Homework for Math 3080 §1, Spring 2014

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April 9, 2014

Please read the relevant sections in the text *Probability and Statistics for Engineering and the Sciences, 8th ed.*, by Jay L. Devore, Brooks / Cole (2012). Make sure that your papers are **self-contained.** You should copy or paraphrase the question, give complete explanation of your solution, state the results that you quote and supply adequate labels to any computer output. Homework from Wednesday and Monday will be due Friday. Late homework that is up to one week late will receive half credit. Homework that is more than one week late will receive no credit at all. The homework reader is Sarah Krstyen. Her email is: `sarah.krstyen@gmail.com` Homework that is placed in her mailbox in JWB 228 before she picks it up at about 2:00 pm Friday afternoon will be considered to be on time.

Please hand in problems A1 – A3 by Friday, January 11.

A1. Type I and type II errors. (From Math 3070 final given 4-30-01.) Two candidates AA and GW are running for office in a certain state. It is believed that 0.5 of the voters favor AA. Suppose you conduct a poll to test the alternative hypothesis that more than 0.5 of the voters favor AA. In a random sample of 15 voters, let X denote the number who favor AA. Suppose that the rejection region for the null hypothesis is $X \geq 9$.

1. What is the probability of making a Type I error, that is, of rejecting $\mathcal{H}_0$ even though it is true?
2. What is the probability of a Type II error, that is of accepting $\mathcal{H}_0$ even though the alternative is true, that actually 0.7 of the voters favor AA?
3. How many voters should you poll in order to be sure that the probability of both errors be at most .05?

A2. Testing a hypothesis about the mean. (From Math 3070 final given 4-30-01.) The desired percentage of SiO_2 in a certain type of cement is 7.85. To test whether the true average percentage is 7.85 for a particular production facility, 25 independent samples are analyzed. Suppose that the percentage of SiO_2 is approximately normally distributed with $\sigma = .500$ and that $\bar{x} = 8.02$.

1. Does this indicate conclusively that the true average differs from 7.85? State the null and altrenative hypotheses. State the test statistic and why it is appropriate. State the rejection region for the null hypothesis. Compute the P-value and draw a conclusion.
2. If the true average percentage is $\mu = 8.10$ and a level $\alpha = .05$ test based on a test with $n = 25$ is used, what is the probability of detecting this departure from $\mathcal{H}_0$?
3. What value of n is required to satisfy $\alpha = .05$ and $\beta(8.10) \leq .05$?

A3. Test for a single proportion. A plan for an executive traveller's club has been developed by Useless Airlines on the premise that 5% of its current customers would qualify for a membership. Of a random sample of 500 customers, 39 were found to qualify.

1. With this data, test at the .05 level of significance the null hypothesis that 5% is correct against the alternative that 5% is not correct.
2. What is the probability, that when the test in part (1.) were used, the company's premise will be judged correct when in fact 10% of all current customers qualify?
3. How large a random sample is required to be sure that the probability is at most 5% that when the test in part (1.) were used, the company's premise will be judged correct when in fact 10% of all current customers qualify?

Please hand in problems B by Friday, January 17.

B. Problems from the text:

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400[3, 7, 8, 10]
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Please hand in problems C1 – C2 by Friday, January 24.

C1. Problems from the text:

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407[15, 18]
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C2. High voltage electric cable consists of 12 wires. The following tare tensile strengths of 12 wires in each of 9 cables.

1. Use the computer to draw side-by-side box plots for the nine cables. Do the box plots indicate that the strength of the wires varies among the nine cables?
2. Cables 1 to 4 were made from one lot of raw material and cables 5 to 9 came from another lot. Do the boxpolts indicate that the that the tensile strengths depend on the lot?
3. Perform a one-way ANOVA to test the hypothesis that the tensile strength does not vary among the cables.
4. Use Tukey's method to determine those differences in the treatment means that are significant. Are the results consistent with the information that cables 1 to 4 came from one lot of raw material and cables 5 to 9 came from another lot?
5. Construct a 95% confidence interval for the mean μ_2.
6. Use an appropriate t-statistic to construct a 95% confidence interval for the difference $\mu_1 - \mu_5$.
7. Express the comparison between the two lots as a contrast, and test whether the tensile strength depends on the lot.

Cable Number								
1	2	3	4	5	6	7	8	9
345	329	340	328	347	341	339	339	342
327	327	330	344	341	340	340	340	346
335	332	325	342	345	335	342	347	347
338	348	328	350	340	336	341	345	348
330	337	338	335	350	339	336	350	355
334	328	332	332	346	340	342	348	351
335	328	335	328	345	342	347	341	333
340	330	340	340	342	345	345	342	347
337	345	336	335	340	341	341	337	350
342	334	339	337	339	338	340	346	347
333	328	335	337	330	346	336	340	348
335	330	329	340	338	347	342	345	341

Supplements Page has the data in a text file `M3082ProlemC2.txt`.

(Source: W. Rosenkrantz, *Probability and Statistics for Science, Engineering and Finance*, Chapman Hall / CRC, 2009, p. 494.)

Please hand in problems D by Friday, January 31.

D. Problems from the text:

`415[26, 31, 41]`

Please hand in problems E by Friday, February 7.

E. Problems from the text:

`430[1, 2, 9],`
`440[19, 22]`

Please hand in problems F by Friday, February 14.

F. Problems from the text:

`449[29]`

Please hand in problems G by Friday, February 21.

G. Problems from the text. You do not need to use Yates's method to compute effects and sums of squares.

462[39, 44, 49],
475[7, 8],
487[14, 15]

Please hand in problems H by Friday, February 28.

H. Problems from the text.

498[31, 32, 37, 38],
505[46, 49, 50]

Please hand in problems I by Friday, March 7.

I. Problems from the text.

516[59, 61, 64],
528[1, 7, 11]

Please hand in problems J by Friday, March 21.

J. Problems from the text.

541[15, 17, 23],
549[26, 27, 33]

Please hand in problems K by Friday, March 28.

K. Problems from the text.

568[40]

Please hand in problems L by Friday, April 4.

L. Problems from the text.

568[43, 47, 51],
585[55, 57, 59]

Please hand in problems M by Friday, April 11.

M. Problems from the text.

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601[3, 9],
610[13, 15, 21]
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Please hand in problems N by Friday, April 18.

N. Problems from the text.

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619[26, 28, 29],
610[3, 5, 7, 8]
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