

Show all work.

Simplify your answers.

Circle your answer.

No notes, 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	6	
2	6	
3	6	
4	6	
5	6	
6	6	
7	6	
Total	42	

Solutions will be posted shortly after the exam: [www.math.wisc.edu/~miller/m210](http://www.math.wisc.edu/~miller/m210)

1. (6 pts) Let  $A$ ,  $B$ , and  $C$  be events which form a partition of a sample space  $S$ . Suppose that  $Pr(A) = 3Pr(B)$  and  $Pr(C) = 2Pr(A)$ . Find  $Pr(A)$ ,  $Pr(B)$ , and  $Pr(C)$ .

2. (6 pts) There are 6 red balls and 8 green balls in an urn. Two balls are chosen randomly and simultaneously. Find the probability that both are red given that at least one is red.

3. (6 pts) A strike in the game of bowling is when the bowler knocks down all the pins with her first ball in the frame. Anything else is not a strike. A bowling game consists of 10 frames.

A bowler is equally likely to get a strike on the her first frame as she is to not get a strike.

If she makes a strike on a frame, she is twice as likely to get a strike on the next frame as she is to not get a strike on the next frame. (Success breeds success.)

Otherwise, if she fails to get a strike on a frame, she is equally likely to get a strike as not on the next frame.

Draw a tree diagram for the first three frames. Find the probability she gets at least 2 strikes in her first three frames.

4. (6 pts)

The domestic pet turtle population is being devastated by infection by the tartaruga virus. It is estimated that about 10 percent of all pet turtles are carriers of this dreaded virus. Dr. Torquer has developed a test for tartaruga virus. If a turtle is infected it will correctly predict this with a positive result 90 percent of the time. If a turtle is not infected the test will correctly give a negative result about 80 percent of the time. Sam just found out that his pet turtle Do-Do has tested positive for the dreaded tartaruga virus. What is the probability that Do-Do has the tartaruga virus?

5. (6 pts) A coin is weighted so that Heads is three times as likely as Tails to occur. The coin is flipped three times and the result noted each time. Find the probability that both Heads and Tails occur.

6. (6 pts) A fair coin is flipped until either there are three flips or a Head appears. A random variable  $X$  is defined to be the number of Tails that are flipped. Find the probability density function of  $X$ . Find the expected value  $E(X) = \mu$  of  $X$  and the variance  $\nu = Var(X)$  of  $X$ .

7. (6 pts) In table below the first column is  $a$  and the second column is  $\Pr(0 \leq Z \leq a)$  (rounded) where  $Z$  has the standard normal distribution.

$a$	$\Pr(0 \leq Z \leq a)$
0.0	.00
0.1	.04
0.2	.08
0.3	.12
0.4	.16
0.5	.19
0.6	.23
0.7	.26
0.8	.29
0.9	.32
1.0	.34
1.1	.36
1.2	.38
1.3	.40
1.4	.42
1.5	.43
1.6	.45
1.7	.46
1.8	.46
1.9	.47
2.0	.48
2.1	.48
2.2	.49
2.3	.49
2.4	.49
2.5	.49
2.6	.50
2.7	.50
2.8	.50
2.9	.50
3.0	.50

A Bernoulli process consists of 192 trials with  $p = \frac{1}{4}$ . Use the normal approximation to the binomial to approximate the probability that the number of successes  $X$  satisfies  $45 \leq X \leq 51$ .



## Answers

1.  $3/10, 1/10, 6/10$

2.  $5/21$

3.  $7/12$

4.  $1/3$

5.  $9/16$

6.

$$Pr(X = 0) = 1/2$$

$$Pr(X = 1) = 1/4$$

$$Pr(X = 2) = 1/8$$

$$Pr(X = 3) = 1/8$$

$$\mu = 7/8 \text{ and } \nu = 71/64.$$

7.

.38 if you use  $Pr(0 \leq Z \leq .5) = .19$ ,

.46 if you use  $Pr(0 \leq Z \leq .6) = .23$ .

.4402 if you use the tables in the book for  $Pr(0 \leq Z \leq 7/12)$

.440187064344... if you use the binomial distribution

Any of these answers are acceptable. All are approximations.