# STAT303: Sec 508
# Spring 2005
# Exam #2
# **Form A**

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1. **Don't EVEN open this until you are told to do so.**
2. Be sure to mark your CORRECT section number and your test form on the scantron!
3. Sign your name where indicated on your scantron. You may keep this exam.
4. There are 20 multiple-choice questions on this exam, each worth 5 points. There is partial credit. Please mark your answers **clearly** on the scantron. Multiple marks will be counted wrong.
5. You will have **60 minutes** to finish this exam.
6. This exam is worth 100 points, and will constitute 20% of your final grade.
7. If you are caught cheating or helping someone to cheat on this exam, you both will receive a grade of **zero** on the exam. You must work alone.
8. Good luck!

1. The Central Limit Theorem tells us that

   A. The distribution of any sample mean, $\overline{X}$, can be represented by the normal if the sample size, $n$, is large enough.
   B. The distribution of any sample can be represented by the normal if the sample size, $n$, is large enough.
   C. The center of any random sample is the sample mean, $\overline{x}$.
   D. Exactly two of the above.
   E. None of the above.

or 1. The sampling distribution of a statistic is

   A. the probability that we obtain the statistic in repeated random samples.
   B. the mechanism that determines whether randomization was effective.
   C. the distribution of values of a statistic in all possible samples of the same size from the same population.
   D. the extent to which the sample results differ systematically from the truth (the population parameter).
   E. the probability that we obtain a particular value for a statistic in repeated samples.

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90%  (13.428, 15.572)
95%  (13.207, 15.793)
99%  (12.751, 16.249)
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2. Given the three confidence intervals for $\mu$ above, what is the range of the $p$-value for testing $H_0 : \mu = 13.5$ vs. $H_A : \mu \neq 13.5$? (or $\neq 15.5$)

   A. $p$-value $> 0.10$
   B. $0.10 >$ $p$-value $> 0.05$
   C. $0.05 >$ $p$-value $> 0.01$
   D. $0.01 >$ $p$-value
   E. The sample mean is 14.5, not 13.5, so we can't use this information.

3. Which of the following is the *best* interpretation of the 95% confidence interval in the last problem, (13.207, 15.793) (assuming we will be sampling from the same population)?

   A. 95% of the time this type of confidence interval will contain 13.5 (or 15.5)
   B. 95% of the time this type of confidence interval will contain 14.5
   C. 95% of the time this type of confidence interval will contain the true mean, $\mu$
   D. The probability of this interval containing the true mean, $\mu$, is 95%.
   E. 95% of the time the true mean, $\mu$, will fall between 13.207 and 15.793.

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4. What affects the sampling distribution of the sample mean, $\overline{X}$?

   A. whether the sample is random or not
   B. the size of the sample, $n$
   C. the parent population distribution (the population being sampled)
   D. All of the above affect the sampling distribution of $\overline{X}$.
   E. Exactly two of the above affect the sampling distribution of $\overline{X}$.

5. Which of the following is/are true?

   A. Probability distributions are for numeric data since you can't find a mean for a proportion (categorical data).
   B. Probability distributions tell us all possible values for the data and what their probabilities are.
   C. Probability distributions are always normal in shape.
   D. All of the above are true.
   E. Exactly two of the above are true.

or 5. Which of the following is true about probability?

   A. Every probability much be positive, but no more than 1(100%).
   B. The probability that an event will occur is the sample proportion of times the event will occur out of multiple repetitions of the experiment.
   C. Just because we know the exact probability that an event will occur doesn't mean we know what will happen next.
   D. All of the above are true.
   E. Only two of the above are true.

6. If the true population proportion, $\pi = 0.3$, what is the approximate sampling distribution of the sample proportion, $p$, for samples of size $n = 30$?

   A. $N(0.3, 0.007^2)$
   B. $N(0.3, 0.084^2)$
   C. $N(0.3, 02.51^2)$
   D. We can't say it is normal since 30 isn't big enough, but $\mu_p = 0.3$ and $\sigma_p = 0.007$
   E. We can't say it is normal since 30 isn't big enough, but $\mu_p = 0.3$ and $\sigma_p = \sqrt{0.3 * (1 - 0.3)/30}$

or 6. What is the sampling distribution of the difference of two means, each from samples of size 25, if the first is $X \sim N(12, 5^2)$ and the second is $Y \sim N(15, 10^2)$? (Find the distribution of $\overline{X}_{25} - \overline{Y}_{25}$.) NOTE: I rounded to the nearest integer.

A. $N(-3, 5^2)$
B. $N(-3, 3^2)$
C. $N(-3, 2^2)$
D. $N(-3, 1^2)$
E. You can't tell whether the new distribution is normal and the sample sizes are less than 30.

7. For $X \sim N(8, 6^2)$, what is $P(16 < X < 20)$?

A. practically 0
B. 0.069
C. 0.0918
D. 0.67
E. 0.8854

or 7. $X \sim N(4, 2^2)$. What is $P(0 < X < 4)$?

A. 0.4772
B. 0.5, the upper half of the normal curve
C. 0.5, the lower half of the normal curve
D. 0.0228
E. 0.025

8. If we took a sample of size 4 from the previous distribution, $X \sim N(8, 6^2)$, what would be true for the same range, $P(16 < \overline{X}_4 < 20)$?

A. The probability would be more.
B. The probability would be the same since it's the same population.
C. The probability would be less.
D. The probability would be the same since it's the same range.
E. You would have to calculate it to find out.

or 8. If we took a sample of size 4 from the previous distribution, $X \sim N(4, 2^2)$, what would be true for the same range, $P(0 < \overline{X}_4 < 4)$?

A. The probability would be more.
B. The probability would be the same since it's the same population.
C. The probability would be less.
D. The probability would be the same since it's half of the curve.
E. You would have to calculate it to find out.

9. What is $z^*$ such that $P(-z^* < Z < z^*) = 0.93$ and $Z \sim N(0, 1^2)$

A. $\pm1.645$
B. $\pm1.675$
C. $\pm1.7$
D. $\pm1.81$
E. $\pm1.07$

10. The $p$-value of a hypothesis

A. is compared to $\alpha$.
B. is compared to $\beta$.
C. is based on the sign of the alternative hypothesis.
D. All of the above are true.
E. Exactly two of the above are true.

| X | 0 | 1 | 2 | 4 | 5 |
|---|---|---|---|---|---|
| p(X) | 0.2 | 0.3 | 0.2 | 0.1 | ? |

11. What are the mean, $\mu_X$ and median, $\tilde{X}$, for the distribution represented in the table above? Yes, you must figure out the missing probability first.

A. $\mu_X = 1.1$ and $\tilde{X} = 2$
B. $\mu_X = 1$ and $\tilde{X} = 2$
C. $\mu_X = 2.1$ and $\tilde{X} = 2.5$
D. $\mu_X = 2.1$ and $\tilde{X} = 1.5$
E. $\mu_X = 2.5$ and $\tilde{X} = 1$

12. For the $X$ distribution above, how likely are you to get 2 observations *less than* 2 if they are drawn randomly?

A. 1
B. 0.5
C. 0.25
D. 0.49
E. 0

13. The sample proportion of red M&M's, in bags with a total of 50, is $p_{red} \sim N(0.2, (0.057^2)$. How likely are you to get only 2 reds (so $p_{red} = 2/50 = 0.04$)? What is $P(p_{red} \leq 0.04)$?

A. $-2.81$
B. 0.0025
C. 0.025
D. 0.0218
E. $-2.017$

or 13. The sample proportion of red M&M's, in bagsor with a total of 50, is $p_{red} \sim N(0.2, (0.057^2)$. How likely are you to get only 4 reds (so $p_{red} = 4/50 = 0.08$)? What is $P(p_{red} \leq 0.08)$?

A. $-2.11$
B. 0.0174
C. 0.9826
D. 0.9192
E. 1.40

14. What is $x^*$ such that $P(X < x^*) = 0.94$ if $X \sim N(2, 5^2)$?

A. 1.555
B. 9.775
C. 3.555
D. 8.11
E. 0.8264

or 14. $X \sim N(4, 2^2)$. What is $x^*$ such that $P(X < x^*) = 0.65$?

A. 0.385
B. 4.385
C. 4.77
D. 4.65
E. 4.325

15. To determine whether the mean nicotine content of a brand of cigarettes is greater than the advertised value of 1.4 mg, a health advocacy group tests $H_0 : \mu \leq 1.4$ vs. $H_A : \mu > 1.4$. The calculated value of the test statistic is $z = 2.42$. The $p$-value and correct conclusion are

A. $p$-value = 0.9922 and we conclude there is insufficient evidence to prove the true mean is more than 1.4.
B. $p$-value = 0.9922 and we conclude the true mean is less than 1.4.
C. $p$-value = 0.0078 and we conclude the true mean is not 1.4.
D. $p$-value = 0.0078 and we conclude the true mean is more than 1.4.
E. Since there is not a stated significance level, we cannot conclude anything.

16. What is $z^*$ such that $P(Z > z^*) = 0.85$ and $Z \sim N(0, 1^2)$?

A. 1.04
B. $\pm 1.04$
C. $-1.04$
D. $-1.44$
E. 1.44

or 16. What is $z^*$ such that $P(Z > z^*) = 0.82$ and $Z \sim N(0, 1^2)$?

A. 0.7939
B. 0.92
C. $-0.92$
D. $-0.7939$
E. 0.2061

17. Suppose you tested $H_0 : \mu = 10$ vs. $H_A : \mu \neq 10$ with a sample mean, $\overline{x} = 11.2$, and got a $p$-value = 0.02. If (10.01,12.39) is a confidence interval using the same sample data, which is *mostly likely* the confidence level for this interval?

A. 90% only
B. 90 or 95%
C. 90, 95 or 99%
D. none of the above %'s since we would have rejected.
E. There's no way to tell.

or 17. Suppose you tested $H_0 : \mu = 10$ vs. $H_A : \mu \neq 10$ with a sample mean, $\overline{x} = 11.2$, and got a $p$-value = 0.06. If (10.01,12.39) is a confidence interval using the same sample data, which is *mostly likely* the confidence level for this interval?

A. 90%
B. 90 or 95%
C. 90, 95 or 99%
D. none of the above %'s since we would have rejected.
E. There's no way to tell.

18. What is the *best* interpretation of the $p$-value in the last problem ($H_0 : \mu = 10$ vs. $H_A : \mu \neq 10$, $\overline{x} = 11.2$ and a $p$-value = 0.02)?

A. 2% of the time we would reject the null hypothesis.
B. 2% of the time we would get a sample mean, $\overline{x} = 10$, if the true mean is 11.2.
C. 2% of the time we would get a sample mean, $\overline{x} = 11.2$, if the true mean is 10.
D. 2% of the time we would get a sample mean at least as far away as 11.2 is from 10 if the true mean is 10.
E. 2% of the time we will get a mean difference of $11.2 - 10 = 1.2$ if the true mean is 10.

or 18. What is the *best* interpretation of the $p$-value in the last problem ($H_0 : \mu = 10$ vs. $H_A : \mu \neq 10$, $\overline{x} = 11.2$ and a $p$-value $= 0.02$)?

A. 2% of the time we would reject the null hypothesis.
B. 2% of the time we would get a sample mean, $\overline{x} = 10$, if the true mean is 11.2.
C. 2% of the time we would get a sample mean, $\overline{x} = 11.2$, if the true mean is 10.
D. 2% of the time we would get a sample mean at least as far away as 11.2 is from 10 if the true mean is 10.
E. 2% of the time we will get a mean difference of $11.2 - 10 = 1.2$ fi the true mean is 10.

19. Let $X \sim N(12, 5^2)$. What is the distribution of $\overline{X}_{36}$? Note: $n = 36$

A. $\overline{X}_{36} \sim N(12, 5^2)$
B. $\overline{X}_{36} \sim N(12, (1/6)^2)$
C. $\overline{X}_{36} \sim N(12, (5/6)^2)$
D. $\overline{X}_{36} \sim N(2, (5/6)^2)$
E. $\overline{X}_{36} \sim N(2, 5^2)$

20. What is the sampling distribution of the difference of two means, each from samples of size 25, if the first is $X \sim N(12, 5^2)$ and the second is $Y \sim N(15, 10^2)$? (Find the distribution of $\overline{X}_{25} - \overline{Y}_{25}$.) NOTE: I rounded to the nearest integer.

A. $N(-3, 5^2)$
B. $N(-3, 3^2)$
C. $N(-3, 2^2)$
D. $N(-3, 1^2)$
E. You can't tell whether the new distribution is normal and the sample sizes are less than 30.

or 20. Suppose the *Battlion* interviewed a random sample of students and asked them if they feel there is adequate student parking on campus. 20 of the 25 interviewed said "no way!". Which of the following is true?

A. If the true proportion, $\pi = 0.80$, we could NOT use the normal approximation for the sample proportion, $p$.
B. If the true proportion, $\pi = 0.80$, we could use the normal approximation for the sample proportion, $p$.
C. The sample is biased since we know there is not enough parking.
D. Both A. and C. are correct.
E. Both B. and C. are correct.

1AorC,2A,3C,4D,5BorE,6EorC,7BorA,8CorA,9D,10E,
11D,12C,13B,14BorC,15D,16C,17BorA,18D,19C,20CorA