

Math 10 Spring 2010 Quiz 5

Name: KEY

May 7, 2010

- (1) All entering students at the University of Podunkitania are tested in reading and mathematics. The summary data is as follows, and the data set is homoscedastic.
- reading: average 75; SD 8
  - math: average 70; SD 10
  - $r = 0.5$

State how you would estimate the following two quantities and do as much of the calculation of those estimates as possible. You may be missing some information; if so, say what it is and how you would use it.

- ② (a) The percentage of entering students who score between 60 and 80 in mathematics.

*This is all students within one SD of the mean!*  
*68%*

- ⑥ (b) Of the entering students who score 80 in reading, the percentage who also score between 60 and 80 in mathematics.

*avg math score associated with 80 in reading?*

$$80 = 75 + \frac{5}{8} \cdot 8 \quad \sim \frac{5}{8} \text{ in standard units.}$$

*assoc. math mean*  $70 + \frac{1}{2} \cdot \frac{5}{8} \cdot 10 = 73.125$

*orig. math mean*       $r$       *orig. math SD*

$$\text{SD in this column} = \text{rms. error} = 10\sqrt{1 - (.5)^2} = 8.66$$

*new conversion to standard units:*

$$\frac{60 - 73.125}{8.66} = -1.52 \qquad \frac{80 - 73.125}{8.66} = 0.79$$

*Need area under standard normal curve between*  
 *$z = -1.5$  and  $z = 0.8$*

- (2) Consider the following simple game: two dice are rolled, one red and one green. If the red one shows a higher value, you win \$3. If they match or the green one shows a higher value, you lose \$2.

- (3) (a) Make a box model (or probability distribution, your choice) for this game.

36 total outcomes! 6 match, rest are half and half red high/green high (15 each)

box model:

$$\boxed{15 \boxed{3} \quad 21 \boxed{-2}}$$

or

$$\boxed{5 \boxed{3} \quad 7 \boxed{-2}}$$

probability distribution:

outcome	probability
3	$\frac{15}{36} = \frac{5}{12} = .42$
-2	$\frac{21}{36} = \frac{7}{12} = .58$

- (6) (b) Find the expected value and standard error for your winnings after 5 rounds of the game.

Note: decimals versus fractions give significant rounding error.

mean for box:

$$\frac{15 \cdot 3 + 21 \cdot (-2)}{36} = \frac{15}{36} (3) + \frac{21}{36} (-2) = \frac{3}{36} = \frac{1}{12} \quad \text{or} \quad 3 \cdot .42 + (-2) \cdot .58 = 0.1$$

$$\text{mean for 5 rounds (EV): } \frac{5}{12} = 0.42 \quad \text{or} \quad 5 \cdot 0.1 = 0.5$$

SD for box:

$$|3 - (-2)| \sqrt{\frac{15}{36} \cdot \frac{21}{36}} = \frac{5\sqrt{315}}{36} = 2.47 \quad \text{or} \quad |3 - (-2)| \sqrt{.42 \cdot .58} = 2.47$$

$$\text{SD for 5 rounds (SE): } \sqrt{5} (2.47) = 5.52$$