AMS5 - Practice Final
Thursday 5th March, 2009

READ THE INSTRUCTIONS CAREFULLY

1. Write your answers in a Blue Book. Put your name, your student ID number, your section day/time and your TA's name on the front of your blue book.

2. This exam consists of five (5) questions. You are expected to answer all the questions. Questions are not necessarily worth equal numbers of marks.

3. You are advised to read the questions carefully, and answer the question asked.

4. Begin your answer to each question on a new page.

5. You must show working for all questions to get full marks.

6. Write your answers in ink. Answers completed in pencil will not be graded.

7. A normal table, a t-table, and a χ^2-table can be found at the end of this exam. [They are not included in this practice exam, but will be included in the actual exam.]

8. Hand in this question paper with your answers.

9. The actual final will include some bonus questions. You can get full marks without answering the bonus questions. Correct answers to the bonus questions will earn you additional marks, but you cannot score more than 100%.

1. *(12 marks)* A factory manufactures widgets. To successfully manufacture widgets, two machines must both be working. The production supervisor has noticed that in a 28 day period, machine A was broken on 5 days, and machine B was broken on 8 days. Assuming that the chance of a machine to be broken on a given day is independent of its chance to be broken on any other day,

   (a) Calculate a 95% confidence interval for the percentage of days that machine A is broken.

   (b) Is there evidence in the data collected that machine B is less reliable than machine A? What additional assumptions are you making, if any?

   (c) The production supervisor's intuition suggests that the machines break down together more than should be expected. Over a 60 day period, she observes that there are 14 days when only machine A breaks down, 13 days when only machine B breaks down, and 2 days when both break down. Does this data support her intuition?

   (d) Assuming that 5/28 and 8/28 represent the respective probabilities that machines A and B will break down, and assuming independence, what is the chance of one or other of the machines breaking down on a given day?

2. *(11 marks)* When we last ate chocolate chip cookies in class, we found that chips ahoy! cookies had, on average, 24.1 chips with an SD of 3.6 chips, and that generic cookies had, on average, 22.4 chips with an SD of 4.4 chips. You may assume that these values for the average numbers of chips and the SDs apply to the populations of cookies.

   (a) Assuming that the number of chips follows the normal curve, what percentage of generic cookies have more than 30 chips? What percentage of chips ahoy! cookies do?

   (b) What is the chance that, in the next 10 generic cookies that you eat, 6 will have more than 30 chips?

   (c) What are the populations from which the cookies we ate are a sample?

   (d) You give 20 cookies of each type to your friend. Do you expect them to be able to tell which brand has more chips?

3. *(5 marks)* Read the summary (just the first paragraph) of the journal article "What Does Doodling Do?", attached to the back of this exam.

    (a) What is the hypothesis that the researchers are studying?

    (b) Formulate the researcher's hypothesis in terms of a null hypothesis.

    (c) Are they performing an observational study or a controlled experiment?

    (d) What difficulties do you foresee in performing a blind experiment?

    (e) What do the researchers conclude?

4. *(11 marks)* For the data consisting of measurements of the temperature at various elevations in California, we found that the average elevation was 3524 ft, with an SD of 1839 ft; the average temperature was 70.3 F, with an SD of 6.5 F; the correlation coefficient, r, was -0.76.

    (a) Sketch (roughly) the scatter diagram for this data. Label the axes.

    (b) What temperature would you expect at 6000ft? At sea level?

    (c) What would the RMS error in these estimates be?

    (d) What percentage of locations at 6000ft would you expect to be hotter than 68F?

    (e) For this data set, the highest elevation was 8050ft, and a temperature of 56F was recorded. If you were to re-visit this site, would you expect to record a higher or a lower temperature? Why?

5. *(5 marks)* A test is developed for a disease. The test is 99% accurate, that is, the chance of a positive test if you have the disease is 0.99, and the chance of a negative test if you do not have the disease is also 0.99.

   (a) Using only your intuition (without doing any calculation) – if someone has a positive test result, what is the chance that they have the disease? Explain your answer.

   (b) Assume that the disease is the common cold, and that 10% of the population currently have the sniffles. Out of a population of 1000

      i. How many people in the population have a cold?
      ii. How many of the people with a cold will test positive?
      iii. How many people in the population do not have a cold?
      iv. How many of the people who do not have a cold will test positive?

   (c) The frequency definition of probability says that the probability of having a cold, conditioned on a positive test, is the ratio of the (# of positive tests amongst people with colds) to the (total # of positive tests).

      Using your answers to part b), what is the chance of a person having a cold, given that they have tested positive?

What Does Doodling do?

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SUMMARY

Doodling is a way of passing the time when bored by a lecture or telephone call. Does it improve or hinder attention to the primary task? To answer this question, 40 participants monitored a monotonous mock telephone message for the names of people coming to a party. Half of the group was randomly assigned to a 'doodling' condition where they shaded printed shapes while listening to the telephone call. The doodling group performed better on the monitoring task and recalled 29% more information on a surprise memory test. Unlike many dual task situations, doodling while working can be beneficial. Future research could test whether doodling aids cognitive performance by reducing daydreaming. Copyright © 2009 John Wiley & Sons, Ltd.

The call centre has put you on hold yet again and you start thinking about how good it would be to have a holiday, where you would like to visit ... then you realize that the person you have been waiting to speak to has already started talking and you have not taken in anything they have said. This scenario illustrates the tendency for daydreaming to start in moments of boredom and, once started, to distract attention from the task in hand. In such a situation some people resort to doodling, aimlessly sketching patterns and figures unrelated to the primary task. It is not known whether doodling impairs performance by detracting resources from the primary task, as would be the case for the most concurrent cognitive tasks or whether it improves performance by aiding concentration (Do & Schallert, 2004) or maintaining arousal (Wilson & Korn, 2007). This question ties into more general issues in cognitive and applied psychology. Boredom is a very common experience (Harris, 2000) and daydreaming is a common response, even in the laboratory (Smallwood & Schooler, 2006). A way of aiding concentration would have implications for psychological research methods as well as practical applications. Dual task designs are commonly used to pinpoint specific cognitive resources needed to perform a task, but they fail to do this accurately if the effects of boredom are overlooked. Performance decrements through competition for task-specific resources may be moderated if the secondary task also reduces the mind-wandering or elevated arousal levels that can be a hidden feature of single task control conditions (Smallwood, O'Connor, Sudbery, & Obonsawin, 2007).

This study is the first experimental test known to the author of the prediction that doodling aids concentration. Participants listened to a monotonous mock telephone message. An auditory task was chosen so that doodling would compete minimally for

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