Name_____ Please circle your TA: Adam Dominic Yiyu

Psychology 317 Final Exam
March 14, 2017

Instructions

1. Use a pencil, not a pen
2. Put your name on each page where indicated, and in addition, put your section on this page.
3. Exams will be due at 10:20!
4. If you find yourself having difficulty with some problem, go on to the rest of the problems, and return to the troublemaker if you have time at the end of the exam.
5. Leave your answers as reduced fractions or decimals to three decimal places.
6. CIRCLE ALL ANSWERS: You will lose credit if an answer is not circled!!
7. Check to make sure that you have all questions (see grading below)
8. SHOW ALL YOUR WORK: An answer that appears from nowhere will receive no credit!!
9. Whenever you are asked to compute anything having to do with the normal distribution, use the z-scaling technique taught in class unless told otherwise.
10. Whenever you use the normal approximation to the binomial, be sure to take the correction for continuity into account.
11. Use $\alpha = .05$ and assume a 95% confidence interval unless told otherwise.

Grading

Problem	Points	Grader
1a-d	/23	Dominic
2a-c	/13	Dominic
3a-b	/15	Yiyu
4a-b	/11	Yiyu
5a-c	/18	Yiyu
6	/10	Adam
7a-b	/10	Adam
TOTAL	/100	

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1. Here is a random sample of n = 9 scores.

11 15 21 13 11 12 11 12 20

a) Compute the mean, median, mode, sum of squares, variance, and standard deviation of these scores (6 points)

b) Arrange the scores as an empirical probability distribution and use this distribution as the basis for computing the mean and the variance. Be especially careful to show all your work. (4 points)

v

c) Suppose that these scores represent heights (in inches) of a sample of n = 9 Emma Plants. In the past these plants are known to have had a population mean height, μ, of 10 inches and a population variance, $\sigma^2 = 1.700$. However, these nine plants have been grown using a new, improved plant food, "Miracu-Gro" which is hypothesized to increase plant height.

Evaluate the alternative hypothesis that Miracu-Gro *increases* plant heights against the null hypothesis that it doesn't. **Use α = .01.** (6 points)

d) With the assumptions of Part (c) compute a 95% confidence interval around your obtained mean from Part (a) (7 points)

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2. Spike's Biker Pub sells beer in Spike's special beer mugs. These mugs are supposed to contain one liter of beer, but years of experience have shown that the amount of beer sold in Spike's special mugs are normally distributed with a population mean, $\mu = .920$ liters, and a variance, σ^2, of 0.040.

a) Write (as an equation) the probability density function of amount of beer in liters (L) in Spike's special mugs. (2 points)

b) Consider an interval that contains 25% of this distribution. If the lower bound of this interval is .884 liters, what is the upper bound? (9 points)

c) Suppose you measure amount of beer in *pints* instead of liters (there are 2.113 pints in each liter). Rewrite your probability density equation from Part (a) for the amount of beer now measured in pints (P), and recompute your answer to Part (b), showing your answer in pints (P). (HINT: This should be easy, but you must still show all your work). (2 points)

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3. You are concerned with whether people who meditate have reaction times that are *different* from people who do yoga. To address this question, you plan to carry out an experiment in which there are two groups. Group 1, the Meditation Group, consists of people who meditate but don't do yoga, while Group 2, the Yoga Group, consists of people who do yoga but don't meditate. Reaction times are to be measured for all subjects.

   Assume that reaction time is distributed in the Meditation population with a variance, $\sigma^2_1 = 49.0$ while reaction time is distributed in the Yoga population with a variance, $\sigma^2_2 = 64.0$.

a) In the experiment, there are $n_1 = 49$ subjects in the Meditation Group and $n_2 = 25$ subjects in the Yoga Group.

   You plan to test the null hypothesis that the Meditation population reaction-time mean (μ_1) is identical to the Yoga reaction-time mean (μ_2) , against the alternative hypothesis that the two population means differ. **You plan to use an a level of 0.03.** State what summary score you will use, compute the criterion summary score(s) and state your decision rule. (8 points)

b) Suppose that the obtained mean reaction times for the Meditation Group and Yoga Group are, respectively, $M_1 = 235$ milliseconds and $M_2 = 230$ milliseconds. Compute a **70%** confidence interval around your obtained summary score. (7 points)

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4. There dwells in Borneo a creature called a Borneo microsaur. Microsaurs are subdivided in two ways.

   First, there are two microsaur sizes: Tiny (T) and Little (L). Twenty-two percent of all microsaurs are Tiny and the rest are Little.

   Second, 70% of microsaurs are Yellow (Y) while the rest are Blue (B).

   It is also true that 36% of the Tiny microsaurs are Blue, while the remainder of the Tiny microsaurs are Yellow.

a) Represent this situation by filling in the contingency table below (Please make microsaur size correspond to columns and microsaur color correspond to rows). **Be sure to show all your work** (8 points)

	T	L	
Y			
B			

b) Are size and color independent? Justify your answer. (3 points)

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5. The game of "Dynamite" works as follows. On each Dynamite trial the player throws a die then flips a coin. The number of points awarded on the trial is computed as follows:

   If the coin comes up tails then the player is awarded the die's face value (i.e., 1 - 6).

   If the coin comes up heads then the player is awarded the die's face value for face values of 1 or 2, but three times the die's face value for face values of 3, 4, 5, or 6.

a) Compute the probability distribution for the number of points per trial and insert it in the table below (note that we have left lots of extra room for you in this table). (10 points)

v_____

b) Compute the expected value, variance, and standard deviation of your distribution from Part (a). (6 points)

c) Suppose that a person plays 312 Dynamite trials. Compute the expected frequency distribution of points. Include this distribution as part of the table above. (2 points)

6. On a *trial*, Alexander throws a fair die N = 60 times and writes down the number of 3's that he gets. Alexander carries out 2,500 trials. Thus at the end of the 2,500 trials, he has 2,500 numbers, each number corresponding to the number of 3's out of 60 die throws that he got on each of the 2,500 trials.

   What is your best guess as to the mean, variance, and standard deviation of this set of 2,500 numbers? (10 points)

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7. Franklin, a biologist, is investigating Borneo microsaurs. According to native folklore, there exist green microsaurs in the microsaur population, in addition to yellow and blue microsaurs, and Franklin is trying to determine whether this is true. He plans to observe a sample of n = 100,000 microsaurs and to determine whether any of them are green. His null and alternative hypotheses are:

   H_0; The number of green microsaurs in the population is zero

   H_1: The number of green microsaurs in the population is greater than zero

   Franklin plans that his summary score will be the number of green microsaurs in his sample.

a) Using a statistical technique that he found on NameYourHypothesis.com, Franklin determines that his criterion summary score should be 3: That is, if he finds 3 or more green microsaurs in his sample of 100,000 microsaurs, he should reject H_0; otherwise he should fail to reject H_0.

   What is wrong with either Franklin's reasoning and/or the statistical technique that he is using?

   HINT: This should be an easy problem. **So be brief in your answer; i.e., you should be able to answer this question in a sentence or two.** (4 points)

b) Franklin further believes (in general, not just with his microsaur experiment) that the results of hypothesis testing can be characterized as follows: if α is always set to .05 then 5% of "reject the null hypothesis" decisions will be wrong.

   Explain the flaw in Franklin's reasoning. **Be brief in your answer; i.e., you should be able to answer this question in no more than three sentences.** (6 points).