

Math 110
Quiz 3 Sample Solutions
March 8, 2010

Be sure to show the calculations that lead to your answers.

1. Fill in the blank:

- (a) If two events are mutually exclusive, the chance that one or the other will happen is the *sum* of their individual chances.
- (b) If two events are independent, that chance that both will happen is the *product* of their individual chances.

2. A fair coin is flipped 7 times. What are the chances that it will land heads up 4 times?

Apply the binomial formula with $N = 7$, $k = 4$, and $p = \frac{1}{2}$:

$$\frac{7!}{4!3!} \left(\frac{1}{2}\right)^4 \left(1 - \frac{1}{2}\right)^3 = \frac{7 \cdot 6 \cdot 5}{3!} \left(\frac{1}{2}\right)^7 = \frac{35}{2^7} = \frac{35}{128} \approx .273.$$

The chance of landing exactly 4 heads is approximately 27.3 %.

3. On consecutive hour exams in a chemistry course, the means and SDs were $\mu_1 = 70$ and $SD_1 = 10$ for the first test and $\mu_2 = 80$ and $SD_2 = 15$ for the second test. The correlation coefficient for the data was $r = .5$. What are the chances that a student who scored 75 on the first test will score 75 or above on the second test?

Use the regression line to approximate the mean on the second test for those who scored 75 on the first test:

$$.5 \frac{15}{10} (75 - 70) + 80 = 83.75.$$

Using 83.75 for the mean and the RMS error $\sqrt{1 - .5^2} \cdot 15 \approx 13$ for the standard deviation, calculate a z value for 75:

$$\frac{83.75 - 75}{13} \approx .67.$$

$z \approx .67$ corresponds to a symmetric area of approximately 50%. Since 75 is below the mean, we must add the area of the right tail to obtain the final answer: $50\% + \frac{1}{2}(100 - 50)\% = 75\%$. So, the student who scored 75 on the first test has a 75% chance of scoring above 75 on the second test.