Midterm 1. PLS120 Fall 2018. **VERSION A**.

Name: Key

Student ID: _____

ALL QUESTIONS HAVE THE SAME VALUE.
USE THE BACK OF THIS SHEET TO REPORT YOUR CALCULATIONS. NO OTHER SHEETS WILL BE ALLOWED.

1. What distribution can be used to represent the number of seeds that germinate out of 10 planted if the probability of germination is constant and seeds are independent?
A. Binomial B. Poisson C. Normal D. Chi-square

constant P
independent trials
set no. trials
} = Binomial

2. You want to determine the probability of observing 17 bikers pass by you during your lunch hour break at the park, knowing that on average, 20 bikers pass by during this time. What would be the appropriate probability function to determine this?
A. Binomial B. Poisson C. Normal D. Chi-square

independent events over time or space
Constant probability
} Poisson

3. Which characteristic is always true for a Normal distribution?
A. the curve is asymmetric around the mean
B. describes data that only contain positive values
C. the mean is 0 and the standard deviation is 1
D. 95% of the area is within +/- 1.96 SD from the mean

$-\infty < Y < \infty$
symmetric
$P(-1.96 < Y < 1.96) = 0.95$
} Normal

4. An Austrian monk, who was investigating the inheritance of pod color and plant height in peas, got the following offspring from a self-pollinated pea plant (N = 10000). Which of the following statements is true?

Plant Height\ Pod color	Green (G)	Yellow (Y)
Tall (T)	5625	1875
Dwarf (D)	1875	625

A. P(G) = P(Y); height and pod color are independent
B. P(G) = P(T); height and pod color are independent
C. P(G) = P(Y); height and pod color NOT independent
D. P(G) = P(T); height and pod color NOT independent

$P(G) = \frac{5625 + 1875}{10,000} = P(T)$

$P(G \cap T) = P(G) \times P(T)$

5. A truck has a large load of tomatoes in which 1% of the tomatoes are infected with a fungus not to be allowed into the factory. What is the probability that an inspector allows the truck into the factory after inspecting 20 tomatoes?
A. 0.95 B. 0.82 C. 0.50 D. 0.20

$P(\text{allow}) = P(\text{no infected tomato found})$
$= 0.99^{20} = 0.82$

6. The range of a sample is a measure of:
A. independence B. central tendency
C. skewness D. dispersion

7. PEARS. Pears from a population have mean mass = 200 g and standard deviation = 20 g. If pears with mass < 190 g are rejected, what proportion of the population is rejected?
A. 0.05 B. 0.975 C. 0.18 D. 0.3085

$\mu = 200 \quad \sigma = 20 \quad P(Y < 190) =$
$= P\left(z < \frac{190 - 200}{20}\right) = P(z < -0.5)$
$= 0.3085$

8. In the same population of PEARS, what would be the lowest mass per pear acceptable if you want to reject the lowest 10% of the population?
A. 210 B. 195 C. 185 D. 174

$P(Y < ?) = 0.10 = P\left(z < \frac{? - 200}{20}\right)$

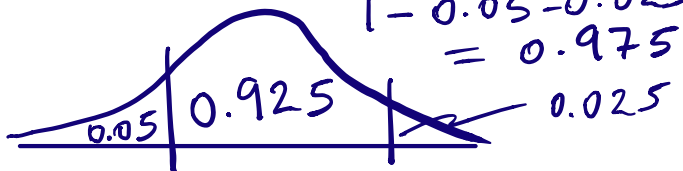
$z_{0.10} = -1.2816$
$Y = (-1.2816) \times 20 + 200 = 174.4$

9. If you pick 10 random pears from the population above, what distribution would you use to calculate the probability that you will reject 2 or more?
A. Poisson B. Binomial C. z D. t E. F

$P = 0.10$ no. trials = 10
independent pears
→ Binomial

10. What is the area under the standard normal distribution between -1.645 and 1.963
A. 0.99 B. 0.975 C.0.95 D. 0.925

$P(z < -1.64) = P(z > 1.64) = 0.05$
$P(z > 1.96) = 0.025$
$1 - 0.05 - 0.025 = 0.975$



-1.64 1.96

11. A sample of farms is randomly selected, and the investigator records the number crops grown in each farm. What type of random variable is the information being collected?
A. Continuous B. Categorical
C. Discrete D. Ratio

Countable, natural numbers, no values between 1 and 2 or Y & Y+1.

12. When we cannot reject a null hypothesis, we accept it as true.
A. True B. False

No, because it is not always meaningful that we could not reject Ho. Maybe we just did not try hard enough.

13. What measure of central tendency is best used when dealing with extreme data values?
A. Mean B. Median C. Mode D. Moment

14. In a 2-tailed test of hypothesis for equality of means the calculated t is 3.5 and the critical t is 2.1. Do you reject Ho?
A. Yes B. No

$t_{calc} > t_{critical}$
$\Rightarrow$ Reject Ho

15. The mean number of weak points that break under tension in wire is 2 per 10 km. What is the probability that there are NO breaks when 5 km of wire are put under tension?
A. 0.61 B. 0.37 C. 0.5 D. 0.05

$\lambda = \frac{2}{10\text{ km}} = \frac{1}{5\text{ km}}$ Poisson

$P(0) = \frac{e^{-\mu}\mu^0}{0!} = e^{-1} = 0.368$

16. The ratio of sample variances from populations with equal variance has an F distribution.
A. True B. False

Definition of F distribution

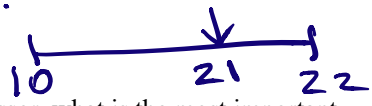
17. What is the probability of getting first a head and then tail in two coin tosses? Think!
A. 0.75 B. 0.5 C.0.25 D. 0.125

$P(HT) = 0.5 \times 0.5 = 0.25$

18. The 95% confidence interval for a mean is (10, 22). Can you conclude that the mean is different from 21 with alpha = 0.05?
A. Yes B. No

$H_0: \mu = \mu_0$

CI contains $\mu_0 \Rightarrow$ can't reject Ho.



19. According to your professor, what is the most important equation in PLS120 or closest to it?
A. $(Y-\mu)/r$ B. $n!/[(n-r)!\, r!]$ C. $\sigma_{\bar{Y}} = \sigma_Y/\sqrt{r}$ D. $1-\beta$

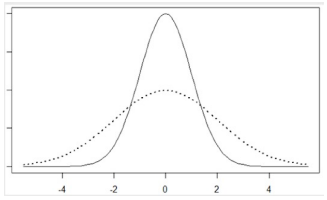
also $\sigma^2_{\bar{Y}} = \frac{\sigma^2_Y}{r}$

20. You estimate a 95% CI for the mean of a population of known variance (sigma^2 = 100). First you obtained a sample of size 4 but the CI was too wide, so you added 96 observations. By what factor did you shrink the width of your confidence interval?
A. 5 B. 10 C. 25 D. 50 E. 100

$CI = \bar{Y} \pm t_{crit} \times SE$. width $= 2 t_{crit} \cdot SE$

$SE_1 = S/\sqrt{4}$
$SE_2 = S/\sqrt{100}$
$\Big\} \frac{SE_1}{SE_2} = \frac{\sqrt{100}}{\sqrt{4}} = \frac{10}{2} = 5$

21. Select the correct completion for the statement: Relative to the full line graph, the Normal with a dotted line
A. has a larger mean.
B. has a smaller mean.
C. has more degrees of freedom.
D. has more variance.
E. has less variance.



Normal does not have df.
Both modes are equal so means are equal if Normal

22. A sample from a normal population with variance 4 has values 1, 2, 2, 3. Make an approximate 95% CI for the mean of the population.
A. 0 to 4 B. 1 to 2 C. 0.05 to 1.95
D. -2 to 6 E. -4 to 4

$\bar{Y} = 2 \quad \sigma^2 = 4 \quad \sigma^2_{\bar{Y}} = 4/4 = 1$

$Z = 1.96$
$CI = 2 \pm 1.96 \times 1 \approx \begin{cases} 0 \\ 4 \end{cases}$