Mu Alpha Theta 2022 National Convention Hustle Statistics Solutions

1. **0.5**. From the information, we can see that there are 10 students in the class who got an A. Since 5 of the students who got an A are in coding club, the probability is 5/10 = .5
2. **B**. Low bias because Ethan is right on target and low variability because he is so consistent.
3. **90720**. $\frac{9!}{2!2!} = \frac{9*8*7*6*5*4*3*2}{2*2}$
4. **0.60 or 3/5**. $P(A \cap B) = P(A)P(B)$ for independent events. In this case, $P(A \cap B) = (.5)(.6) = .30$. Therefore, $P(A \cup B) = P(A) + P(B) - P(A \cap B) = .5 + .6 - .30 = .80$. Since $P(A \cup B) = .80, P(A' \cap B') = .20$. Plugging into the final expression produces $(.80 - .20) = .60$
5. **0.128 or 16/125**. In order for this to happen, Will has to fail the first two runs but pass the third. Probability of this is $.8 * .8 * .2 = .128$.
6. $\mathbf{10}$. $E(X) = \Sigma XiPi = 5(0.5) + 10(0.2) + 15(0.1) + 20(0.2) = 10$
7. **0.15**. $P(Type\ I\ error) = \alpha = 0.15$
8. **5.6 or 28/5**. The formula for a z score $= \frac{raw - mean}{sd}$. Plugging the numbers in gives $\frac{66-78}{5} = -\frac{12}{5} = -2.4$ for Annie and $\frac{94-78}{5} = \frac{16}{5} = 3.2$ for Bahar. The difference is $(3.2) - (-2.4) = 5.6$.
9. **12.** Organized, the set is {5, 8, 10, 13, 14, 17, 20, 22, 29, 30}. The median of the first half of the data set is 10 and the median of the second half is 22, so the IQR is 22-10=12.
10. **Nonresponse**
11. **-2.5**. residual = $y - \hat{y} = 22 - 24.5 = -2.5$
12. $\mathbf{\sqrt{14}}$. The mean of the data is 6. When you subtract the mean from each value, square the differences and add them up, you get a total of 70. Divided by (n-1), or 5 in this case, gives a variance of 14, and standard deviation is the square root of that.
13. **3**. The non-resistant measures are the mean, range, and standard deviation.
14. **172**. The expected number of people to go through in this geometric distribution is $\frac{1}{p}$ or $\frac{1}{.07} = \frac{100}{7}$. To fill 12 slots, an expected $\frac{100}{7} * 12 = \frac{1200}{7} \approx 172$ people must be looked through.
15. $\mathbf{\frac{\sqrt{913}}{5}}$. The standard deviation of two dependent variables is given by $\sigma_{x-y} = \sqrt{\sigma_x^2 + \sigma_y^2 - 2r\sigma_x\sigma_y}$. Plugging in the values gives $\sqrt{8^2 + 3^2 - 2(.76)(8)(3)} = \frac{\sqrt{913}}{5}$
16. **B.** A binomial distribution is skewed right with small values of n and p, as there is a higher probability of obtaining a small number of successes in a set number of trials. As p approaches 0.5, the shape becomes more normally distributed or symmetric.
17. $\mathbf{\frac{7}{18}}$. $1 - \frac{P(Alk\ wins)}{P(Alk\ wins)} = \frac{11}{7} \rightarrow 7 - 7P(Alk\ wins) = 11P(Alk\ wins) \rightarrow 7 = 18P(Alk\ wins) \rightarrow P(Alk\ wins) = \frac{7}{18}$.
18. **Common response**. The common variable causing the association of higher rank with higher GPA is the student's study habits and knowledge.
19. $\frac{29}{29+30} = \mathbf{\frac{29}{59}}$.
20. $\mathbf{\sqrt{2}}$. The x-coordinate of the right endpoint of the segment is $(\sqrt{2}, \sqrt{2})$ in order for the area under the curve to be one

21. $\mathbf{\frac{26}{27}}$. $1 - P(none) = 1 - \left(\frac{3}{9}\right)^3 = \frac{26}{27}$.
22. $\sqrt{\mathbf{21}}$. The standard deviation for a binomial distribution is $\sqrt{np(1 - p)}$. Plugging in the numbers gives $\sqrt{100(\frac{70}{100})(\frac{30}{100})} = \frac{\sqrt{2100}}{10} = \sqrt{21}$.
23. **3**. The degrees of freedom for a 2 way chi-square table can be found with $(r - 1)(c - 1) = (4 - 1)(2 - 1) = 3$
24. **9**. The width of a confidence interval is found by doubling the margin of error. Since the population standard deviation was given, we use a z distribution: $MA = z * \frac{\sigma}{\sqrt{n}} = 1.96 * \frac{14}{\sqrt{36}} \approx 4.66$. Double that is approximately 9.
25. $-\mathbf{\frac{\sqrt{19}}{5}}$. The coefficient of determination is r squared, so the least value of r will be the negative one. $\sqrt{\frac{76}{100}} = \frac{-\sqrt{19}}{5}$.