1. Please write any questions or explanations on this exam. I will read them before assigning your grade.

2. There are 20 multiple-choice questions on this exam, each worth 5 points. There is partial credit. Please mark your answers clearly on the exam. Multiple marks will be counted wrong.

3. You will have 60 minutes to finish this exam.

4. 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 AND you must not talk to anyone about this exam until Friday.

5. This exam is worth 100 points and the equivalent weight of a regular exam.

6. Good luck!
1. Which of the following is/are true?
   A. A simple random sample is always the best method of sampling.
   B. Blocking is used to eliminate confounding variables.
   C. One type of control within an experiment is the use of comparison of several treatments.
   D. All of the above are true statements.
   E. Exactly two of the above are true statements.

2. The weight of a package of mints is believed to be normally distributed with mean 21.37 grams and standard deviation 0.4, \( X \sim N(21.37, 0.4^2) \). What is the chance that a sample of 4 packages of mints has an average weight, \( \bar{X}_4 \), between 21 and 22 grams?
   A. 0.0314
   B. 0.9032
   C. 0.9426
   D. 0.9670
   E. 0.9938

3. Using the rules for shift and scale changes, if \( X \sim N(25, 3^2) \), what is the distribution of \( W = 10 \times X + 5 \)?
   A. \( \mu_W = 255, \sigma_W = 30 \), but we can’t say the shape is normal.
   B. \( N(250, 30^2) \)
   C. \( N(255, 35^2) \)
   D. \( N(255, 30^2) \)
   E. \( N(25, 3^2) \)

4. Suppose the IQ of children with Fetal Alcohol Syndrome is normally distributed with true mean \( \mu = 70 \) and true standard deviation \( \sigma = 12 \). What does \( P(X < 50) \), where X is the IQ’s of these children, actually mean?
   A. how likely an average child with FAS would have an IQ of 50 or less
   B. how likely any child with FAS would have an IQ of 50 or less
   C. how likely a sample of children with FAS would have an average of 50 or less
   D. how likely one child out of a sample of children with FAS would have an IQ of 50 or less
   E. how likely the true mean IQ of children with FAS is 50 or less

5. The term ‘sampling distribution’ refers to
   A. the distribution of the sample data
   B. the standard normal curve
   C. the distribution of parameters
   D. the distribution from which we took our sample
   E. the distribution of our sample statistic

6. There exists at least 100 years of weather data, but suppose we only took a sample of years and calculated a 95% confidence interval for the true yearly average total rainfall of (16.5, 22) inches (obviously this isn’t for Texas A&M!). Which of the following is best interpretation of this interval?
   A. There is a 95% probability that the true yearly average total rainfall is between 16.5 and 22 inches.
   B. If we sampled many years, 95% of the yearly totals would be between 16.5 and 22 inches.
   C. As long as we sampled enough years (at least 30), we will be 95% confident that the true yearly average total rainfall between 1.65 and 22 inches.
   D. If we took many different samples of years, about 95% of the confidence intervals created from these samples would contain the true yearly average total rainfall.
   E. If we took many different samples of years, about 95% of the yearly average totals would equal the true yearly average total rainfall.

7. Referring to the confidence interval in the last problem, (16.5, 22), which of the following statements are plausible for this data (with 95% confidence)?
   A. The true yearly average total rainfall could be 20 inches.
   B. The true yearly average total rainfall could be 16 inches.
   C. The true yearly average total rainfall could NOT be 22 inches.
   D. All of the above are plausible.
   E. Only two of the above are plausible.
8. We want to know the percentage of former students that use Statistics after graduation. What is the “best” sampling scheme to apply?
A. We ask the Association of Former Students for a list of graduates. We chose the first 1000 names on the list to interview.
B. We put an advertisement in the 3 major newspapers in U.S. asking former students to contact us regarding a survey.
C. We ask the Association of Former Students for a list of graduates. We took a simple random sample of 1000 persons from the list to interview them.
D. We send 3 students to different gates in Kyle Field before the A&M-UT game. They ask the people at the gates if they are former students and if they answer yes, we ask the question of interest. The students stop after 200 answers have been recorded.
E. None of the above would give us the proper sample.

9. Suppose you have 3 confidence intervals for $\pi$ from the same data: 90% - (0.45,0.55), 95% - (0.4,0.6) and 99% - (0.2,0.8). If I wanted to know whether the true proportion was 75% or not, what could I conclude?
A. Since 75% is only in the 99%, I would reject 75% as a plausible value for $\pi$ at the 1% level.
B. Since 75% is only in the 99%, I would reject 75% as a plausible value for $\pi$ at the 5% and 10% levels.
C. Since 75% is only in the 99%, I would reject 75% as a plausible value for $\pi$ at the 10% level only.
D. 75% is plausible since we can’t guarantee the true proportion will fall in any interval.
E. You can’t make conclusions with confidence intervals, only hypothesis tests.

10. A new TAAS math test is being developed. It is believed that the sample proportion $p$ that will pass in a sample of 40 students is normally distributed with $\pi = 0.73$ and $\sigma_p = 0.07$, $p \sim N(0.73,0.07^2)$. How likely are you to see less than half of a class of 40 students (assuming they make up a random sample) pass?
A. 0.0005
B. 5%
C. 0.4840
D. 0
E. 0.23

11. Assuming that my samples are always random, what could I do to reduce the standard deviation of my sample means, $\sigma_{\bar{x}}$ by a factor of 3, i.e., make it one third as large?
A. use 3 times as much data
B. use one third as much data
C. use 4 times as much data
D. use 6 times as much data
E. use 9 times as much data

12. Ok, I just made these up, but suppose that the distribution of quiz grades is the following:

<table>
<thead>
<tr>
<th>X</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>p(X)</td>
<td>0.10</td>
<td>0.25</td>
<td>0.20</td>
<td>0.10</td>
<td>0.25</td>
<td>0.10</td>
</tr>
</tbody>
</table>

What is the true mean score of the quiz grades?
A. We can only estimate the true mean.
B. 25
C. 30
D. 24.5

13. What are the $z$ critical values, the $z_{\alpha/2}$, for a 64% confidence interval?
A. $\pm 0.36$
B. $\pm 0.57$
C. $\pm 0.915$
D. $\pm 0.895$
E. $\pm 0.74$

14. “How would you describe your own physical health at this time? Would you say your health is excellent, good, only fair or poor?” If the true proportion of people who think their health is good is $\pi = 0.78$, how many people must we sample to make the sampling distribution of the sample proportion, $p$, approximately normal?
A. 10
B. 13
C. 30
D. 46
E. 50
15. Suppose the measurements on your bathroom scale are normally distributed with true mean, $\mu = \text{your true weight}$ and true standard deviation, $\sigma = 0.25 \text{lbs}$. If we look at all possible samples of 10 measurements of your weight on the bathroom scale, and calculated the sample mean for each, which of the following would be true about those sample means?

A. They would be normally distributed.
B. They would not be normally distributed since the sample sizes are only 10.
C. The standard deviation of the sample means would be 0.25.
D. The true average of the sample means would be normally distributed.
E. Exactly two of the above are true.

16. If we constructed 95% confidence intervals from the samples above, which of the following COULD be true about the intervals?

A. All of the confidence intervals contain all of the sample means.
B. All of the confidence intervals contain your true weight.
C. 95% of the confidence intervals contain your true weight.
D. All of the above could be true (but obviously not at the same time).
E. Only two of the above could ever be true.

17. Which of the following is TRUE regarding the variation of a sampling distribution of a sample proportion, $p$?

A. Its variation depends on the population size as well as the sample size.
B. The variance of its sampling distribution depends on the true population proportion, $\pi$ but not the sample proportion, $p$.
C. As the size of the sample increases, the variation of the sampling distribution approaches the variation of the population.
D. For a given sample size, the variation of the sampling distribution of a sample proportion, $p$, is larger when the population proportion is $\pi = 0.5$ than when it is $\pi = 0.9$.
E. Two of the above are true.

18. Suppose $X \sim N(50, 12^2)$ and $Y \sim N(30, 15^2)$. If we take samples of size 25 from each, what is the distribution of the difference of the means, $\bar{X}_{25} - \bar{Y}_{25}$?

A. The shape is normal and $\mu_{\bar{X}_{25} - \bar{Y}_{25}} = 20$, but we can’t calculate $\sigma_{\bar{X}_{25} - \bar{Y}_{25}}$ without knowing that X and Y are independent.
B. $\mu_{\bar{X}_{25} - \bar{Y}_{25}} = 20$ and $\sigma_{\bar{X}_{25} - \bar{Y}_{25}} = 3.84$, but we can’t say the shape is normal.
C. $\mu_{\bar{X}_{25} - \bar{Y}_{25}} = 20$ and $\sigma_{\bar{X}_{25} - \bar{Y}_{25}} = 3$, but we can’t say the shape is normal.
D. $N(20, 3^2)$
E. $N(20, 3.84^2)$

19. What do we mean by the term confidence in reference to confidence intervals?

A. We are confident that our data is random.
B. We are confident that our method produces intervals that contain the parameter $(1 - \alpha)100\%$ of the time.
C. We are confident that our method produces intervals that contain the parameter $\alpha * 100\%$ of the time.
D. We are confident that our interval contains the parameter.
E. We are confident that our method produces intervals that contain the statistic $(1 - \alpha)100\%$ of the time.

20. What is the name of the following theorem “In repeated independent samples from any population, the sample mean of the observed values will get as close to the population mean as you choose”?

A. The Central Limit Theorem
B. The Law of Large Numbers
C. Bayes theorem
D. Sampling Distribution
E. Simpson’s Paradox

1C, 2D, 3D, 4B, 5E, 6D, 7A, 8C, 9B, 10A, 11E