

STAT/MA 41600
Midterm Exam #1: October 10, 2014

Name _____

Purdue student ID (10 digits) _____

1. The testing booklet contains 4 questions, which are all weighted evenly (i.e., each question is worth 1/4 of the midterm exam grade).
2. Permitted Texas Instruments calculators:
 - BA-35
 - BA II Plus*
 - BA II Plus Professional Edition*
 - TI-30XS MultiView*
 - TI-30Xa
 - TI-30XIIS*
 - TI-30XIIB*
 - TI-30XB MultiView*

*The memory of the calculator should be cleared at the start of the exam.
3. **Circle your final answer in your booklet**; otherwise, no credit may be given.
4. There is no penalty for guessing or partial work.
5. Show all your work in the exam booklet. If the majority of questions are answered correctly, but insufficient work is given, the exam could be considered for academic misconduct.
6. Extra sheets of paper are available from the proctor.

1. Suppose that there are two 6-sided dice in a hat. One die has 3 white sides and 3 black sides. The other die has 2 white sides and 4 black sides. Juanita reaches into the hat and randomly pulls out a die. She rolls the chosen die and “black” appears on top. Given this condition, what is the probability that the chosen die has 3 white sides and 3 black sides?

2. There are 20 Statistics students and 20 Mathematics students. They are randomly split into 20 groups, with 2 students per group (all such arrangements are equally likely). Let X denote the number of groups consisting of 1 Statistics student and 1 Mathematics student.

2a. Find $\mathbb{E}(X)$.

2b. Find $\text{Var}(X)$.

3. Suppose Alice rolls a *4-sided dice* until she gets her first occurrence of “1” and then she stops. Let X denote the number of rolls until (and including) that first occurrence of “1.” Suppose Bob flips a fair coin until he gets his first occurrence of “heads” and then he stops. Let Y denote the number of flips until (and including) that first occurrence of “heads.” Find $P(X \geq Y)$.

4. During the holiday rush, there are 300,000 shoppers in a certain city. Each of these shoppers is extremely likely to purchase candy. Their choices (whether or not to purchase candy) are made independently. Suppose that a person purchases candy with probability $99,999/100,000$ and declines to purchase candy with probability $1/100,000$. Let X be the number of people who decline to purchase candy.

4a. Give an exact formula for the probability that $P(X \leq 4)$. You do *not* have to evaluate the formula on your calculator.

4b. Use a Poisson estimation for the probability above.

4c. Use your calculator to evaluate the Poisson expression that you gave in part **4b**.