Math 20, Midterm 1
October 2nd

Name _____ (please print)

Instructions

- Please **print your name** in the blank space above.
- Please **turn off cell phones** or other electronic devices which may be disruptive.
- Calculators or other computing devices are not allowed.
- Except when indicated, you must show all work and give justification for your answer. **A correct answer with incorrect work will be considered wrong.**

All work on this exam should be completed in accordance with the Dartmouth Academic Honor Principle.

TIPS:

- Work cleanly and neatly; this makes it easier to give partial credit.
- Use scratch paper to figure out your answers and proofs before writing them on your exam.
- Please box your answers, when appropriate.
- You dont have numerically expand all answers. For example, you can leave an answer in the form $5! \cdot \binom{7}{2} \cdot \binom{10}{3}$, rather than 302400.
- Consider signing the FERPA waiver:

FERPA waiver: By my signature I relinquish my FERPA rights in the following context: This exam paper may be returned en masse with others in the class and I acknowledge that I understand my score may be visible to others. If I choose not to relinquish my FERPA rights, I understand that I will have to present my student ID at my instructors office to retrieve my examination paper. FERPA waiver signature: _____

Grader's use only:

1. _____ /21

2. _____ /18

3. _____ /20

4. _____ /11

5. _____ /10

Total: _____ /80

Section 1: True or False

1. (21 points) Choose **True** or **False**. *No justification is required for your answers. No partial credit will be awarded.*

   (a) If A and B are two disjoint events, then they are independent.

   True False

   (b) If A and B are independent events and B has a positive probability, then $P(A|B) = P(A)$.

   True False

   (c) The number of k-letter words is $\binom{26}{k}$.

   True False

   (d) If $P(A \cap B) = 0$, then A and B are two disjoint events.

   True False

   (e) The number of ways to pick 4 people out of a class of 40 and sit them in a line in the front row of the classroom is $40 \cdot 39 \cdot 38 \cdot 37$

   True False

   (f) The number of distinguishable permutations of the word TOOTS is 30.

   True False

   (g) Let X be a random variable, and A an event with positive probability. The sample space of random variable $X|A$ is A.

   True False

Section 2: Fill in the blank

2. (18 points) *No justification is required for your answers. No partial credit will be awarded*

   (a) How many ways can 8 people sit next to each other at a movie if a certain 2 of them refuse to sit next to each other?

   Answer:

   (b) Twenty couples go the movies. Assume that their seats were randomly assigned to two rows of twenty seats each, what is the probability that no couple sits in the same row?

   Answer:

(c) You have 15 identical cookies that you want to divide them amongst 7 friends. In how many different ways can you do this?

Answer:

Section 3: Free response

You must show all work to receive credit!

3. (20) In a card game a player has figured out that two opponents have between them the 6 remaining hearts in their hands.

   (a) What is the probability that these hearts are split 3,3?

   (b) What is the probability for this event if you know that they each have at least one heart?

4. (11) Two archers, Mary and Paul, are shooting at the same target. Mary hits the target 75% of the time and Paul hits the target 25% of the time. Now suppose that both archers shoot independently one arrow at the target at the same time. If exactly one arrow hits the target, what is the probability that it was shot by Mary?

5. (10) You and a friend are in a group of 9 people. The group is split in three teams of three at random. What is the probability that you both are in the same team?

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