Homework 17 Chapters 28 nd 29 (Problems 1 to 8)

Due on May 12

Math 125 *Kovitz* Spring 2025

Problems 5 and 6 are subtle. For parts 5 (a) and (b), refer to pages 480–481. For part 5 (c), which is tricky, refer to pages 552–554. For 6 (a), see pages 552–553. For 6 (b), see page 545.

1. A gambler is accused of using a loaded die, but he pleads innocent. A record has been kept of the last 60 throws. There is disagreement about how to interpret the data and a statistician is called in.

   The observed frequencies for the six numbers on the die are summarized in this table.

Value	*Observed frequency*
1	9
2	11
3	10
4	8
5	12
6	10

   Make a χ^2-test of the null hypothesis that the die is fair.

2. Two people are trying to decide whether a die is fair. They roll it 100 times, with the results shown. One person wants to make a z-test, the other wants to make a χ^2-test. Who is right? Explain briefly, and make the test.

   21 ones, 15 twos, 13 threes, 17 fours, 19 fives, 15 sixes

   Average of numbers rolled ≈ 3.43, SD ≈ 1.76

3. (a) One day, upon tossing a single die 180 times, I got:

   32 ones, 28 twos, 35 threes, 36 fours, 29 fives, and 20 sixes.

   Compute χ^2 and find P for this experiment.

   (b) Another day, upon tossing the same single die 120 times, I got:

   12 ones, 26 twos, 26 threes, 28 fours, 15 fives, and 13 sixes.

   Compute χ^2 and find P for this experiment.

   (c) Now, compute the pooled χ^2 using the combined degrees of freedom, and find the pooled P-value.
   Is the die biased, based on the combined evidence?

   (d) Give the details of an alternate method of setting up a χ^2-test on the combined data. (Just indicate the steps in the procedure—do not perform the computations.)

4. The International Rice Research Institute in the Philippines devlops new lines of rice which combine high yields with resistance to disease and insects. The technique involves crossing different lines to get a new line which has the most advantageous combination of genes. Detailed genetic modeling is required. One project involved breeding new lines to resist the "brown plant hopper" (an insect): 374 lines were raised, with the results shown below.

	Number of lines
All plants resistant	97
Mixed: some plants resistant, some susceptible	184
All palnts susceptible	93

   According to the IRRI model, the lines are independent: each line has a 25% chance to be resistant, a 50% chance to be mixed, and a 25% chance to be susceptible. Are the facts consistent with this model?

5. True or false, and explain:

   (a) The P-value of a test is the chance that the null hypothesis is true.

   (b) If a result is statistically significant, there are only 5 chances in 100 for it to be due to chance, and 95 chances in 100 for it to be real.

   (c) Big samples are bad because small diferences will look significant.

6. True or false, and explain briefly.

   (a) A statistically significant difference is big and important.

   (b) A P-value of 4.7% means something quite different from a P-value of 5.2%.

7. Which of the following questions does a test of significance deal with?

   (i) Is the difference due to chance?

   (ii) Is the difference important?

   (iii) What does the difference prove?

   (iv) Was the experiment properly designed?

   Explain briefly.

8. In employment discrimination cases, courts have held that there is proof of discrimination when the percentage of blacks among a firm's employees is lower than the percentage of blacks in the surrounding geographical region, provided the difference is "statistically significant" by the z-test. Suppose that in one city, 10% of the people are black. Suppose too that every firm in the city hires employees by a process which, as far as race is concerned, is equivalent to simple random sampling. Would any of these firms ever be found guilty of discrimination by the z-test? Explain briefly.