ST 301 (AKI) BONUS for MID2 \((10 \times 2 = 20 \text{ points})\)

PLEASE DO NOT OPEN YET!

FIRST NAME:

LAST NAME:

STUDENT ID:

\[ z_\alpha \equiv \text{upper } \alpha \text{ quantile:} \]
\[ z_{0.05} = 1.64, \quad z_{0.025} = 1.96 \]
1. Let the number of successes $X$ have a binomial distribution with $p = 0.25$ and $n = 300$. Which one is NOT correct?
   
   (a) $P[X = 75] = 0$
   
   (b) $P[X \leq 75]$ is very close to 0.5
   
   (c) The standard deviation of $X$ is 7.5
   
   (d) The mean of $X$ is 75
   
   (e) $\frac{X - np}{\sqrt{np(1-p)}}$ can be viewed as normal distributed in an approximate way.

   Note: This is from p281 [6.3]. ANS=(a). (a) is wrong, because $P[X = 75] \neq 0$.

2. The average weight of a brand of motors is different from the manufacturer’s target of 6 pounds. We want to use hypotheses test to support this claim, which one is correct?
   
   (a) $H_0 : \mu = 6; H_1 : \mu \neq 6$
   
   (b) $H_0 : \mu \leq 6; H_1 : \mu > 6$
   
   (c) $H_0 : \mu > 6; H_1 : \mu = 6$
   
   (d) $H_0 : \mu = 6; H_1 : \mu < 6$
   
   (e) None of them

   Note: This is from p353 [4.1]. ANS=A.

3. Suppose you are to verify the claim that $\mu > 20$ on the basis of a random sample of size 100, and you know that $\sigma = 10$. Which one is correct?
   
   (a) The test statistic is $\bar{X}$
   
   (b) The rejection region is $\bar{X} > 21.96$, if the level of significance is 0.025.
   
   (c) The rejection region is $\bar{X} > 20 - z_\alpha$
   
   (d) The test should be $H_0 : \mu > 20; H_1 : \mu = 20$
   
   (e) None of them

   Note: This is from p355 [4.7]. ANS=B. (A) is wrong because test statistics in this case is $(\bar{X} - 20)/(10/\sqrt{100}) = \bar{X} - 20$. (B) is correct. For $\alpha = 0.025$ level test for this hypothesis test, use $qnorm(1-0.025) = 1.96$ as cut off. Hence reject $H_0$ if $\bar{X} - 20 > 1.96$, i.e., $\bar{X} > 1.96 + 20$. (C) is wrong. The rejection region is $\bar{X} > 1.96 + z_\alpha$. (D) is wrong. The test should be $H_0 : \mu = 20; H_1 : \mu > 20$. 
4. Suppose you are to verify the claim that $\mu \neq 20$ on the basis of a random sample of size 100, and you know that $\sigma = 10$. Which one is correct?
   (a) The test statistic is $\bar{X}$
   (b) The rejection region is $\bar{X} > 21.96$, if the level of significance is 0.025.
   (c) The rejection region is $|\bar{X} - 20| > z_{\alpha/2}$ where $\alpha$ is level of significance.
   (d) The test should be $H_0 : \mu \neq 20; H_1 : \mu = 20$
   (e) None of them
   Note: This is from p355 [4.7]. ANS=C.

5. With a random sample of size $n = 100$ and $\sigma = 10$, someone proposes $(-1.96, 1.96)$ to be a confidence interval for $\mu$. Which one is correct?
   (a) The error margin could be calculated only if we know the $\bar{X}$.
   (b) The level of the confidence interval is 97.5%
   (c) $(-1.96, 1.96)$ can cover $\mu$ with a probability of 95%.
   (d) For test $H_0 : \mu = 0; H_1 : \mu \neq 0$ with level 0.05, the conclusion can not be rejected.
   (e) None of them
   Note: ANS=(D). (C) is wrong. $(-1.96, 1.96)$ is not random anymore. You already observed it! $(-1.96, 1.96)$ can cover $\mu$ with a probability of 100% ! $(\bar{X} - Z_{0.025}\sigma/\sqrt{n}, \bar{X} + Z_{0.025}\sigma/\sqrt{n})$ can cover $\mu$ with a probability of 95%. In this expression, $\bar{X}$ is random.

6. Choose the output of the R command:
   > pnorm(-4, mean=-4, sd=4)
   (a)-4 (b) -0.5 (c) 0.5 (d) 1 (e) None of them
   Note: ANS (c) because -4 is the center of N(-4,4).

7. Choose the output of the R command:
   > qt(0.5, df=18)
   (a) -1 (b) 0 (c) 1 (d) 30 (e) None of them
   Note: ANS (b) because t-distribution is symmetric at 0.
8. Choose the output of the R command:
   > qnorm(0.95, mean=-4, sd=1)
   (a) 1.64+4  (b) 1.64  (c) 1.64-4  (d) 1.96+4  (e) None of them
   Note: ANS (c) Just shift -4 from N(0,1).

9. Choose the output of the R command:
   > qnorm(0.95, mean=-4, sd=4)
   (a) -1.64-4  (b) -1.96-4  (c) -4  (d) -1.64-1.96-4  (e) None of them
   Note: ANS (e). the 0.95 quantile must be bigger than -4, regardless of sd because
   0.5 quantile is -4. (a),(b),(c), (d) are all less than -4.

10. Which output is the same as $z_{\alpha/3}$?
    (a) qnorm( $\alpha/3$, mean=0, sd=1)
    (b) qnorm( 1 $\alpha/3$, mean=0, sd=1)
    (c) pnorm( 1 $\alpha/1.5$, mean=0, sd=1)
    (d) pnorm( 1 $\alpha/6$, mean=0, sd=1)
    (e) None of them
    Note: ANS (b). because you specify lower quantile for qnorm.