Practice for Quiz 5

(the quiz is on Wednesday, May 7)

Math 125 *Kovitz* Spring 2025

A die is alleged to be fair.

A test was run by rolling it 4500 times, and 770 of the rolls resulted in the side with five spots showing.

Does this support the assertion that this die is fair, or is there cause for concern based on the result?

(Set up an appropriate test of hypotheses. Then find P and decide if the die is fair or gets too many fives.)

You must:

- State both the null and the alternate hypotheses.
- Set up a box model with the correct number of tickets.
- Find the average and SD of that box.
- State how the test statistic was derived from the draws from the box.
- Find the expected value and standard error of that test statistic.
- Draw the normal curve and fix its center.
- Draw an appropriate block and carefully find its endpoints. Some adjustment might be necessary.
- Shade the tail area that applies to the observed result.
- Put into standard units the endpoint that forms the boundary of the boundary of the tail area.
- Find the numerical value of P—the tail area. Use the normal table and your picture.
- Decide if P (the numerical value of the tail area) is less than 5%, or 5% or greater.
- Make the decision and use it to answer the question.

Select one of the following five options.

(A) $P = 1.58\%$, not fair (B) $P = 4\%$, not fair (C) $P = 21\%$, fair
(D) $P = 27\%$, fair (E) $P = 46\%$, fair

The answers are on the next page.

Answers.

1. Null: the die is fair
   Alternative: the die is not fair.
2. The modelling box has six tickets in it: five 0's and a 1.
3. 0.16667 and 0.372678, or 1/6 and $\sqrt{5}/6$.
   Calculation of the SD:
   $(1-0) \times \sqrt{(1/6) \times (5/6)} = \sqrt{0.16667 \times 0.8333} = \sqrt{0.138888} = 0.372678$.
4. The test statistic will be the sum of the draws from this box.
5. 750 and 25.
6. The center is at 750 heads.
7. The block for the observed result (770 heads) starts at 769.5 heads and ends at 770.5 heads.
8. The tail area must include this result and all results more extreme (further away from the average).
   It starts at 769.5 heads and continues to the right.
9. $(769.5 - 750)/25 = 0.78$.
10. The area for $z = 0.80$ is about 57.63%.
    The tail is about $(100\% - 57.63\%)/2 = 42.37\%/2 = 21.185\%$.
11. For this result, $P > 5\%$.
12. That could reasonably be attributed to chance error. It supports the assertion that the die is fair.

Summary of the Answer:

P is equal to 21%.

P is greater than 5%, so accept the null hypothesis.

Decison: the die is fair.

Answer: (C)