

Show all work.

Simplify your answers.

Circle your answer.

Cheat sheet OK, but no books, no calculator, no cell phones, no pagers, no electronic devices.

Name _____

Circle your Discussion Section:

DIS 343 12:05p T B329 VAN VLECK

DIS 344 12:05p R B321 VAN VLECK

DIS 345 1:20p T 595 VAN HISE

DIS 346 1:20p R 3401 STERLING

Problem	Points	Score
1	12	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	12	
Total	84	

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

1. (12 pts) Your sock drawer contains 2 blue socks, 4 green socks, and 6 red socks. In the dark you reach into the drawer and randomly choose two of the socks. What is the probability that both socks have the same color?

2. (10 pts) Draw a Venn diagram for the set $(A \cap B) \cup C$.

3. (10 pts) A box contains 2 red and 3 green balls. A ball is selected at random and its color is noted. If it is red it is replaced by a green ball. If it is green, it is replaced by a red ball. Then a second ball is randomly drawn from the box. A random variable X is defined to be the total number of red balls selected. Find the probability density function of X and the expected value of X , $\mu = E(X)$.

4. (10 pts) Bubba-Billy-Bob (BBB) buys a house in Wilmoood Neighborhood in Austin, TX. The developer Big-Bill-Wilmoood (BBW) offers BBB a special deal on a 30 year mortgage. For the first 5 years of BBB's mortgage the monthly payments will be interest only. After 5 years BBB will still owe exactly the same amount that he originally borrowed. His monthly payment will then increase so as to amortize the loan over the remaining 25 years.

(a) BBB buys his house for \$55,000. He is required to make a 20% down payment. How much does he borrow?

(b) For the first five years the effective monthly interest rate that BBW offers is 1%. What is the amount of each monthly payment p for the first 5 years?

5. (10 pts) A system of equations is given by

$$3x + y - z = 6$$

$$2x - z = 2$$

$$y + kz = 3$$

where k is a number. For what values of k (if any) does the system have infinitely many solutions?

6. (10 pts) Find the inverse of the matrix A or determine that it does not have an inverse.

$$A = \begin{bmatrix} -1 & 1 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 1 & -1 & 1 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix}$$

7. (10 pts) Set up but do **not** solve the following linear optimization problem:

Bob wants to design a weekly exercise schedule in order to lose weight by burning the optimal number of calories. This will involve jogging, swimming, and walking a certain number of hours each week. These activities burn the following number of calories per hour:

activity	calories per hour
jogging	700
swimming	600
walking	300

Each weekday he walks to and from work for a total of 5 hours each week. Bob counts this as part of his exercise time.

He wishes to jog at most 3 hours a week.

He wants the time spent swimming to be less than or equal to the time spent on each of the other exercises.

He wants that his total exercise time each week to be at most 15 hours.

If Bob wishes to burn the maximum number of calories each week how much time should he spend doing each exercise?

Set up this problem but do not solve it.

8. (12 pts) Find the maximum of $z = 2x - y$ subject to the constraints:

$$x \leq 3$$

$$y \geq 0$$

$$2y \leq x + 3$$

$$y \leq 2x$$

Answers

1. $1/3$

3. $E(X) = 21/25$

4. (a) 44000 (b) 440

5. $k = 1/2$

6.

$$A^{-1} = \begin{bmatrix} -1 & -1 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & -1 & -1 & -1 \\ 0 & 0 & 0 & -1 \end{bmatrix}$$

7. maximize $C = 700j + 600s + 300w$ subject to:

$$w \geq 5$$

$$s \geq 0$$

$$j \geq 0$$

$$j \leq 3$$

$$s \leq j$$

$$s \leq w$$

$$\text{and } j + s + w \leq 15.$$

8. 6