

# DEPARTMENT OF MATHEMATICS

Ma 162 Final Exam December 13, 2012

**Instructions:** No cell phones or network-capable devices are allowed during the exam. You may use calculators, but you must show your work to receive credit. If you have no work to support your answer, you will receive no credit. You are graded not on what you know, but on what you write on this exam. Be sure to communicate your understanding, not just write down the final answer.

<b>Problem</b>	<b>Maximum Score</b>	<b>Actual Score</b>
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

NAME: \_\_\_\_\_ Section: \_\_\_\_\_

Last four digits of Student ID: \_\_\_\_\_

Dice have six sides:  $\square$ ,  $\square$ ,  $\square$ ,  $\square$ ,  $\square$ ,  $\square$ . Coins have two sides: H or T. Make sure to show your work.

1. (a) What is the probability of rolling at least two  $\square$  on three dice?

(b) What is the probability of rolling a “double” on three six-sided dice? (*That is, exactly two of the dice are the same; no “triples” allowed. So  $\square$  and  $\square$  are okay, but  $\square$  and  $\square$  are not.*)

(c) What is the probability of getting “exactly four in a row” if you flip a coin seven times? (*That is, four heads with no tails in between, or four tails with no heads in between, but not five heads or five tails in a row. So  $HHHHTTT$  and  $THHHHTT$  are okay, but  $HTHHHTH$  and  $HHHHHTT$  are not okay.*)

(d) What is the probability of getting more than twice as many heads as tails if you flip a coin four times?

2. A company wants to determine when to replace its machine belts. It would prefer to replace them before they fail, but would also prefer not to waste them. There is a data-sheet from the belt manufacturer with some failure probabilities recorded.

100% of belts last 30 days or more.

90% of belts last 60 days or more.

60% of belts last 90 days or more.

40% of belts last 120 days or more.

(a) What percentage of belts last between 60 and 90 days?

(b) What percentage of belts that have already lasted 60 days will last at least another 30 days?

(c) What is the probability that a belt that has lasted 90 days will fail within the next 30 days?

(d) What is the probability that a belt that lasted 60 days will last 120 days or more?

3. A store is trying out an ad campaign to increase visits. People who have not recently seen the new ad have a 10% chance of stopping by the store, but people who have recently seen it have a 70% chance of stopping by. The store wants 20% of people to see the ad.

(a) The first month, only 20% of people have recently seen the ad. What is the probability that someone who stops by the store has seen the ad?

(b) The company decides to spend less money on advertisements, since (in their own words) “so many people have already seen it.” The second month, only 4% of people have recently seen the ad. What is the probability that someone who stops by the store has seen the ad?

(c) What percentage of people ended up stopping by the store during the 4% campaign of part (b)?

(d) How does that percentage in part (c) compare to the percentage of people who ended up stopping by the store during the 20% campaign of part (a)?

4. A company employs people from 3 demographic groups, and after its restructure will either promote, lay off, or retain (at their current position) each employee. The company is concerned that its decisions are independent of the demographic group, and so made the following table:

	Demo1	Demo2	Demo3
Promote	10	5	1
Lay off	20	10	9
Retain	270	135	90

(a) What is the probability that an employee will be promoted?

(b) What is the probability that a member of Demo3 will be promoted?

(c) What is the probability that an employee will be laid off?

(d) What is the probability that an employee that is laid off is in Demo1?

(e) Which demographic group was treated unfairly and why?

5. The Gothic Glee Club is trying to maximize its fund-raiser's profit. They are selling two hand-made candy sculptures: the Santapede and Mrs. Claws. The sculptures require candy canes, marshmallow Santas, and black (like their hearts) licorice. The ingredients and expected profits are given in the following table:

	Candy Cane	Marshmallow Santas	Black Licorice	Profit
Santapede	8 per	2 per	2 per	\$10 per
Mrs. Claws	4 per	2 per	4 per	\$12 per
Inventory	104	30	48	

**In plain English, give a recommendation to the GGC to maximize their profit:**

Now justify it with mathematics:

