Show all work.
Simplify your answer.
Circle your answer.

No books, no calculators, no cell phones, no pagers, no electronic devices of any kind.

Name____________________________________

Circle your Discussion Section:

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343  T   12:05--12:55        1412 STERLING
344  R   12:05--12:55        1327 STERLING
345  T   13:20--14:10        1327 STERLING
346  R   13:20--14:10        1327 STERLING
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Problem	Points	Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
Total	70	

Solutions will be posted shortly after the exam: www.math.wisc.edu/~miller/m210

1. (10 pts) State the three Axioms for a Probability Measure:

A probability measure assigns to each event E of a sample space S a number denoted by $Pr[E]$ and called the probability of E. This assignment must satisfy the three axioms:

i.

ii.

iii.

2. (10 pts) There are 8 mice in a cage: 3 white males, 3 gray females, and 2 gray males. Two mice are selected simultaneously and at random. Find the probability that at least one mouse is a male, given that at least one is gray.

3. (10 pts) There are 4 quarters, 2 dimes, and 2 nickels in a drawer. An experiment consists of selecting a coin at random, noting its value, and setting it aside. If it is a dime, the experiment ends. If it is not a dime, then another coin is selected at random, and its value noted. Find the probability that at least one nickel is selected.

4. (10 pts) Students are being tested for Virus X and it is estimated that one percent of the students are infected. If a student is infected, the test is positive 90% of the time. If a student is not infected, the test is negative 80% of the time. If the test is applied to a student whose infection status is unknown, and if the test is negative, find the probability that the student is actually infected with Virus X.

5. (10 pts) A high school basketball player makes one-fourth of his three-point shots. If we assume that his shots are Bernoulli trails, how many must he shoot to have a probability of at least 1/2 of making at least one of them?

6. (10 pts) A carnival game consists of selecting 3 balls simultaneously and at random from a box containing 5 red and 3 green balls. Each red ball pays 20 cents each green ball pays 50 cents. It costs 1 dollar to play. A random variable X is the net payoff, i.e., prize money minus cost. Find the probability density function of X.

7. (10 pts) A coin is weighted so that the probability of **Heads** is 1/6. The coin is flipped twelve times. Let X be the random variable which counts the number of **Tails** which come up. Find the

(a) expectation of X, $\mu = E(X)$

$\mu =$

(b) the variance of X, $\nu = Var(X)$,

$\nu =$

(c) and the standard deviation of X, $\sigma = SD(X)$.

$\sigma =$

Answers

1. see page 88.

2. 22/25

3. 11/28 This assumes that at most two selections were made which was what was intended.
Some students interpreted the problem to mean that the experiment continues until a dime is selected. We may as well assume that the selection process stops whenever a nickel or dime is selected. Since any of the four stopping coins is equally likely to be the stop coin, the probability that the stop coin is a nickel is $2/4 = 1/2$. This probability is the same whether there is 0 quarters or 100 quarters.

4. 1/793

5. $n = 3$. This is the least n such that $(3/4)^n \leq 1/2$.

6.

k	Pr(X=k)
.5	1/56
.2	15/56
-.1	30/56
-.4	10/56

7. $\mu = 10$, $\nu = 10/6$, $\sigma = \sqrt{\nu}$