Name: __________________________

ACMS 20340, Practice Exam 2 (Spring 2016)  Instructor: ________________________
March 1, 2016

• Be sure that you have all 9 pages of the test.
• The exam lasts for 1 hour and 15 min.
• The Honor Code is in effect for this examination, including keeping your answer sheet under cover.

Good Luck!

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1. (a) (b) (c) (d) (e)
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Multiple Choice

1. (pts.) Let $X$ be a Normally distributed random variable with mean $\mu = 0$ and $\sigma = 2$. What is the probability that $X$ is less than 0.5?

(a) 0  (b) 0.8413  (c) 0.5987  (d) 0.6915  (e) 0.5

2. (pts.) IQ scores from a local university are Normally distributed with a mean of 100 and a standard deviation of 15. Using the 68-95-99.7 rule, what percent of students score below a 70?

(a) 2.5%
(b) 5%
(c) 0.15%
(d) 16%
(e) 32%
3. (pts.) A random sample of newborn children in the United States have a mean weight of 8.23 pounds, compared to a mean weight of 7.47 pounds of all newborns in the United States. Which of the following is true?

(a) Both 7.47 lbs. and 8.23 lbs. are statistics.
(b) 7.47 lbs. is a statistic, while 8.23 lbs. is a parameter.
(c) Both 7.47 lbs. and 8.23 lbs. are parameters.
(d) 8.23 lbs. is a statistic, while 7.47 lbs. is a parameter.
(e) None of the above.

4. (pts.) In taking a collection of samples (of different sizes) from a given population, we find that as the sample size increases, the sample mean gets closer to the population mean. This is a consequence of

(a) the central limit theorem.
(b) the sampling distribution of \( \hat{p} \).
(c) the Normal distribution.
(d) the sampling distribution of \( \bar{x} \).
(e) the law of large numbers.
5. (pts.) The sampling distribution of a statistic

(a) is the probability that we obtain the statistic in repeated random samples.
(b) exists because of the central limit theorem.
(c) is the mechanism that determines whether randomization was effective.
(d) is the distribution of values taken by that statistic in all possible samples of the same size from the same population.
(e) is the extent to which the sample results differ systematically from the truth.

6. (pts.) Which of the following is not true of a confidence interval for a population mean?

(a) The size of the interval is determined, in part, by the confidence level.
(b) We can be absolutely confident that it contains the population mean.
(c) To find the margin of error, we multiply the standard deviation of the sampling distribution by the critical value.
(d) The center of the interval is the mean of a sample.
(e) With a 95% confidence interval, 95% of the time, the population mean is contained in the interval.
According to the National Institute of Allergy and Infectious Diseases, about 3.7% of American adults have a food allergy. A large company plans a lunch reception for its 400 employees. Assume that employees are independent. Let the random variable $X$ be the number of company employees who have a food allergy. Using this Normal approximation, the probability that at least 20 of the 400 employees have a food allergy is closest to

(a) 0.05  
(b) 0.084  
(c) 0  
(d) 0.644  
(e) 0.5

Here is a histogram of two normal distributions. Let $X_1$ be the variable following blue pdf curve. And red one is $X_2$. $X_1 \sim N(\mu_1, \sigma_1), X_2 \sim N(\mu_2, \sigma_2)$. Which of the statement is true.

(a) $X_1 \sim N(2, 1), X_2 \sim N(3, 0.2)$  
(b) $X_1 \sim N(2, 0.2), X_2 \sim N(3, 1)$  
(c) $X_1$ has less standard deviation than $X_2$.  
(d) $X_1 \sim N(3, 0.2), X_2 \sim N(2, 1)$  
(e) $X_1 \sim N(3, 1), X_2 \sim N(2, 0.2)$
9. (pts.) Assuming a parent is heterozygous for a particular gene, the likelihood of passing on the dominant allele is 50% the same as for passing on the recessive allele. Assuming that separate births are independent, the probability that exactly five out of the next ten births receive the recessive allele is

(a) 0.2461
(b) 0.3125
(c) 0
(d) 0.5
(e) 0.1667

10. (pts.) Suppose that a lot of 5000 electrical fuses contain 5% defectives. If a sample of 5 fuses is tested, what are the number of ways to get 2 defective?

(a) \( \binom{5}{2} (0.05)^2 \)
(b) \( \binom{5000}{2} (0.05)^2 (0.95)^{4998} \)
(c) \( \binom{5}{2} \)
(d) \( \binom{5}{2} (0.05)^2 (0.95)^3 \)
(e) \( \binom{5000}{2} \)
11. (pts.) In a study of the effect of diet on cholesterol, rats were fed a diet with 5% added fiber from oat bran. For the 12 rats which were fed this diet, average blood cholesterol level (in milligrams per deciliter [mg/dl]) was 96. The standard deviation of the measured blood cholesterol levels in these rats was 15 mg/dl. Cholesterol levels are approximately Normal. Give the 98% confidence interval for the mean cholesterol level \( \mu \) in this population.

(a) 83.87 to 108.13
(b) 84.23 to 107.77
(c) 85.93 to 106.07
(d) 78.39 to 101.61
(e) 75.16 to 104.84
12. (pts.) There are about 8,300 undergraduates at Notre Dame, and approximately 3320 (= 830 × 4) of them are from the western United States. Suppose we choose 25 undergraduates at random. Let \( \hat{p} \) be the proportion of people from the west in our sample.

(i) (2 pts.) What is the population?

(ii) (3 pts.) Do we know the population parameter \( p \)? If so what is it?

(iii) (3 pts.) What is the mean of the sample statistic \( \hat{p} \)?

(iv) (3 pts.) What is the standard deviation of \( \hat{p} \)?

(v) (4 pts.) What is the probability that a randomly selected group of 25 Notre Dame undergraduates contains 8 or more students from the western United States (i.e. \( P(\hat{p} \geq 8/25) \))?
13. (15 pts.)

(i) (8 pts.) A packaging machine fills jars of aspirin by weight, where the distribution of weights is Normal, with standard deviation 0.8 ounces. Suppose that we take an SRS of 64 jars and find the average weight to be 4.9 ounces. What is a 95% confidence interval for the average weight of jars filled by the machine?

(ii) (3 pts.) Saying that the above interval is at the 95% level means that if we were to take many samples and construct similar confidence intervals for each sample, we would expect the

________________________ __________________ to be in about __________ of the intervals.

(iii) (4 pts.) The settings on the machine tell us that each jar should weight 5.1 ounces. Using the 95% confidence interval you constructed in part (i), can you conclude whether or not the machine is working correctly? Why or why not?
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Good Luck!

### PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

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