**Day 18 Fair Coin, Fair Dice, Bank Manager, Margin of Error Homework**

*You do not have to use Fathom to complete this assignment, but if you do not remember what the simulations are, you should refresh your memory by looking at them on Fathom. Specific file names and directions are below.*

**Fair Coin**

1. Summarize the Fair Coin Fathom experiment performed in class. If you don’t remember, you can do the simulation “Coin\_Sim” in the Fathom file (directions for accessing Fathom files are on your instructor’s website).
2. What would a result of 560 in the Fathom simulation represent?
3. Circle the letter of the statements that are true concerning the Fathom simulation. Read each statement very carefully—language is important!
4. The theoretical probability is 500 heads and 500 tails. Therefore all the data should fall very close to 500.
5. The theoretical probability is 500 heads and 500 tails. Therefore all the data should be centered around 500.
6. A fair coin should never give a result that is much larger than 500.
7. The majority of the data will be close to 500.
8. We would always expect to see a few values much greater than or less than 500 due to natural variation.
9. Indicate if each statement below is true (T) or false (F). If a statement is false, rewrite it so it is true.

|  |  |
| --- | --- |
|  | If all the Math 105 students flipped a fair coin 300 times, I can be confident (but not certain) that most of the results will be close to 150 heads and 150 tails. |
|  | If I flip a fair coin and get five heads in a row, I can be confident (but not certain) that the next flip will be tails. |
|  | If I flip a coin 500 times and get a number of heads that is outside of the confidence interval, I can say that the coin is probably not fair. |
|  | If a result falls outside the confidence interval, I know for certain that it is due to an external effect and is not due to natural variation. |

**Fair Die**

1. Summarize the Fair Die Fathom experiment performed in class. If you don’t remember, you can do the simulation “FAIR AND UNFAIR DICE” from the Fathom file.
2. How is the “evenMinusOdd” statistic defined?
3. Suppose you got a result of -16 for the “evenMinusOdd” statistic in the Fair Die simulation. Circle the statement which is true:
	1. There were 62 evens and 46 odds.
	2. There were 20 evens and 36 odds.
	3. There were 36 evens and 20 odds.
	4. There were 46 evens and 62 odds.
4. What is the largest possible value you could get for evenMinusOdd? Justify your answer.
5. Based on theoretical probability, what would the evenMinusOdd statistic be for a fair die? Why?
6. If your answer to #9 is correct, in the simulation, why did the fair die have results as high as 30 or as low as -30?
7. Why do we need to have a test statistic to determine if a die is fair or not?
8. How does the data collected in the Coin and Die simulations illustrate natural variation?

**Bank Manager**

1. Review the Bank Manager problem from class and complete the following table:

|  |  |  |
| --- | --- | --- |
|   | **Men**  | **Women** |
| **Recommended for Promotion** |  |  |
| **Not recommended** |  |  |

1. In the card simulation, we started out with 48 cards. What did these cards represent in the actual study?
2. In the card simulation, we dealt out 35 cards. What did these cards represent in the actual study?
3. ***Based on the theoretical probability of a fair decision***, how many women would you expect to be promoted if there were no discrimination? Give your answer in absolute and relative terms. Justify your answer.
4. ***According to the experiment***, how many women were actually promoted? Give your answer in absolute and relative terms.

Suppose we had simulated the Bank Manager Problem 200 times and got the following results:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Number of Women Promoted** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** |
| % of Occurrences | 1% | 0% | 1% | 2% | 8% | 19% | 21% | 29% | 12% | 4% | 1% | 0% | 2% | 0% |

1. Would you consider a result of 15 likely to be due to natural variation, discrimination or inconclusive? Explain why.
2. Would you consider a result of 21 likely to be due to natural variation, discrimination or inconclusive? Explain why.
3. Would you consider a result of 19 likely to be due to natural variation, discrimination or inconclusive? Explain why.

**Margin of Error / Confidence Intervals**

Use the following information for questions 21 & 22: A survey of 500 people finds that 52% plan to vote for Smith for governor. The margin of error is .

1. What is the confidence interval?
2. Is it possible that the true percentage of the population that plans to vote for Smith for governor is 45%? Why or why not?