Carefully Read The Instructions!

Instructions: This exam will last 50 minutes and consists of 7 problems and an extra credit problem. Provide solutions to the problems in the space provided. All solutions must be sufficiently justified to receive credit. You may use a calculator on this exam. You may also use one page of hand written notes on the exam. Good Luck!

Advice: If you get stuck on a problem don’t panic! Move on and come back to it later.

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1. Consider the observations 10, 7, 8, 5, 8, 11 of a quantitative variable.

   (a) Compute the mean of these observations.

   (b) Compute the median of these observations.

   (c) Compute the first and third quartiles of these observations.

   (d) Compute the standard deviation of these observations.
2. A bird watcher named Kevin sits at a park and watches birds fly by, and then records the colors of the birds in the order that he sees them. The birds in the park come in only three different colors: black, red and green. Suppose two birds fly by and Kevin records their colors as they pass him.

(a) Write down the sample space for the two colors that Kevin records.

(b) Write down the event $A$ that at least one of the birds was green in terms of the outcomes in the sample space.

(c) Write down the event $B$ that neither of the birds were black in terms of the outcomes in the sample space.

(d) Compute $(A \cap B) \cup A^c$

(e) If all possible color combinations of the birds are equally likely to appear at the park, compute $P(A)$. 
3. A class of 21 first graders line up for recess every day after lunch. There are 12 boys in the class and 9 girls.

(a) How many ways are there to arrange the recess line?

(b) How many ways are there to arrange the recess line so that a boy is in the front of the line?

(c) If the line is formed at random (i.e. all possible arrangements of the line are equally likely to be formed), compute the probability that a girl is at the front of the line.

(d) The principle needs to select 2 boys and 2 girls from the first grade class to be in the school picture, how many ways can she do this?
4. Draw a venn diagram for the following set:

\[(A \cap B \cap D) \cup ((B \cup D)^c \cap A)\]
5. Marcel writes programs for a software developer. His programs are sometimes flawed, and are therefore checked by a second programmer after they are completed. If Marcel’s program contains a flaw, the probability that it is discovered by the second programmer is 88%. If the program is not flawed, the probability that the second programmer mistakenly identifies a flaw in the program is 11%. It is known that 8% of Marcel’s programs contain flaws. Suppose Marcel sends a program in for inspection.

(a) What is the probability that the second programmer finds a flaw with Marcel’s program?

(b) What is the probability that Marcel’s program actually contains a flaw given that the second programmer found a flaw in the program?

(c) What is the probability that Marcel’s program actually contains a flaw given that the second programmer could not find a flaw with the program?
6. An individual who has automobile insurance from a certain company is randomly selected. Let $Y$ be the number of moving violations for which the individual was cited during the last 3 years. The pmf of $Y$ is as follows:

$$p(x) = \begin{cases} .4 & \text{if } x = 0, \\ .35 & \text{if } x = 1, \\ .15 & \text{if } x = 2, \\ .1 & \text{if } x = 3. \end{cases}$$

(a) Compute the cdf of $Y$.

(b) Compute the expected value of $Y$.

(c) Compute the variance of $Y$.

(d) Suppose an individual with $Y$ violations incurs a surcharge of $(100 + 10Y^2)$ dollars. Compute the expected amount of the surcharge.
7. Four married couples, among them Kent and Paula, have purchased theater tickets and are seated in a row consisting of just eight seats. They take their seats in a completely random fashion (i.e. all arrangements are equally likely). What is the probability that Kent and Paula do NOT end up sitting next to one another?
8. (Extra Credit) You have 7 distinct books and 2 shelves on which to put them, each one being capable of holding all 7 books. How many ways can you arrange the 7 books on the 2 shelves?