Biology

General Description (Option 1): **Biology.** Gregor Mendel preformed hybridization *experiments with pea plants to learn how characteristics are passed from parents to offspring*. Gregor Mendel's experiment with pea plants concluded that biological inheritance is influenced by genes that determine the traits passed on to the next generation. One of Mendel's famous experiments with peas resulted in 580 offspring, and 152 of them were yellow peas and the remaining green. Mendel claimed that under the same conditions, 25% of offspring peas would be yellow. ***Optional fun video with details of how Mendel experiment with peas relates to genetics:*** https://www.youtube.com/watch?v=Mehz7tCxjSE

Scenario: You have been hired by a botanist who does experiments on hybrid plants and cross-pollinations and self-pollinations. The botanist is writing a grant to fund of her research and she needs help to determine the statistical significance of such results. She wants you to help her complete this statistical analysis for her grant application. Explain if the results of 152 yellow peas are either significantly high or significantly low using the Range Rule of Thumb. Explain the process of finding the probability of such an experiment producing 152 yellow peas by hand. Then calculate the probability of such an experiment producing more 152 yellow peas with technology. Explain which probability calculation should be considered when determining if the result of 152 yellow peas is significantly high. Based on probability, is the result of 152 yellow peas significantly high? What does the results suggest about Mendel's claim of 25%?

Answer: Range Rule Bounds: 124.1, 165.9. Since 124.1<152 < 165.9, it is not significantly low or high. P(152)= 0.030 and P(152 or more)= 0.265. We use the P(152 or more) to determine significance due to the theorem, which suggests that the event is not significantly high since it is larger than 0.05. The results suggest that it is highly unlikely that a random selection process will result in 7 or less minorities chosen.

Reference for problem: Elementary Statistics, Edition 14, Triola, Pearson Publishing, page 231, problem 40.

Criminal Justice

General Description (Option 2): **Criminal Justice.** In the classic case of Whitus v. Georgia, a jury of 90 people was supposed to be randomly selected from a population in which 27% were minorities. Among the 90 people selected, 7 were minorities.

Scenario: A young lawyer is practicing law in a rural community. He has a case where he is concerned about the jury selection for his client. Although they are following voir dire selection process, he still have concerns. He plans to make his concerns to the judge but needs your help to investigate the old case of Whitus v. Georgia. He hires you to investigate the statistical significance of the jury selection from that case. He wants to include it in this presentation to the judge. Use the range rule of thumb to test significance of the results. Find the probability of getting 7 minorities if that jury pool was randomly selected. Use the formula and round to 3

decimal places. Find the probability of getting 7 or fewer minorities if the jury pool was randomly selected. Use the technology and round to 3 decimal places.   Is the result of 7 minorities significantly low? Explain using both range rule and the probability theorem. What does the result suggest about the jury selection process? Present this to the young lawyer in the program in any format of choice (MS PowerPoint, report format (MS Word), or short video).

Answer: Range Rule Bounds: 15.9, 32.7. Since 7 < 15.9, it is significantly low. P(7)= 0.000 and P(7 or less)= 0.000. We use the P(7 or less) to determine significance due to the theorem, which suggests that the event is significantly low since it is smaller than 0.05.   The results suggest that it is highly unlikely that a random selection process will result in 7 or less minorities chosen.

Reference for problem: Elementary Statistics, Edition 14, Triola, Pearson Publishing, page 229, problem 25.

Sociology

General Description (Scenario 3): **Sociology.** Based on a Society for Human Resource Management survey, 36% of human resource professionals are at companies that reject job candidates because of information found in their social media. ***Optional article that explains this concept:*** https://www.businessnewsdaily.com/2377-social-media-hiring.html

Scenario: Year Up is a non-profit organization that provides a tuition-free job training program for young adults in Charlotte, NC. You have been hired by Year Up to provide a short presentation to their young adults in their program who are at the end of the program. You were asked to look at some recent data to share the importance of having a positive social media presence. Consider 25 randomly selected human resource professional from some of the companies who work with Year Up. Suppose it was found that 14 of them are at companies that rejected job candidates because of information found on their social media. Are the results statistically significant? Address this using range rule of thumb and the probability theorem. Compute the probability of exactly 14 of them to reject a job candidate based on their social media using the formula. Compute the probability of exactly 14 or more of them to reject a job candidate based on their social media using the technology.   Round all probabilities to 3 decimal places. Explain which calculation is needed for determining statistical significance. Present this to the young adults in the program in any format of choice (MS PowerPoint, report format (MS Word), or short video).

Answer: Range Rule Bounds: 4.2, 13.8. Since 14 > 13.8 it is significantly high. P(14)= 0.020 and P(14 or more)= 0.033. We use the P(40 or more) to determine significance due to the theorem, which suggests that the event is significantly high since it is smaller than 0.05.   The results suggest that the program participants should consider cleaning up their social media presence

Reference for problem: Elementary Statistics, Edition 14, Triola, Pearson Publishing, page 229, problem 26.

Political Science

<mark>General Description (Option 4):</mark> **Political Science.** The County Clerk in Essex, NJ was accused of cheating by not using randomness in assigning the order in which candidate's names appeared on voting ballots. Among 41 different ballots, Democrats were assigned the desirable first line 40 times. Assume that Democrats and Republicans are assigned the first line using a method of random selection so that they are equally likely to get that first line. ***Optional reading about NC Secretary of State random selection of the order of candidates' names appearing on ballots:*** *https://www.ncsbe.gov/news/press-releases/2022/03/04/state-board-randomly-determines-ballot-order-2022-elections*

<mark>Scenario:</mark> You are working with the NJ Secretary of State to help investigate this claim. You are to take the known information above provided and determine the statistical significance of the results. Use the range rule of thumb and the probability theorem to determine significance. Find the probability of exactly 40 first line for Democrats randomly using the formula. Find the probability of exactly 40 or more first line for Democrats randomly using technology.   Round both probabilities to 3 decimal places. Explain which calculation is needed for determining statistical significance. What do the results suggest about how the clerk met the requirement of using a random method to assign the order of candidates' name on the ballots? Provide the Secretary of State your answers with explanation of how you are getting the results in any format of choice (MS PowerPoint, report format (MS Word), or short video).

Answer: Range Rule Bounds: 14.1, 26.9. Since 40 > 26.9 it is significantly high. P(40)= 0.000 and P(40 or more)= 0.000. We use the P(40 or more) to determine significance due to the theorem, which suggests that the event is significantly high since it is smaller than 0.05.   The results suggest that the clerk did not randomly assigned the order of the candidate's names on the voting ballots.

Reference for problem: Elementary Statistics, Edition 14, Triola, Pearson Publishing, page 231, problem 38.

RUBRIC

	Exemplary (3)	Well done (2)	Can improve (1)
Grammar and structure	No errors; well written/spoken and complete thoughts. Presentation is well organized.	Some grammatical errors, but presentation is organized.	Various grammatical errors or incomplete thoughts (written/verbally). Presentation is hard to follow.
Directions followed	All required areas are addressed and discussed in detail.	Missing one or two required parts.	Missing more than 2 required parts.
Statistical calculations and explanations	Calculations and explanations are correct and meaningful.	Minimal errors in calculations and/or explanations but overall correct ideas.	Substantial errors but some good ideas.