

Math 1300 Fall 2013  
Quiz 7  
Monday November 11 2013  
No Work = No Credit

Name: \_\_\_\_\_ Student Number: \_\_\_\_\_

Signature: \_\_\_\_\_

Instructor: \_\_\_\_\_ Section: \_\_\_\_\_

**Instructions:** Answer all questions and show all of your work.

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1. ( points) A red die and a green die are tossed simultaneously. Let  $E$  be the event  $E = \{ \text{the sum of the numbers is 8} \}$ . List the outcomes in  $E$  and find  $P(E)$ .

**Solution:**

$$E = \{(2, 6)(6, 2)(3, 5)(5, 3)(4, 4)\}$$

$$Pr(E) = \boxed{\frac{5}{36}}$$

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2. ( points) A fair coin is tossed three times and the sequence of  $H$ s or  $T$ s is observed. Let  $E$  be an event where  $E = \{ \text{at least one Tail} \}$ . Find  $Pr(E)$ .

**Solution:**

$$E' = \{HHH\}$$

$$Pr(E) = 1 - Pr(E') = 1 - \frac{1}{8} = \boxed{\frac{7}{8}}$$

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3. ( points) Suppose the odds against a certain horse winning a certain race are 9 to 2. What is the probability that the horse will win the race?

**Solution:**

Odds in favor of horse winning are 2 to 9

$$Pr(W) = \frac{2}{2+9} = \boxed{\frac{2}{11}}$$

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4. ( points) The National Weather Service indicates that there is a 10% chance of rain on a certain day. What are the odds in favor of rain on that day?

**Solution:**

$$Pr(R) = \frac{1}{10}$$

$$\text{Odds Fraction}(R) = \frac{\frac{1}{10}}{1 - \frac{1}{10}} = \frac{\frac{1}{10}}{\frac{9}{10}} = \frac{1}{9}$$

Odds: 1 to 9

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5. ( points) Eggs generally come in cartons of 12. Steve's mom always samples 2 eggs to see if they are cracked prior to making a purchase. If either egg is cracked, she will not purchase the carton. What is the probability that she will accidentally purchase a carton with 4 cracked eggs? (Round your answer to four decimal places.)

**Solution:**

$$\frac{C(8, 2) * C(4, 0)}{C(12, 2)} = \boxed{.4242}$$

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6. ( points) Three friends go online and look up the day of the week on which they were born. What is the probability that two or more of the friends were born on the same day of the week? (Round your answer to four decimal places.)

**Solution:**

$$Pr(\text{Two or More}) = 1 - Pr(\text{Not Two or More}) = 1 - \frac{(7)(6)(5)}{7^3} = \boxed{.3878}$$

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7. ( points) A die is rolled 12 times. What is the probability of getting exactly 5 1s? (Round your answer to four decimal places.)

**Solution:**

$$Pr(X = 5) = \binom{12}{5} \left(\frac{1}{6}\right)^5 \left(\frac{5}{6}\right)^7 \approx \boxed{.0285}$$



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8. ( points) The 14 members of the undefeated University of Missouri women's volleyball team pose for a picture standing side-by-side in a line after humiliating yet another SEC opponent. What is the probability that sophomores Regan Peltier and Lydia Ely will be standing next to each other? (Round your answer to four decimal places.)

**Solution:**

$$\frac{13 * 2 * 12!}{C(14, 2) * 2 * 12!} = \boxed{.1429}$$

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9. ( points) A magician performing at a birthday party asks one of the attendees to write down two different numbers between 1 and 10 and one letter of the alphabet a, b or c. What are the odds against the magician being able to guess these numbers and this letter correctly?

**Solution:**

$$\frac{1}{C(10,2)} * \frac{1}{3} = \frac{1}{135} = \boxed{134 \text{ to } 1}$$

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10. ( points) Let  $S$  be a sample space and let  $E$  and  $F$  be events associated with  $S$ . Suppose  $Pr(E) = .7$ ,  $Pr(F) = .8$  and  $Pr(E \cap F) = .6$ . Calculate  $Pr(F|E')$ . (Express your answer as a simplified fraction.)

**Solution:**

$$Pr(F|E') = \frac{Pr(F \cap E')}{Pr(E')} = \frac{.2}{.3} = \boxed{\frac{2}{3}}$$

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11. ( points) A fair coin is tossed 3 times. At least one of the coins is showing an  $H$ . What is the probability that 3  $H$ s are showing?

**Solution:**

$$E = \{\text{at least one Heads}\} = \{HHH, HHT, HTH, THH, HTT, THT, TTH\}$$

$$F = \{\text{three Heads}\} = \{HHH\}$$

$$Pr(F|E) = \boxed{\frac{1}{7}}$$

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12. ( points) Suppose a population is 50% male and 50% female and that 4% of the men and 0.2% of the women are color blind. One person is chosen at random from the population and found to be color blind. What is the probability that this person is male? (Express your answer as a simplified fraction or round your answer to four decimal places.)

**Solution:**

$$Pr(M|CB) = \frac{Pr(M \cap CB)}{Pr(CB)} = \frac{.02}{.02 + .001} = \frac{.020}{.021} = \frac{20}{21} \approx .9524$$

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13. ( points) A football quarterback completes 64% of his passes. Write an expression for the probability that this player will complete  $k$  passes out of the next 20?

**Solution:**

$$Pr(X = k) = \binom{20}{k} (.64)^k (.36)^{20-k}$$

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14. ( points) Urn I contains 8 red balls and 8 white balls. Urn II contains 11 white balls. A ball is selected at random from Urn I and placed in Urn II. Then a ball is selected at random from Urn II. What is the probability that the ball selected from Urn II is white? (Express your answer as a simplified fraction or round your answer to four decimal places.)

**Solution:**

$$Pr(W) = \left(\frac{1}{2}\right) \left(\frac{11}{12}\right) + \left(\frac{1}{2}\right) (1) = \boxed{\frac{23}{24}} \approx \boxed{.9583}$$

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15. ( points) Consider the data sets  $A = \{3, 4, 6, 20\}$  and  $B = \{x, 2, 4, 6, 16\}$ . For what value of  $x$  will the medians of the two data sets be the same?

**Solution:**

$$\text{Median}(A) = 5$$

$$\text{Median}(B) = 5 \longrightarrow \boxed{x = 5}$$



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16. ( points) Find  $Q_1$ ,  $Q_2$  and  $Q_3$  for the following data set:  $\{10, 11, 12, 13, 16, 17, 19, 20, 21, 22, 24\}$

**Solution:**

$$Q_2 = 17, \quad Q_1 = 12, \quad Q_3 = 21$$

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17. ( points) Find  $Q_1$ ,  $Q_2$  and  $Q_3$  for the following data set:  $\{9, 10, 11, 12, 13, 16, 17, 19, 20, 21, 22, 24\}$

**Solution:**

$$Q_2 = 16.5, Q_1 = 11.5, Q_3 = 20.5$$

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18. ( points) A study determines that 42% of individuals prefer crunchy peanut butter to creamy peanut butter. 10 individuals are randomly selected for a survey of their peanut butter preferences. What is the probability that 3 or more of these individuals will prefer crunchy peanut butter? (Round your answer to four decimal places.)

**Solution:**

$$\begin{aligned} Pr(X \geq 3) &= 1 - Pr(X \leq 2) \\ &= 1 - \binom{10}{0} (.42)^0 (.58)^{10} - \binom{10}{1} (.42)^1 (.58)^9 - \binom{10}{2} (.42)^2 (.58)^8 \\ &= 1 - .004308 - .031196 - .101656 = \boxed{.8628} \end{aligned}$$

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19. ( points) On a certain mathematics exam, the mean is 80 with a standard deviation of 8. Use Chebychev's Inequality to determine the minimum probability that a randomly selected exam score lies between 70 and 90. (Round your answer to four decimal places.)

**Solution:**

$$c = 10$$

$$Pr(70 < X < 90) \geq 1 - \frac{\sigma^2}{c^2} = 1 - \frac{8^2}{10^2} = 1 - \frac{64}{100} = \boxed{.3600}$$

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20. ( points) A homeowner believes that the probability that his home will suffer catastrophic damage and need to be replaced during the next year is .005. He decides to take out a \$200,000 insurance policy to protect himself against this potential loss.

- (a) Let  $x$  be the amount that the homeowner pays for the policy. Write an expression for the net amount received from the insurance company (payoff on the loss of the house minus the amount paid for the insurance) if the house is catastrophically damaged.

**Solution:**

$$200,000 - x$$

- (b) Find the probability that the house will not suffer catastrophic damage during the year. (Round your answer to four decimal places.)

**Solution:**

$$1 - .005 = .995$$

- (c) Let  $X$  be a random variable that represents the value of the insurance policy. Write an expression for  $E(X)$ , the expected value of  $X$ .

**Solution:**

$$E(X) = (200,000 - x)(.005) + (-x)(.995)$$

- (d) Set up and solve an inequality that determines the maximum amount that the homeowner should pay for this insurance policy. Clearly state your final answer as a dollar amount rounded to the nearest cent.

**Solution:**

$$E(X) \geq 0$$

$$(200,000 - x)(.005) + (-x)(.995) \geq 0$$

$$1000 - x \geq 0 \longrightarrow x \leq 1000 \longrightarrow \text{The homeowner should pay no more than } \boxed{\$1000.00}$$

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21. ( points) In a carnival game, a player selects one ball at a time, without replacement, from an urn containing three red balls and four yellow balls. The game proceeds until a red ball is drawn. The player \$3.00 to play the game and receives \$1.00 for each ball drawn.

- (a) Create a tree diagram that represents the possible outcomes and related probabilities for this game.

**Solution:**

- (b) Find the probability distribution for random variable  $X$ , the amount of money won or lost on this game.

**Solution:**

Earnings $X$	Probability $Pr(X)$
-2	$\frac{3}{7}$
-1	$\frac{2}{7}$
0	$\frac{6}{35}$
1	$\frac{3}{35}$
2	$\frac{1}{35}$

- (c) Find the expected value  $E(X)$ , the expected amount of money won or lost playing this game.

**Solution:**

$$E(X) = (-2) \left( \frac{3}{7} \right) + (-1) \left( \frac{2}{7} \right) + (0) \left( \frac{6}{35} \right) + (1) \left( \frac{3}{35} \right) + (2) \left( \frac{1}{35} \right) = \boxed{-\$1.00}$$