

## Homework 7

1. The *New England Journal of Medicine*, in its issue of January 8, 1998, contained an article by H.T. Stelfox, G. Chua, K. O'Rourke, and A.S. Detsky examining the possible relationship between the results of trials reported in journals and whether a researcher's research was supported by a drug company. The authors of the study examined 70 reports from 1995 and 1996 related to whether the use of calcium-channel blockers to treat hypertension led to an increased risk of heart disease. They classified 30 of the reports as favorable to the drugs, 17 as neutral, and 23 as critical of the drugs. They further determined that 29 of the favorable reports had authors who had received money from manufacturers of calcium-channel blockers, 10 of the neutral reports had such authors, and 8 of the critical reports had such authors.
  - (a) Is the probability that a favorable study has authors who received money from drug companies significantly different from the probability that a neutral study has authors who received money from drug companies? Carefully state the hypotheses that you are testing and the test that you are using.
  - (b) Answer part (a) for the other two pairs of study types (i.e., favorable versus critical, and neutral versus critical).
2. The file `distance.mpj` gives the results of a survey taken by Heather Campbell of members of Block 3 from the class of 1999. The survey asks how far the student lives from Stern (`Distance`), the student's travel time to Stern (`Travel time`), the student's `Gender`, whether or not the student lived in New York City before coming to Stern (`Previous NYC residence`), whether or not the student is an `American` citizen, and whether or not the student `Lives with spouse`.
  - (a) Is there a significant difference in the distance a student lives from Stern based on gender or whether a student lives with a spouse? Be sure to test these questions correctly, paying attention to the appropriate assumptions.
  - (b) Why do you think the observed patterns might exist?
3. The file `munibond.mpj` gives summary information for a sample of New York municipal bond funds in October, 1997. The file gives two variables for each fund: the return `Return` (what would have been earned in the last 12 months, after deducting loads and including dividends and capital gains or losses) and the yield `Yield` (the actual interest rate earned over the last 12 months, which is the number typically reported by funds). The funds are also separated by whether or not the fund charges a fee for purchasing or redeeming shares (the so-called load). Note that while the yield is what is usually reported by funds, the return is a much more reasonable representation of how much you actually make in investing in a fund. Is there a difference in the typical difference between return and yield for load versus no load funds? Test this question in any way that seems appropriate, paying attention to the appropriate assumptions. Why do you think the observed pattern might exist?

**Homework due: never**

## Answers to homework 7

1. In each case, the hypotheses being tested are

$$H_0 : p_1 = p_2$$

versus

$$H_a : p_1 \neq p_2,$$

where  $p_1$  is the probability of the authors of the first type of study being supported by drug companies and  $p_2$  is the probability of the authors of the second type of study being supported by drug companies. The test used is the  $z$ -test,

$$z = \frac{|\bar{p}_1 - \bar{p}_2|}{\sqrt{\bar{p}_1(1 - \bar{p}_1)/n_1 + \bar{p}_2(1 - \bar{p}_2)/n_2}}.$$

Here is Minitab output for the three tests.

Favorable versus neutral

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Test and Confidence Interval for Two Proportions

Sample	X	N	Sample p
1	29	30	0.966667
2	10	17	0.588235

Estimate for p(1) - p(2): 0.378431

95% CI for p(1) - p(2): (0.135823, 0.621040)

Test for p(1) - p(2) = 0 (vs not = 0): Z = 3.06 P-Value = 0.002

Favorable versus critical

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Test and Confidence Interval for Two Proportions

Sample	X	N	Sample p
1	29	30	0.966667
2	8	23	0.347826

Estimate for p(1) - p(2): 0.618841

95% CI for p(1) - p(2): (0.413869, 0.823812)

Test for p(1) - p(2) = 0 (vs not = 0): Z = 5.92 P-Value = 0.000

Neutral versus critical  
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Test and Confidence Interval for Two Proportions

Sample	X	N	Sample p
1	10	17	0.588235
2	8	23	0.347826

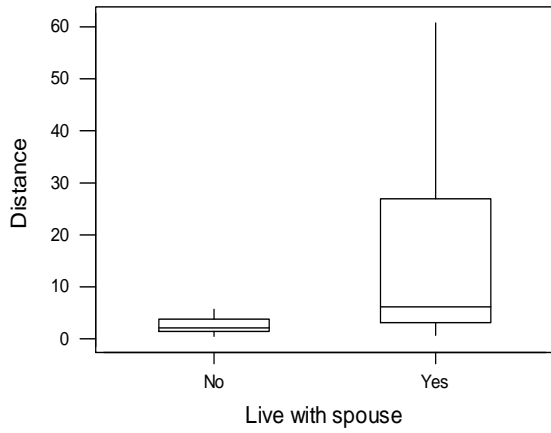
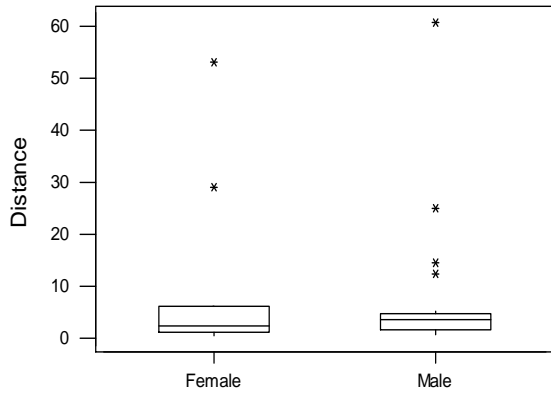
Estimate for  $p(1) - p(2)$ : 0.240409

95% CI for  $p(1) - p(2)$ : (-0.0639263, 0.544745)

Test for  $p(1) - p(2) = 0$  (vs not = 0):  $Z = 1.55$  P-Value = 0.122

There is a big (and statistically significant) difference in proportions for reports that are favorable versus neutral or critical. The neutral reports have a higher percentage of authors with drug company support than the critical ones, but it's not statistically significant at a .05 (or .10) level.

2. Here are side-by-side boxplots of distance separated by gender and by whether or not a student lives with a spouse. It is apparent that there are long tails in the distance variable, casting doubt on  $t$ -tests. Certainly there is nonconstant variance evident in the boxplot separating by living with a spouse or not, so the  $t$ -test that does not assume constant variance would be more appropriate. Nonparametric tests would be useful here. We could also take logs of the distance variable, in which case our hypotheses would refer to differences in the geometric means of the two groups.



Here is Minitab output for the two questions.

Male versus female  
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Two Sample T-Test and Confidence Interval

Two sample T for Distance

Gender	N	Mean	StDev	SE Mean
Female	11	9.5	16.6	5.0
Male	24	7.0	12.7	2.6

95% CI for mu (Female) - mu (Male ): ( -7.9, 12.9)

T-Test mu (Female) = mu (Male) (vs not =): T = 0.49 P = 0.63 DF = 33

Both use Pooled StDev = 14.0

Mann-Whitney Confidence Interval and Test

Distmale N = 11 Median = 2.20  
Distfema N = 24 Median = 3.40  
Point estimate for ETA1-ETA2 is -0.30  
95.1 Percent CI for ETA1-ETA2 is (-2.40,2.21)  
W = 186.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.6828

The test is significant at 0.6826 (adjusted for ties)

Cannot reject at alpha = 0.05

Live with spouse versus don't live with spouse  
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Two Sample T-Test and Confidence Interval

Two sample T for Distance

Live wit	N	Mean	StDev	SE Mean
No	22	2.46	1.48	0.32
Yes	13	16.7	20.0	5.5

95% CI for mu (No ) - mu (Yes): ( -22.88, -5.7)

T-Test mu (No ) = mu (Yes) (vs not =): T = -3.37 P = 0.0019 DF = 33

Both use Pooled StDev = 12.1

## Two Sample T-Test and Confidence Interval

### Two sample T for Distance

Live wit	N	Mean	StDev	SE Mean
No	22	2.46	1.48	0.32
Yes	13	16.7	20.0	5.5

95% CI for  $\mu$  (No ) -  $\mu$  (Yes): ( -26.36, -2.2)

T-Test  $\mu$  (No ) =  $\mu$  (Yes) (vs not =): T = -2.57 P = 0.025 DF = 12

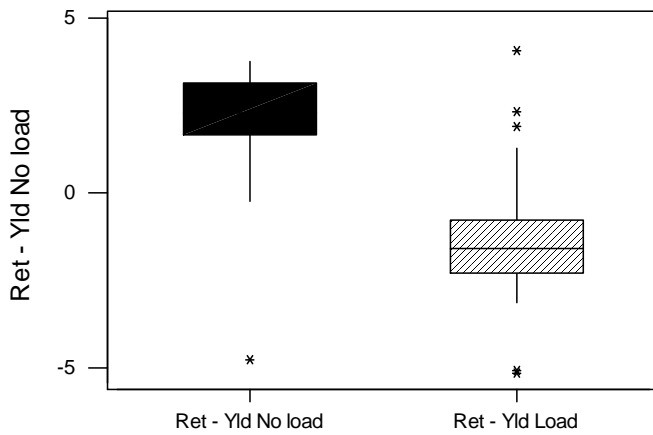
### Mann-Whitney Confidence Interval and Test

Distnosp N = 22 Median = 2.05  
Distspou N = 13 Median = 6.10  
Point estimate for ETA1-ETA2 is -4.50  
95.0 Percent CI for ETA1-ETA2 is (-20.50,-1.29)  
W = 312.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0044  
The test is significant at 0.0043 (adjusted for ties)

In this case the parametric and nonparametric tests agree. There is no apparent difference in distance for men versus women, presumably reinforcing the empowered nature of Stern women MBA's. (Right on, sister!) On the other hand, married folks live farther away from Stern than unmarried ones (the medians don't differ that much, but everyone without a spouse lives within 6 miles of school). I imagine that this reflects the requirements and wishes of the spouse — when you don't have someone else to worry about, you're going to try hard to live close to school.

3. Side-by-side boxplots of the difference between return and yield show a clear difference between load and no-load funds. Not surprisingly, load funds have a worse relative performance, which just reflects the load. What this is telling you is that it's yields that matter, not returns! There appear to be a few outliers, so nonparametric tests are useful here.



Here is some output.

### Two Sample T-Test and Confidence Interval

Two sample T for Ret - Yld No load vs Ret - Yld Load

	N	Mean	StDev	SE Mean
Ret - Yl	21	2.01	1.81	0.40
Ret - Yl	57	-1.46	1.54	0.20

95% CI for mu Ret - Yl - mu Ret - Yl: ( 2.64, 4.29)

T-Test mu Ret - Yl = mu Ret - Yl (vs not =): T = 8.39

P = 0.0000 DF = 76

Both use Pooled StDev = 1.62

### Mann-Whitney Confidence Interval and Test

Ret - Yl N = 21 Median = 2.280

Ret - Yl N = 57 Median = -1.590

Point estimate for ETA1-ETA2 is 3.880

95.0 Percent CI for ETA1-ETA2 is (3.290,4.490)

W = 1330.0

Test of ETA1 = ETA2 vs ETA1 not = ETA2 is significant at 0.0000

The test is significant at 0.0000 (adjusted for ties)

This is real bad news for load funds. From the point of view of what you get, for no load funds the return is about 2 percentage points higher than the yield, while for the load funds it's about 1.5 percentage points lower. This statistically significant difference of 3.5 percentage points reflects the fee you're paying for the expertise of the fund managers. But is it worth it? That's the question ...