MA 180/418   Midterm Test 2, Version A   Fall 2010

Student Name (PRINT):. . . . .

Student Signature: . . . .

The test consists of 10 questions.
Questions 1 through 5 are multiple-choice and worth 5 points each.
Questions 6 through 10 are computational and worth 15 points each.

For questions 1 through 5, circle the correct answer (**a**, **b**, **c**, or **d**) after each question.
Each question is 5 points. No partial credit.

Q1 Select the correct interpretation of the term **99% confidence interval**.

(a) It is an interval containing 99% of the data.

(b) It means that the population parameter will be in our interval with probability 99% and outside of that interval with probability 1%.

(c) It means that if we repeat the procedure many times, approximately 99% of the intervals so constructed will contain the true population parameter.

(d) It is an interval over which the area under the density curve is 0.99.

Correct answer (circle one):   (a)   (b)   (c)   (d)

Q2 What is a **Type-II error** in hypothesis testing?

(a) A Type-II error occurs when the test statistic happens to be outside the critical region.

(b) A Type-II error occurs when the null hypothesis is accepted when, in fact, the null hypothesis is false.

(c) A Type-II error occurs when the null hypothesis is rejected when, in fact, the null hypothesis is true.

(d) A Type-II error occurs when the P-value exceeds the significance level α.

Correct answer (circle one):   (a)   (b)   (c)   (d)

Q3 What is the **P-value** for a hypothesis test?

(a) The P-value is the probability of getting a value of the test statistic that is at least as extreme as the one representing the sample data, assuming the null hypothesis is true.

(b) The P-value is twice the level of significance, α. That is, $P = 2\alpha$.

(c) The P-value is twice the area of the right tail for a Right-Tailed test and twice the area of the left tail for a Left-Tailed test.

(d) The P-value is used instead of the critical value when the latter is not available.

Correct answer (circle one):   (a)   (b)   (c)   (d)

Q4 What is the meaning of the **rare event rule** in statistics?

(a) If the probability of a particular observed event is extremely small, we conclude that the probability is perhaps incorrectly computed.

(b) If, under a given assumption, the probability of a particular observed event is extremely small, we conclude that the assumption is perhaps not correct.

(c) An event is a rare event if its probability is ≤ 0.01.

(d) An event is a rare event if its probability is ≤ 0.05.

Correct answer (circle one):   (a)   (b)   (c)   (d)

Q5 How do you compute the number of **degrees of freedom** for one sample?

(a) The number of degrees of freedom is equal to the sample mean, $\bar{x}$.

(b) The number of degrees of freedom is equal to the sample variance, s.

(c) The number of degrees of freedom is equal to the sample size, n.

(d) The number of degrees of freedom is the sample size minus one, i.e., $n - 1$.

Correct answer (circle one):   (a)   (b)   (c)   (d)

For questions 6 through 10, write your answer in the space provided. Show your work. Each question is worth 15 points.

[Q6] When 12 different medical students measured the blood pressure of the same person, they obtained the following results (in mmHg)

$$122 \quad 141 \quad 135 \quad 129 \quad 131 \quad 125 \quad 140 \quad 121 \quad 137 \quad 130 \quad 128 \quad 136$$

Assume that the population has normal distribution and its standard deviation is known to be 6 mmHg.

(a) Construct a 99% confidence interval for the population mean. Show your work. If you use a formula, write it down in <u>algebraic form</u> and then <u>fill in the numerical values</u>. If you use a calculator function, <u>name it</u>. (Round off to **two** decimal places.)

(b) Give the best point estimate of the population mean.

(c) Give the margin of error. Explain how you computed it.

[Bonus] Construct a 90% confidence interval for the population mean. Which interval is wider? Why?

Q7 How many randomly selected adults must he surveyed to estimate the percentage of adults who now use the Internet? Assume that we want to be 98% confident that the sample percentage is within two percentage points of the true population percentage. (Write down the formulas that you use.)

(a) Assume that nothing is known about the percentage of adults who use the Internet.

(b) Assume that a recent survey suggests that about 84% of adults use the Internet.

Q8 A random sample of the weights of 18 green M&Ms has a mean of 0.86 g and a standard deviation of 0.04 g. Assume that the population has normal distribution.

(a) Give an appropriate point estimate for the standard deviation of weights of all M&Ms.

(b) Construct an 80% confidence interval estimate of the standard deviation of weights of all M&Ms. (Round off to **three** decimal places.) Name the distribution that you use. Give the number of degrees of freedom.

Q9 Among 400 subjects tested for marijuana use, 74 tested positively. Use a 0.1 significance level to test the claim that 20% of the population use marijuana.

(a) State the null and the alternative hypotheses.

(b) Compute the test statistic.

(c) Draw a diagram. Find and mark the critical value(s). Make an <u>initial conclusion</u> and a <u>final conclusion</u>.

(d) Find the P-value of the test. Make a conclusion by using the P-value.

$\boxed{\text{Q10}}$ A sample of 91 adults is obtained, and each person's red blood cell count is measured. The sample mean is 5.313 and the sample standard deviation is 0.54. Use a 0.025 significance level to test the claim that the sample is from a population with a mean greater than 5.2.

(a) State the null and the alternative hypotheses.

(b) Compute the test statistic. (Round off to **three** decimal places.)

(c) Draw a diagram. Find and mark the critical value(s). Make an <u>initial conclusion</u> and a <u>final conclusion</u>.

[Bonus] Use Table A-3 to determine an interval for the P-value, or use a calculator to find the exact P-value (round it off to **four** decimal places).