

Statistics 151 Midterm #1 – October 18, 2006

This exam has 4 problems and is worth 80 points. Instructor: Michael Kozdron

You must answer all of the questions in the exam booklet provided.

*You have 50 minutes to complete this exam. Please read all instructions carefully, and check your answers. Show all work neatly and in order, and clearly indicate your final answers. Answers must be justified whenever possible in order to earn full credit. **Unless otherwise specified, no credit will be given for unsupported answers, even if your final answer is correct.** Points will be deducted for incoherent, incorrect, and/or irrelevant statements.*

This exam is closed-book, except that one $8\frac{1}{2} \times 11$ double-sided page of notes is permitted. A copy of Table E will be provided, and calculators are allowed. Other than these exceptions, no other aids are allowed.

1. (16 points) Michael, a lazy statistics instructor, decides to assign grades at random to students in his class of 120. For each student, he rolls a fair (standard, six-sided) die and passes the student if the die shows 1, 2, 3, or 4. He fails the student if the die shows 5 or 6.

- (a) (6 points) What is the probability that every student passes?
- (b) (4 points) How many students are expected to pass?
- (c) (6 points) Write down as complete an expression as possible to represent the probability that at most 3 students fail. (Do not evaluate your expression.)

2. (28 points) During January 2006, Michael (a Canadian from Regina, SK), was escaping the snow and vacationing in Phoenix, Arizona. While watching the evening news, the American meteorologist would announce the day's high temperature in degrees Fahrenheit. Michael remembered to write down the temperature 17 times during his 31-day stay in Phoenix. Here is what he recorded:

74, 78, 82, 83, 78, 73, 84, 89, 91, 78, 77, 82, 69, 93, 76, 74, 79.

- (a) (4 points) Construct a stem-and-leaf plot of this temperature data by completing the following table in your exam booklet. (Be sure to recopy these stems.)

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- (b) (4 points) Draw a histogram of this temperature data. Use class boundaries of width 5. (i.e., 55–60, 60–65, 65–70, etc.)
- (c) (4 points) Determine the mean temperature (in degrees Fahrenheit) for those days in which Michael remembered to record the temperature.
- (d) (4 points) Determine the standard deviation of this temperature data.
- (e) (4 points) Determine the five number summary of this temperature data (in degrees Fahrenheit).
- (f) (4 points) In your opinion, which measure of centre (mean or median) is most appropriate for this data set.
- (g) (4 points) In order to gloat with his friend's back home, Michael needed to convert his temperature observations into degrees Celsius. Remembering that

$$\text{fahrenheit} = \left(\frac{5}{9} \times \text{celsius} \right) + 32$$

determine, in *degrees Celsius*, the mean of this temperature data.

3. (20 points) There are an estimated 1.4 million Canadians who suffer from a disease which leads to bone fragility and increased risk of fractures, especially the hip, spine and wrist. In order to determine if a patient has normal bone structure, a test is done to measure her *bone mineral density (BMD)*, and is said to have *osteoporosis* if the value of her BMD test “is 2.5 standard deviations or more below the young adult mean.” It has been found that young adult BMD values are normally distributed with mean 0.85 g/cm^2 and standard deviation 0.11 g/cm^2 .

- (a) (4 points) Jessica had a BMD test which produced a value of 0.67 g/cm^2 . Does Jessica have osteoporosis?
- (b) (4 points) Allison had a BMD test which produced a value of 1.13 g/cm^2 . Does Allison have osteoporosis?
- (c) (6 points) Audrey was told that her BMD test produced a value which was in the middle 75% of all BMD values. Determine the range of possible values for Audrey’s BMD test.
- (d) (6 points) Lynne is about to have a BMD test. What is the probability that her BMD test will produce a value between 0.70 and 1.05 g/cm^2 ?

4. (16 points)

Answer each of the following with a short paragraph. Your answer should draw on as many appropriate ideas as possible as have been discussed in Statistics 151 so far this semester.

- (a) (8 points) A number of volunteers were assigned to one of two groups, one of which received daily doses of vitamin C, and one of which received a placebo (a “sugar” pill without any active ingredients). It was found that the rate of colds was lower in the vitamin C group than in the placebo group. It became evident, however, that many of the subjects in the vitamin C group correctly guessed that they were receiving vitamin C, rather than the placebo, because of the taste. Can it still be said that the difference in treatments is what caused the difference in cold rates?
- (b) (8 points) Ten marijuana users, aged 14 to 16, were drawn from patients enrolled in a drug abuse program and compared to nine drug-free volunteers of the same age group. Neuropsychological tests for short-term memory were given, and the marijuana group average was found to be significantly lower than the drug-free group average. The marijuana group was held drug-free for the next six weeks, at which time a similar test was given with essentially the same result. The researchers concluded that marijuana use caused adolescents to have short-term memory deficits that continue for at least six weeks after the last use of marijuana. Can these results be generalized to other 14–to 16–year olds?

Bonus Question: How many extra points should be added to your Assignment #2? (Include your answer in your exam booklet.)