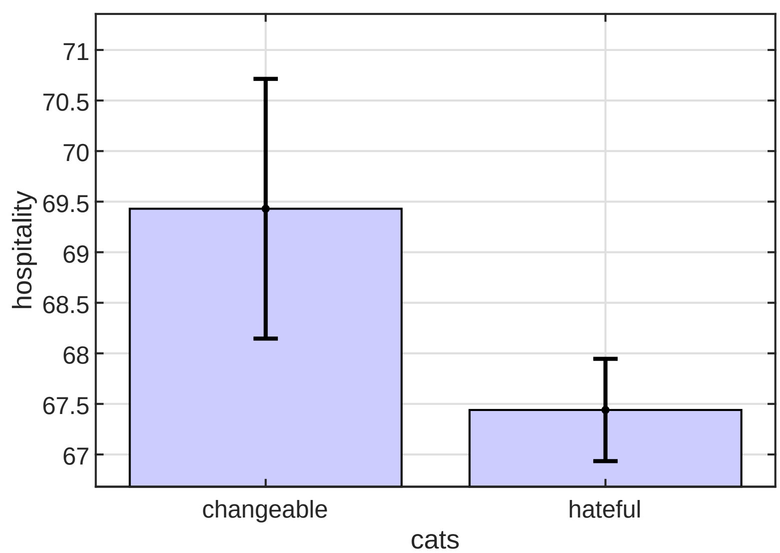
$$t_{crit} = \pm 2.62(df = 126)$$

We fail to reject H_0.

The hospitality of changeable cats (M = 69.43, SD = 5.7426) is not significantly different than the hospitality of hateful cats (M = 67.44, SD = 5.2567) t(126) = 1.53, p = 0.1285.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|69.43-67.44|}{5.3328} = 0.37$
This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.37, n = $\frac{(20+108)}{2}$ = 64 and α = 0.01 is 0.3000.



58) One tailed independent measures t-test

$s_p = \sqrt{\frac{(27-1)4.3358^2+(75-1)3.9223^2}{(27-1)+(75-1)}} = 4.0339$

$s_{\bar{x}-\bar{y}} = 4.0339\sqrt{\frac{1}{27}+\frac{1}{75}} = 0.9053$

$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{24.36-26.21}{0.9053} = -2.04$

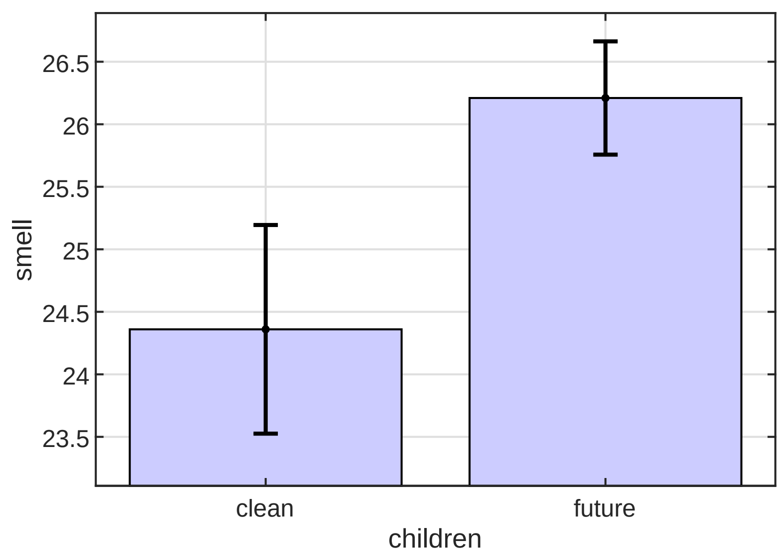
$t_{crit} = -1.66(df = 100)$

We reject H_0.

The smell of clean children (M = 24.36, SD = 4.3358) is significantly less than the smell of future children (M = 26.21, SD = 3.9223) t(100) = -2.04, p = 0.022.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|24.36-26.21|}{4.0339} = 0.46$
This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.46, n = $\frac{(27+75)}{2}$ = 51 and $\alpha = 0.05$ is 0.7500.



59) Two tailed z-test for one mean
$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{7}{\sqrt{83}} = 0.7683$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(25.66 - 25)}{0.7683} = 0.86$

z_{crit} for $\alpha = 0.01$ (Two tailed) is ± 2.58

We fail to reject H_0.

The distance of weather events (M = 25.66) is not significantly different than 25, z=0.86, p = 0.3898.

60) One tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{1.6569}{\sqrt{65}} = 0.2055$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{66.31 - 67}{0.2055} = -3.37$

df = (n-1) = (65-1) = 64

$t_{crit} = -1.67$

We reject H_0.

The morality of luxuriant potatoes (M = 66.31, SD = 1.66) is significantly less than 67 , t(64) = -3.37, p=0.0006.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|66.31 - 67|}{1.6569} = 0.418$

This is a medium effect size.

The observed power for one tailed test with an effect size of d = 0.418, n = 65 and $\alpha = 0.05$ is 0.9531.

61) χ^2 test for independence

Sums and expected frequencies				
	elements	baby names	laboratory rats	sum
eatable	$\frac{(47)(35)}{131} =$ 12.5573	$\frac{(47)(46)}{131} =$ 16.5038	$\frac{(47)(50)}{131} =$ 17.9389	47
robust	$\frac{(84)(35)}{131} =$ 22.4427	$\frac{(84)(46)}{131} =$ 29.4962	$\frac{(84)(50)}{131} =$ 32.0611	84
sum	35	46	50	131

$\chi 2 = \frac{(8-12.5573)^2}{12.5573} + \frac{(27-22.4427)^2}{22.4427} + \frac{(16-16.5038)^2}{16.5038} + \frac{(30-29.4962)^2}{29.4962} + \frac{(23-17.9389)^2}{17.9389} + \frac{(27-32.0611)^2}{32.0611} =$

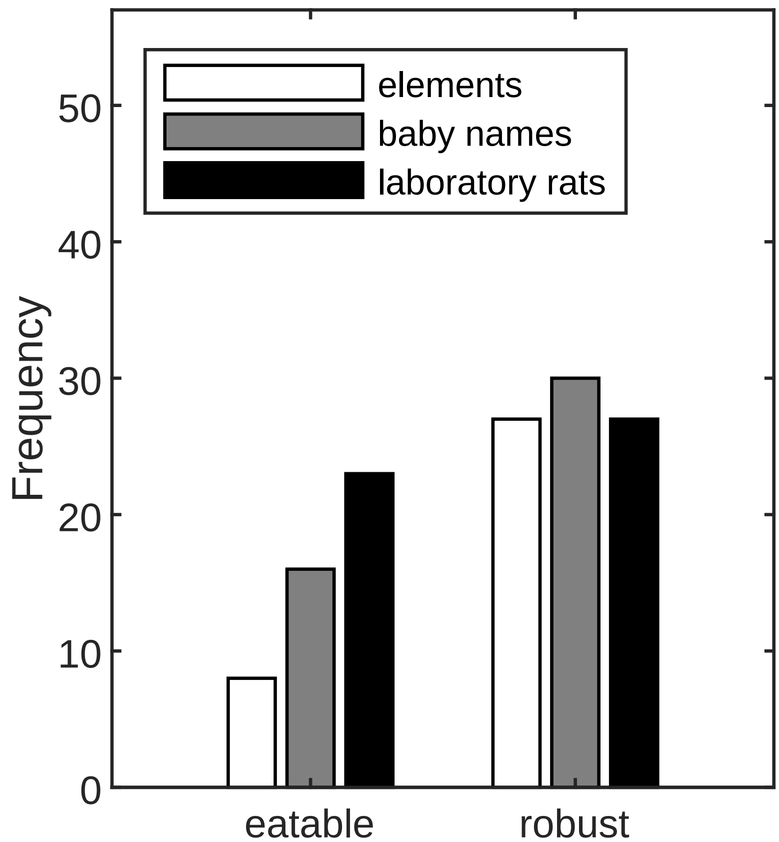
$1.6539 + 0.9254 + 0.0154 + 0.0086 + 1.4279 + 0.7989 = 4.8301$

df = (2-1)(3-1) = 2

$\chi^2_{crit} = 9.21$

We fail to reject H_0.

The elements, baby names and laboratory rats are distributed independently of the varieties of eatable and robust, χ^2(2, N=131)=4.8301, p=0.0894.



elements
baby names
laboratory rats
Frequency
50
40
30
20
10
0
eatable
robust

62) Two tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{8.5298}{\sqrt{41}} = 1.3321$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{25.57 - 30}{1.3321} = -3.32$

df = (n-1) = (41-1) = 40

$t_{crit} = \pm 2.02$

We reject H_0.

The health of beers (M = 25.57, SD = 8.53) is significantly different than 30 , t(40) = -3.32, p=0.0019.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|25.57 - 30|}{8.5298} = 0.519$

This is a medium effect size.

The observed power for two tailed test with an effect size of d = 0.519, n = 41 and $\alpha = 0.05$ is 0.8998.

63) χ^2 test on one dimension

$\chi 2 = \frac{(6-11)^2}{11} + \frac{(16-11)^2}{11} =$

$2.2727 + 2.2727 = 4.5454$

χ^2 for each cell	
tenuous	hapless
2.2727	2.2727

df = (2-1) = 1

$\chi^2_{crit} = 6.63$

We fail to reject H_0.

The frequency of 22 pants is distributed as expected across the 2 varieties of tenuous and hapless, χ^2(1, N=22)= 4.55, p = 0.0329.

64) χ^2 test on one dimension

$$\chi 2 = \frac{(39-32)^2}{32} + \frac{(31-32)^2}{32} + \frac{(26-32)^2}{32} =$$

$1.5313 + 0.0313 + 1.125 = 2.6876$

χ^2 for each cell		
fertile	lying	freezing
1.5313	0.0313	1.125

df = (3-1) = 2

$\chi^2_{crit} = 9.21$

We fail to reject H_0.

The frequency of 96 children is distributed as expected across the 3 varieties of fertile, lying and freezing, χ^2(2, N=96)= 2.69, p = 0.2605.

65) χ^2 test for independence

Sums and expected frequencies			
	UW undergraduates	skittles	sum
half	$\frac{(21)(52)}{98} = 11.1429$	$\frac{(21)(46)}{98} = 9.8571$	21
curved	$\frac{(45)(52)}{98} = 23.8776$	$\frac{(45)(46)}{98} = 21.1224$	45
domineering	$\frac{(32)(52)}{98} = 16.9796$	$\frac{(32)(46)}{98} = 15.0204$	32
sum	52	46	98

$\chi 2 = \frac{(5-11.1429)^2}{11.1429} + \frac{(33-23.8776)^2}{23.8776} + \frac{(14-16.9796)^2}{16.9796} + \frac{(16-9.8571)^2}{9.8571} + \frac{(12-21.1224)^2}{21.1224} + \frac{(18-15.0204)^2}{15.0204} =$

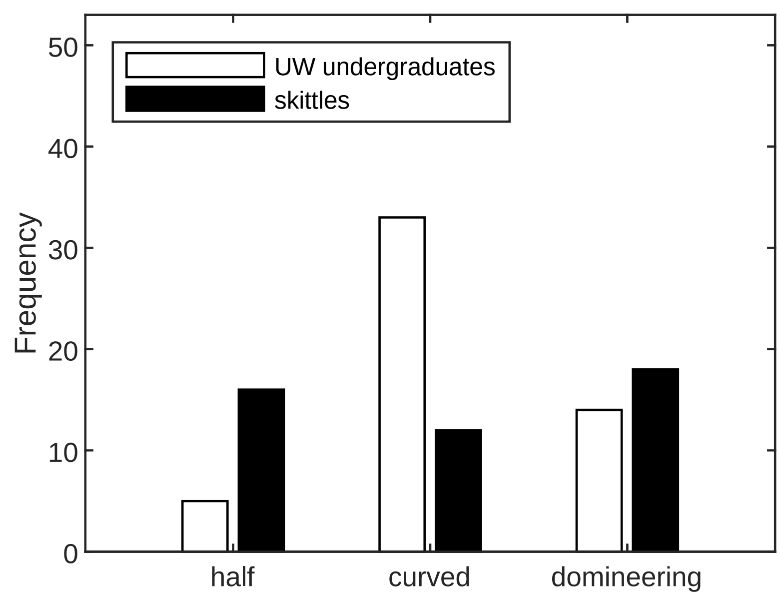
$3.3865 + 3.4852 + 0.5229 + 3.8282 + 3.9398 + 0.5911 = 15.7537$

df = (3-1)(2-1) = 2

$\chi^2_{crit} = 5.99$

We reject H_0.

The UW undergraduates and skittles are not distributed independently of the varieties of half, curved and domineering, χ^2(2, N=98)=15.7537, p=0.0004.



66) One tailed repeated measures t-test

$s_{\bar{D}} = \frac{2.3879}{\sqrt{14}} = 0.64$

df = 14-1 = 13

$t = \frac{2.7}{0.64} = 4.2188$

$t_{crit} = 1.77$

We reject H_0.

The farts of huge elements (M = 0.58, SD = 2.0667) is significantly less than the farts of daily elements (M=3.28, SD = 1.4805), t(13) = 4.2188, p = 0.0005.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{2.7}{2.3879} = 1.13$ This is a small effect size.

The observed power for one tailed test with an effect size of d = 1.13, n = 14 and $\alpha = 0.05$ is 0.9856.

67) 1-factor ANOVA

$MS_{bet} = \frac{500.7222}{1} = 500.7222$

$SS_w = SS_{total} - SS_{bet} = 3351.49 - 500.722 = 2849.61$

$MS_w = \frac{2849.607}{36} = 79.16$

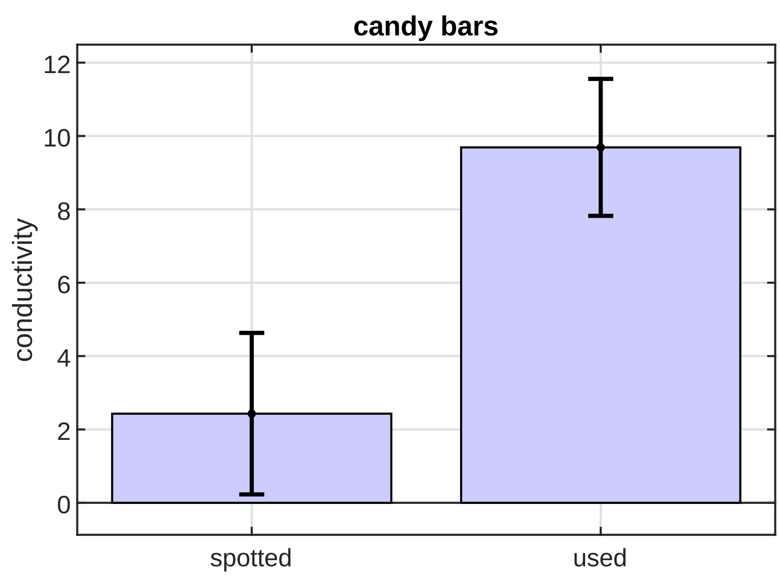
$F = \frac{500.7222}{79.1558} = 6.33$

$F_{crit} = 4.11$ (with $df_{bet} = 1$, $df_w = 36$ and $\alpha = 0.05$)

	SS	df	MS	F	F_{crit}	p-value
Between	500.7222	1	500.7222	6.3258	4.11	0.0165
Within	2849.607	36	79.1558			
Total	3351.4908	37				

We reject H_0.

There is a significant difference in mean conductivity across the 2 groups of candy bars, F(1,36) = 6.33, p = 0.0165.



68) 1-factor ANOVA

$MS_{bet} = \frac{1687.4452}{4} = 421.8613$

$SS_w = SS_{total} - SS_{bet} = 5682.25 - 1687.45 = 3994.8$

$MS_w = \frac{3994.802}{45} = 88.77$

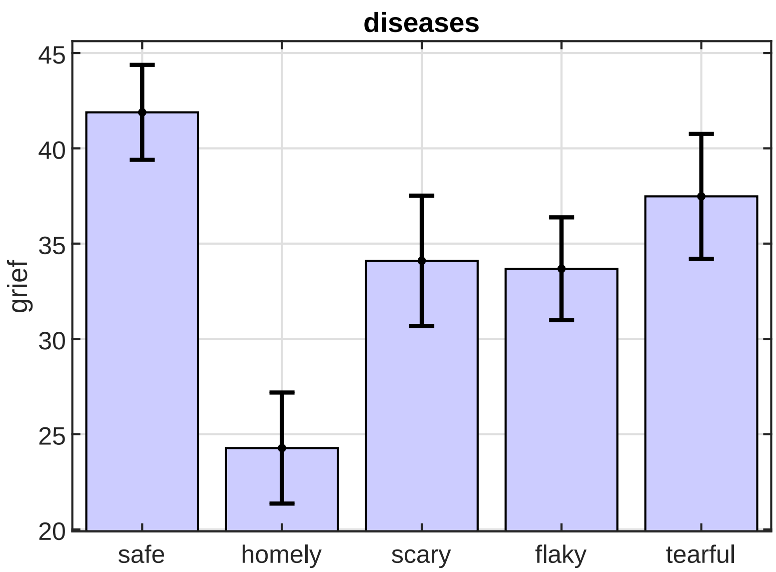
$F = \frac{421.8613}{88.7734} = 4.75$

$F_{crit} = 3.78$ (with $df_{bet} = 4$, $df_w = 44$ and $\alpha = 0.01$)

	SS	df	MS	F	F_{crit}	p-value
Between	1687.4452	4	421.8613	4.7521	3.78	0.0028
Within	3994.802	45	88.7734			
Total	5682.2472	49				

We reject H_0.

There is a significant difference in mean grief across the 5 groups of diseases, F(4,45) = 4.75, p = 0.0028.



69) One tailed t-test for $\rho_1 = \rho_2$

$z_1 = -0.4118$

$z_2 = -0.1409$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{80-3} + \frac{1}{15-3}} = 0.3104$

$z = \frac{-0.4118+0.1409}{0.3104} = -0.8727$

$z_{crit} = -2.326$

We fail to reject H_0.

The correlation between the courage and baggage for proctologists (-0.39) is not significantly less than the correlation for UW undergraduates (-0.14), z = -0.8727, p = 0.1914.

70) One tailed t-test for $\rho_1 = \rho_2$

$z_1 = 1.3331$

$z_2 = 0.4477$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{23-3} + \frac{1}{16-3}} = 0.3563$

$z = \frac{1.3331-0.4477}{0.3563} = 2.485$

$z_{crit} = 1.645$

We reject H_0.

The correlation between the courage and damage for chickens (0.87) is significantly greater than the correlation for Europeans (0.42), z = 2.485, p = 0.0065.

71) χ^2 test on one dimension

$$\chi 2 = \frac{(20-18)^2}{18} + \frac{(17-18)^2}{18} + \frac{(29-18)^2}{18} + \frac{(6-18)^2}{18} =$$

$0.2222 + 0.0556 + 6.7222 + 8 = 15$

χ^2 for each cell			
cagey	silly	itchy	uneven
0.2222	0.0556	6.7222	8

df = (4-1) = 3

$\chi^2_{crit} = 11.34$

We reject H_0.

The frequency of 72 chickens is not distributed as expected across the 4 varieties of cagey, silly, itchy and uneven, χ^2(3, N=72)=15.00, p = 0.0018.

72) One tailed t-test for ρ =0

$t = 0.7116$
$t_{crit} = 1.72 (df = 22)$

or $r_{crit} = 0.34$

We fail to reject H_0.

The correlation between pain threshold and news for video games is not significantly greater than zero, r(22) = 0.15, p = 0.2421.

73) χ^2 test on one dimension

$$\chi 2 = \frac{(32-27.3333)^2}{27.3333} + \frac{(20-27.3333)^2}{27.3333} + \frac{(30-27.3333)^2}{27.3333} =$$

$0.7968 + 1.9675 + 0.2602 = 3.0245$

χ^2 for each cell		
nervous	mysterious	chivalrous
0.7968	1.9675	0.2602

df = (3-1) = 2

$\chi^2_{crit} = 9.21$

We fail to reject H_0.

The frequency of 82 elbows is distributed as expected across the 3 varieties of nervous, mysterious and chivalrous, χ^2(2, N=82)= 3.02, p = 0.2209.

74) One tailed z-test for one mean

$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{9}{\sqrt{14}} = 2.4054$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(45.99 - 43)}{2.4054} = 1.24$

z_{crit} for $\alpha = 0.01$ (One tailed) is 2.33

We fail to reject H_0.

The leisure of professors (M = 45.99) is not significantly greater than 43, z=1.24, p = 0.1075.

75) Two tailed t-test for $\rho_1 = \rho_2$

$z_1 = 0.4477$

$z_2 = 0.0902$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{20-3} + \frac{1}{28-3}} = 0.3144$

$z = \frac{0.4477 - 0.0902}{0.3144} = 1.1371$

$z_{crit} = \pm 1.96$

We fail to reject H_0.

The correlation between the violance and duration for Seattleites (0.42) is not significantly different than the correlation for sponges (0.09), z = 1.1371, p = 0.2555.

76) One tailed independent measures t-test

$$s_p = \sqrt{\frac{(62-1)8.9243^2 + (27-1)8.8634^2}{(62-1)+(27-1)}} = 8.9061$$

$$s_{\bar{x}-\bar{y}} = 8.9061\sqrt{\frac{1}{62} + \frac{1}{27}} = 2.0535$$

$$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{80.53-82.01}{2.0535} = -0.72$$

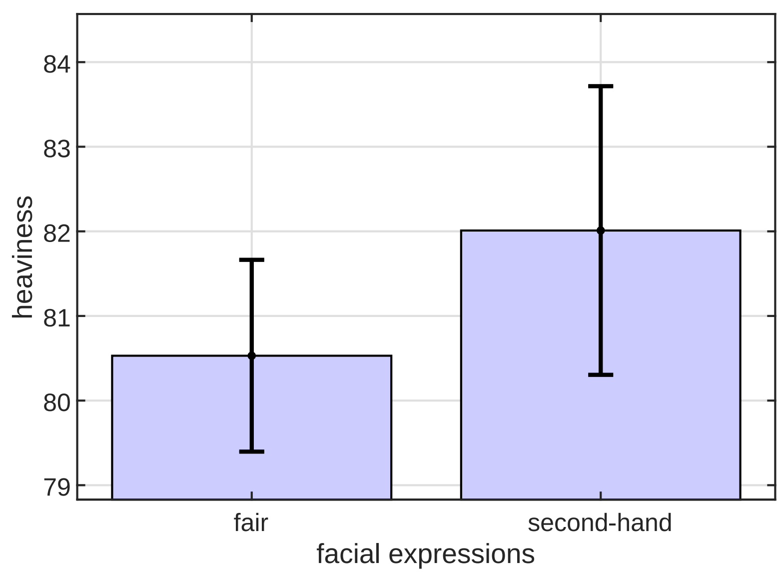
$$t_{crit} = -1.66(df = 87)$$

We fail to reject H_0.

The heaviness of fair facial expressions (M = 80.53, SD = 8.9243) is not significantly less than the heaviness of second-hand facial expressions (M = 82.01, SD = 8.8634) t(87) = -0.72, p = 0.2367.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|80.53-82.01|}{8.9061} = 0.17$
This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.17, n = $\frac{(62+27)}{2}$ = 45 and α = 0.05 is 0.2000.



77) One tailed t-test for ρ =0

$t = -0.6869$
$t_{crit} = -3.14 (df = 6)$

or $r_{crit} = -0.79$

We fail to reject H_0.

The correlation between visual acuity and knowledge for brave balloons is not significantly less than zero, r(6) = -0.27, p = 0.2589.

78) χ^2 test on one dimension

$$\chi 2 = \frac{(13-9.5)^2}{9.5} + \frac{(6-9.5)^2}{9.5} =$$

$1.2895 + 1.2895 = 2.579$

χ^2 for each cell	
near	spiky
1.2895	1.2895

df = (2-1) = 1

$\chi^2_{crit} = 6.63$

We fail to reject H_0.

The frequency of 19 iPhones is distributed as expected across the 2 varieties of near and spiky, χ^2(1, N=19)= 2.58, p = 0.1082.

79) χ^2 test for independence

Sums and expected frequencies				
	examples	baseballs	video games	sum
limping	$\frac{(76)(67)}{144} =$ 35.3611	$\frac{(76)(38)}{144} =$ 20.0556	$\frac{(76)(39)}{144} =$ 20.5833	76
boiling	$\frac{(68)(67)}{144} =$ 31.6389	$\frac{(68)(38)}{144} =$ 17.9444	$\frac{(68)(39)}{144} =$ 18.4167	68
sum	67	38	39	144

$$\chi 2 = \frac{(38-35.3611)^2}{35.3611} + \frac{(29-31.6389)^2}{31.6389} + \frac{(26-20.0556)^2}{20.0556} + \frac{(12-17.9444)^2}{17.9444} + \frac{(12-20.5833)^2}{20.5833} + \frac{(27-18.4167)^2}{18.4167} =$$

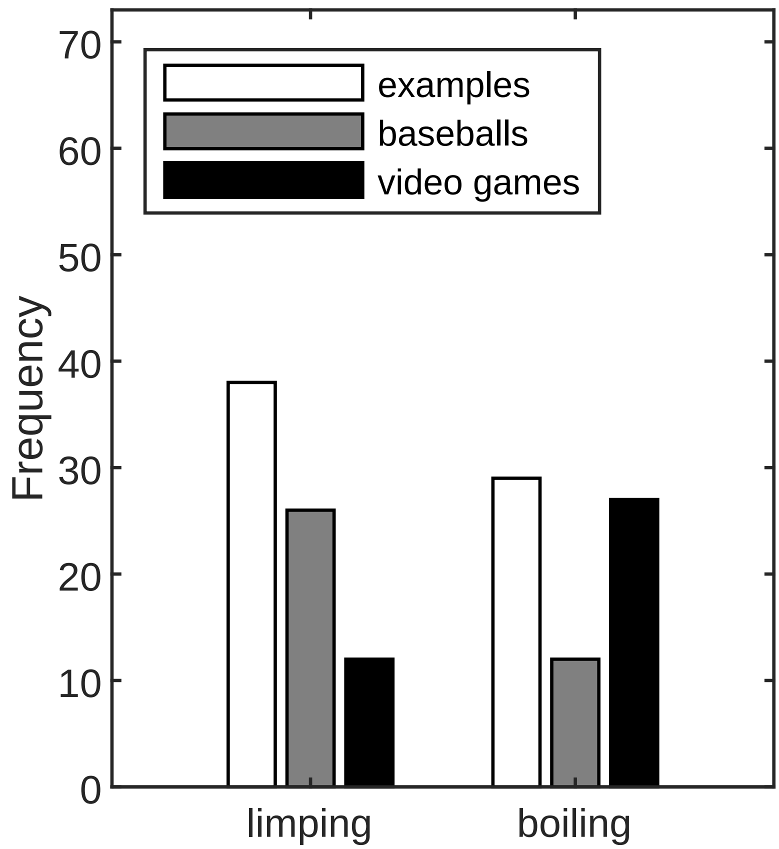
$0.1969 + 0.2201 + 1.7619 + 1.9692 + 3.5793 + 4.0003 = 11.7277$

df = (2-1)(3-1) = 2

$\chi^2_{crit} = 5.99$

We reject H_0.

The examples, baseballs and video games are not distributed independently of the varieties of limping and boiling, χ^2(2, N=144)=11.7277, p=0.0028.


70
60
50
40
30
20
10
0
Frequency
examples
baseballs
video games
limping
boiling

80) One tailed repeated measures t-test

$s_{\bar{D}} = \frac{5.0455}{\sqrt{10}} = 1.6$

df = 10-1 = 9

$t = \frac{1.2}{1.6} = 0.75$

$t_{crit} = 2.82$

We fail to reject H_0.

The news of far amygdalas (M = 63.8, SD = 2.866) is not significantly less than the news of imaginary amygdalas (M=64.99, SD = 3.4009), t(9) = 0.75, p = 0.2362.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{1.2}{5.0455} = 0.24$ This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.24, n = 10 and $\alpha = 0.01$ is 0.0346.

81) χ^2 test on one dimension

$$\chi 2 = \frac{(15-18.25)^2}{18.25} + \frac{(22-18.25)^2}{18.25} + \frac{(9-18.25)^2}{18.25} + \frac{(27-18.25)^2}{18.25} =$$

$0.5788 + 0.7705 + 4.6884 + 4.1952 = 10.2329$

χ^2 for each cell			
slippery	steadfast	private	unable
0.5788	0.7705	4.6884	4.1952

df = (4-1) = 3

$\chi^2_{crit} = 11.34$

We fail to reject H_0.

The frequency of 73 brain images is distributed as expected across the 4 varieties of slippery, steadfast, private and unable, χ^2(3, N=73)=10.23, p = 0.0167.

82) Two tailed t-test for ρ =0

$\bar{x} = \frac{7.08}{22} = 0.32$
$\Sigma(X^2) = 1.8496 + 4.2025 + ... + 3.1684 = 7.08$
$\Sigma y = 1.26 - 0.87 - ... - 1.57 = -0.13$
$\bar{y} = \frac{-0.13}{22} = -0.01$
$\Sigma(Y^2) = 1.5876 + 0.7569 + ... + 2.4649 = 7.08$
$\Sigma xy = -1.7136 - 1.7835 - ... - 2.7946 = -14.5562$
$SS_x = (-1.36 - 0.32)^2 + (2.05 - 0.32)^2 + ... + (1.78 - 0.32)^2 = 27.2$
$s_x = \sqrt{\frac{27.1988}{22-1}} = 1.1381$
$SS_y = (1.26 + 0.01)^2 + (-0.87 + 0.01)^2 + (-1.57 + 0.01)^2 = 16.61$
$s_y = \sqrt{\frac{16.6091}{22-1}} = 0.8893$

$$r = \frac{-14.5562 - \frac{(7.08)(-0.13)}{22}}{\sqrt{\left(29.4772 - \frac{(7.08)^2}{22}\right)\left(16.6095 - \frac{(-0.13)^2}{22}\right)}} = -0.68$$

$t_{crit} = \pm 2.85 (df = 20)$

or $r_{crit} = \pm 0.54$

We reject H_0.

The correlation between speed and size for undergraduates is significantly different than zero, r(20) = -0.68, p = 0.0005.

83) One tailed t-test for $\rho_1 = \rho_2$

$z_1 = 0.5101$

$z_2 = 0.2342$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{24-3} + \frac{1}{32-3}} = 0.2865$

$z = \frac{0.5101-0.2342}{0.2865} = 0.963$

$z_{crit} = 2.326$

We fail to reject H_0.

The correlation between the sadness and trouble for examples (0.47) is not significantly greater than the correlation for antidepressants (0.23), z = 0.963, p = 0.1678.

84) One tailed repeated measures t-test

$s_{\bar{D}} = \frac{8.3394}{\sqrt{23}} = 1.74$

df = 23-1 = 22

$t = \frac{3.84}{1.74} = 2.2069$

$t_{crit} = 1.72$

We reject H_0.

The work of sharp students (M = 91.87, SD = 5.8148) is significantly less than the work of icy students (M=95.7, SD = 5.772), t(22) = 2.2069, p = 0.019.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{3.84}{8.3394} = 0.46$ This is a small effect size.

The observed power for one tailed test with an effect size of d = 0.46, n = 23 and $\alpha = 0.05$ is 0.6851.

85) 1-factor ANOVA

$MS_{bet} = \frac{1559.7413}{4} = 389.9353$

$SS_w = SS_{total} - SS_{bet} = 25861.7 - 1559.74 = 24303.3$

$MS_w = \frac{24303.3213}{101} = 240.63$

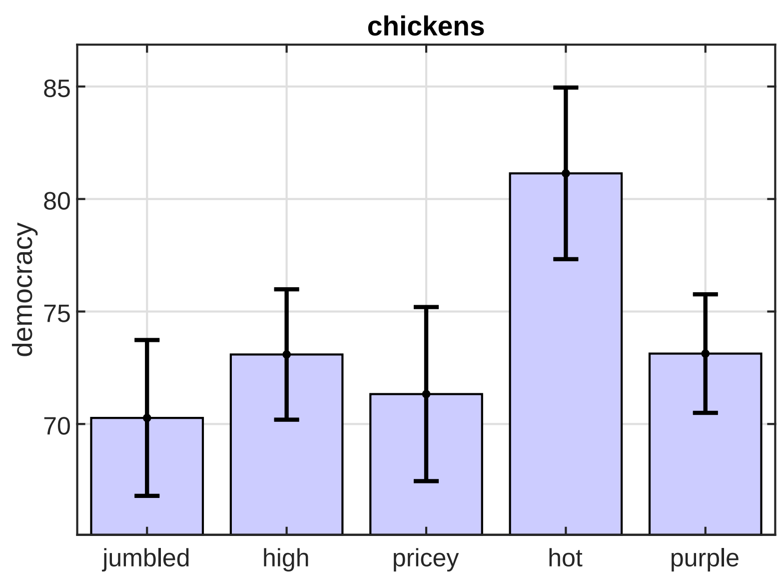
$F = \frac{389.9353}{240.6269} = 1.62$

$F_{crit} = 2.46$ (with $df_{bet} = 4$, $df_w = 100$ and $\alpha = 0.05$)

	SS	df	MS	F	F_{crit}	p-value
Between	1559.7413	4	389.9353	1.6205	2.46	0.1749
Within	24303.3213	101	240.6269			
Total	25861.745	105				

We fail to reject H_0.

There is not a significant difference in mean democracy across the 5 groups of chickens, F(4,101) = 1.62, p = 0.1749.



86) χ^2 test for independence

Sums and expected frequencies				
	balloons	cartoon characters	fingerprints	sum
messy	$\frac{(40)(27)}{67} = 16.1194$	$\frac{(40)(24)}{67} = 14.3284$	$\frac{(40)(16)}{67} = 9.5522$	40
absurd	$\frac{(27)(27)}{67} = 10.8806$	$\frac{(27)(24)}{67} = 9.6716$	$\frac{(27)(16)}{67} = 6.4478$	27
sum	27	24	16	67

$\chi 2 = \frac{(15-16.1194)^2}{16.1194} + \frac{(12-10.8806)^2}{10.8806} + \frac{(17-14.3284)^2}{14.3284} + \frac{(7-9.6716)^2}{9.6716} + \frac{(8-9.5522)^2}{9.5522} + \frac{(8-6.4478)^2}{6.4478} =$

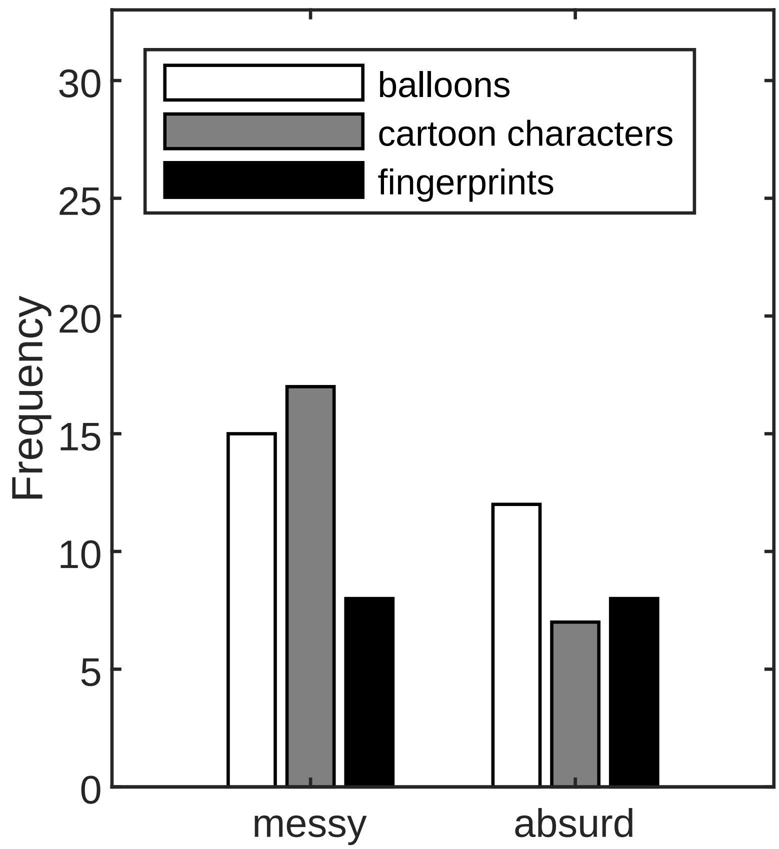
$0.0777 + 0.1152 + 0.4981 + 0.738 + 0.2522 + 0.3737 = 2.0549$

df = (2-1)(3-1) = 2

$\chi^2_{crit} = 5.99$

We fail to reject H_0.

The balloons, cartoon characters and fingerprints are distributed independently of the varieties of messy and absurd, χ^2(2, N=67)=2.0549, p=0.3579.


balloons
cartoon characters
fingerprints
Frequency
0
5
10
15
20
25
30
messy
absurd

87) Two tailed repeated measures t-test

$s_{\bar{D}} = \frac{11.0806}{\sqrt{108}} = 1.07$

df = 108-1 = 107

$t = \frac{1.2}{1.07} = 1.1215$

$t_{crit} = \pm 2.63$ (using df = 100)

We fail to reject H_0.

The damage of tired politicians (M = 97.92, SD = 7.6217) is not significantly different than the damage of enchanting politicians (M=99.12, SD = 8.3021), t(107) = 1.1215, p = 0.2646.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{1.2}{11.0806} = 0.11$ This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.11, n = 108 and $\alpha = 0.01$ is 0.0711.

88) Two tailed t-test for $\rho_1 = \rho_2$

$z_1 = -0.1717$

$z_2 = -0.4001$

$\sigma_{z_1 - z_2} = \sqrt{\frac{1}{45-3} + \frac{1}{80-3}} = 0.1918$

$z = \frac{-0.1717+0.4001}{0.1918} = 1.1908$

$z_{crit} = \pm 2.576$

We fail to reject H_0.

The correlation between the pain threshold and weight for fraternities (-0.17) is not significantly different than the correlation for elections (-0.38), z = 1.1908, p = 0.2337.

89) Two tailed independent measures t-test

$s_p = \sqrt{\frac{(33-1)8.6335^2+(43-1)8.7028^2}{(33-1)+(43-1)}} = 8.6729$

$s_{\bar{x}-\bar{y}} = 8.6729\sqrt{\frac{1}{33} + \frac{1}{43}} = 2.0072$

$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{59.71-54.57}{2.0072} = 2.56$

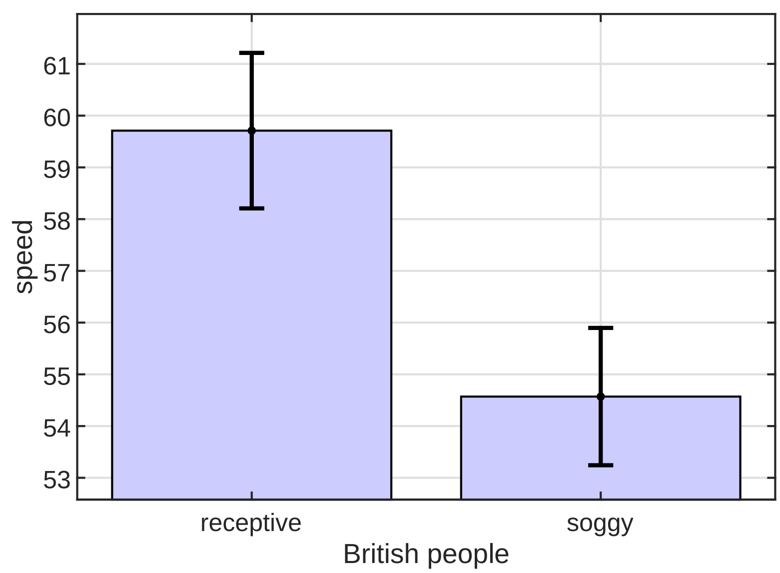
$t_{crit} = \pm 1.99 (df = 74)$

We reject H_0.

The speed of receptive British people (M = 59.71, SD = 8.6335) is significantly different than the speed of soggy British people (M = 54.57, SD = 8.7028) t(74) = 2.56, p = 0.0125.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|59.71-54.57|}{8.6729} = 0.59$
This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.59, n = $\frac{(33+43)}{2}$ = 38 and $\alpha = 0.05$ is 0.7200.



90) Two tailed repeated measures t-test

$s_{\bar{D}} = \frac{6.8915}{\sqrt{105}} = 0.67$

df = 105-1 = 104

$t = \frac{1.93}{0.67} = 2.8806$

$t_{crit} = \pm 1.98$ (using df = 100)

We reject H_0.

The duration of yummy Martians (M = 67.43, SD = 4.2941) is significantly different than the duration of disagreeable Martians (M=69.36, SD = 5.0162), t(104) = 2.8806, p = 0.0048.

Effect size: d = $\frac{|\bar{D}|}{s_D} = \frac{1.93}{6.8915} = 0.28$ This is a small effect size.

The observed power for two tailed test with an effect size of d = 0.28, n = 105 and $\alpha = 0.05$ is 0.8112.

91) One tailed z-test for one mean

$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{9}{\sqrt{94}} = 0.9283$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(56.59 - 59)}{0.9283} = -2.60$

z_{crit} for $\alpha = 0.05$ (One tailed) is -1.64

We reject H_0.

The happiness of fathers (M = 56.59) is significantly less than 59, z=-2.6, p = 0.0047.

92) One tailed t-test for ρ =0

$\bar{x} = \frac{7.32}{18} = 0.41$
$\Sigma(X^2) = 0.4624 + 0.1521 + ... + 0.81 = 7.32$
$\Sigma y = 0.69 + 0.2 - ... + 0.06 = 0.21$
$\bar{y} = \frac{0.21}{18} = 0.01$
$\Sigma(Y^2) = 0.4761 + 0.04 + ... + 0.0036 = 7.32$
$\Sigma xy = -0.4692 + 0.078 - ... + 0.054 = 1.5605$
$SS_x = (-0.68 - 0.41)^2 + (0.39 - 0.41)^2 + ... + (0.9 - 0.41)^2 = 14.14$
$s_x = \sqrt{\frac{14.1428}{18-1}} = 0.9121$
$SS_y = (0.69 - 0.01)^2 + (0.2 - 0.01)^2 + ... + (0.06 - 0.01)^2 = 8.27$
$s_y = \sqrt{\frac{8.2745}{18-1}} = 0.6977$
$r = \frac{1.5605 - \frac{(7.32)(0.21)}{18}}{\sqrt{\left(17.1194 - \frac{(7.32)^2}{18}\right)\left(8.2769 - \frac{(0.21)^2}{18}\right)}} = 0.14$
Regression line: $Y' = 0.11(X - 0.41) + 0.01 = 0.11X + -0.04$
$t_{crit} = 2.58(df = 16)$

or $r_{crit} = 0.54$

We fail to reject H_0.

The correlation between liberty and rain for humdrum oranges is not significantly greater than zero, r(16) = 0.14, p = 0.2898.

93) One tailed t-test for one mean

$s_{\bar{x}} = \frac{s_x}{\sqrt{n}} = \frac{5.7928}{\sqrt{87}} = 0.6211$

$t = \frac{\bar{x} - \mu_{hyp}}{s_{\bar{x}}} = \frac{37.79 - 40}{0.6211} = -3.56$

df = (n-1) = (87-1) = 86

$t_{crit} = -2.37$

We reject H_0.

The importance of bitter exams (M = 37.79, SD = 5.79) is significantly less than 40 , t(86) = -3.56, p=0.0003.

Effect size: $d = \frac{|\bar{x} - \mu_{hyp}|}{s_x} = \frac{|37.79 - 40|}{5.7928} = 0.3816$

This is a medium effect size.

The observed power for one tailed test with an effect size of d = 0.3816, n = 87 and $\alpha = 0.01$ is 0.8811.

94) Two tailed independent measures t-test

$s_p = \sqrt{\frac{(14-1)2.9874^2+(44-1)3.2467^2}{(14-1)+(44-1)}} = 3.1884$

$s_{\bar{x}-\bar{y}} = 3.1884\sqrt{\frac{1}{14} + \frac{1}{44}} = 0.9784$

$t = \frac{\bar{x}-\bar{y}}{s_{\bar{x}-\bar{y}}} = \frac{7.51-11.8}{0.9784} = -4.38$

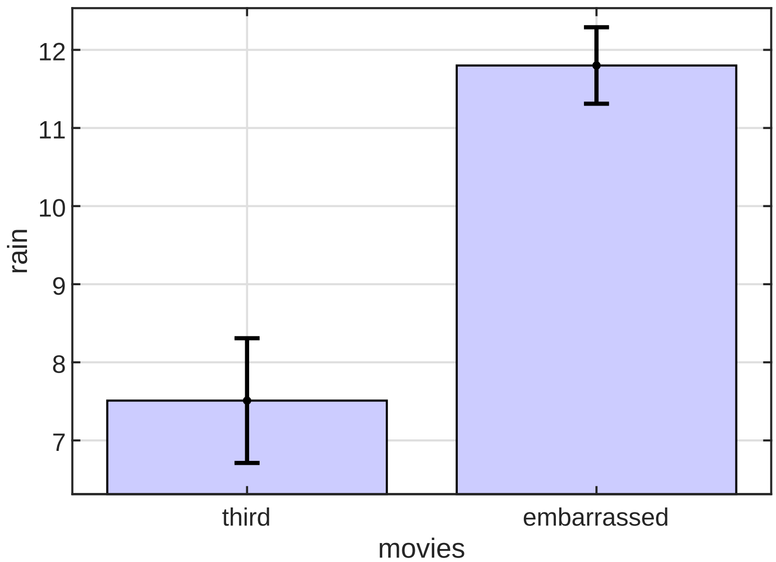
$t_{crit} = \pm 2.67 (df = 56)$

We reject H_0.

The rain of third movies (M = 7.51, SD = 2.9874) is significantly different than the rain of embarrassed movies (M = 11.8, SD = 3.2467) t(56) = -4.38, p = 0.0001.

The effect size is $d = \frac{|\bar{x}-\bar{y}|}{s_p} = \frac{|7.51-11.8|}{3.1884} = 1.35$
This is a small effect size.

The observed power for two tailed test with an effect size of d = 1.35, n = $\frac{(14+44)}{2}$ = 29 and $\alpha = 0.01$ is 0.9900.



95) Two tailed t-test for ρ =0

$\bar{x} = \frac{-0.22}{15} = -0.01$
$\Sigma(X^2) = 0.0576 + 0.7744 + ... + 0.0169 = -0.22$
$\Sigma y = 1.2 - 0.01 + ... - 0.73 = -1.08$
$\bar{y} = \frac{-1.08}{15} = -0.07$
$\Sigma(Y^2) = 1.44 + 0.0001 + ... + 0.5329 = -0.22$
$\Sigma xy = -0.288 - 0.0088 - ... - 0.0949 = -5.2345$
$SS_x = (-0.24 + 0.01)^2 + (0.88 + 0.01)^2 + ... + (0.13 + 0.01)^2 = 16.37$
$s_x = \sqrt{\frac{16.3691}{15-1}} = 1.0813$
$SS_y = (1.2 + 0.07)^2 + (-0.01 + 0.07)^2 + (-0.73 + 0.07)^2 = 15.58$
$s_y = \sqrt{\frac{15.5781}{15-1}} = 1.0549$
$r = \frac{-5.2345 - \frac{(-0.22)(-1.08)}{15}}{\sqrt{\left(16.372 - \frac{(-0.22)^2}{15}\right)\left(15.6558 - \frac{(-1.08)^2}{15}\right)}} = -0.33$
$t_{crit} = \pm 2.16(df = 13)$

or $r_{crit} = \pm 0.51$

We fail to reject H_0.

The correlation between liberty and hospitality for acoustic fraternities is not significantly different than zero, r(13) = -0.33, p = 0.2297.

96) One tailed t-test for ρ =0

$t = 1.309$
$t_{crit} = 1.86(df = 8)$

or $r_{crit} = 0.55$

We fail to reject H_0.

The correlation between evil and width for cartoon characters is not significantly greater than zero, r(8) = 0.42, p = 0.1134.

97) Two tailed z-test for one mean
$\sigma_{\bar{x}} = \frac{\sigma_x}{\sqrt{n}} = \frac{9}{\sqrt{64}} = 1.125$

$z_{obs} = \frac{\bar{x} - \mu_{hyp}}{\sigma_{\bar{x}}} = \frac{(13.71 - 18)}{1.125} = -3.81$

z_{crit} for $\alpha = 0.01$ (Two tailed) is ± 2.58

We reject H_0.

The density of laboratory rats (M = 13.71) is significantly different than 18, z=-3.81, p = 0.0001.

98) 1-factor ANOVA

$MS_{bet} = \frac{374.5679}{2} = 187.284$

$SS_w = SS_{total} - SS_{bet} = 8199.95 - 374.568 = 7825.07$

$MS_w = \frac{7825.0684}{58} = 134.91$

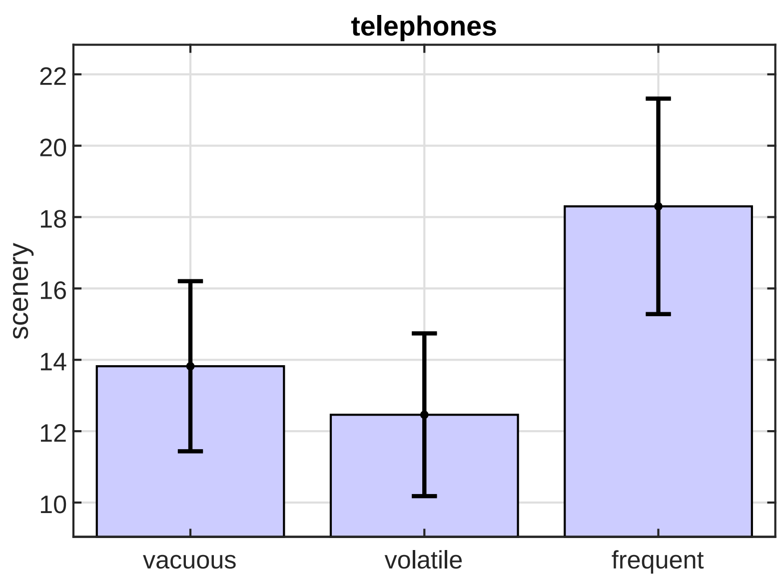
$F = \frac{187.284}{134.915} = 1.39$

$F_{crit} = 3.16$ (with $df_{bet} = 2$, $df_w = 55$ and $\alpha = 0.05$)

	SS	df	MS	F	F_{crit}	p-value
Between	374.5679	2	187.284	1.3882	3.16	0.2577
Within	7825.0684	58	134.915			
Total	8199.9492	60				

We fail to reject H_0.

There is not a significant difference in mean scenery across the 3 groups of telephones, F(2,58) = 1.39, p = 0.2577.



99) χ^2 test on one dimension

$$\chi2 = \frac{(19-22.8333)^2}{22.8333} + \frac{(16-22.8333)^2}{22.8333} + \frac{(16-22.8333)^2}{22.8333} + \frac{(20-22.8333)^2}{22.8333} + \frac{(35-22.8333)^2}{22.8333} + \frac{(31-22.8333)^2}{22.8333} =$$

$0.6435 + 2.045 + 2.045 + 0.3516 + 6.483 + 2.921 = 14.4891$

χ^2 for each cell					
large	quirky	unkempt	medical	parsimonious	stupid
0.6435	2.045	2.045	0.3516	6.483	2.921

df = (6-1) = 5

$\chi^2_{crit} = 15.09$

We fail to reject H_0.

The frequency of 137 beer is distributed as expected across the 6 varieties of large, quirky, unkempt, medical, parsimonious and stupid, χ^2(5, N=137)=14.49, p = 0.0128.