

Student name:

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MATH 120: Elementary Statistics  
Section 1

Test 2  
March 28, 2019

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**Instructions:**

- This is a regular “closed-book” test, and is to be taken without the use of notes, books, or other reference materials. Collaboration or group work is not permitted.
  - Cell-phone usage, in any form, is prohibited for the entire duration of the test. This also applies to any restroom breaks taken during the test.
  - Important: For full credit, all solutions must show relevant calculation steps, reasons, sketch, and/or justification, as needed.
  - This test adds up to 50 points. It contains questions numbered 1-7.
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1. [6 points] Given the probabilities  $P(A) = 0.6$ ,  $P(A \text{ and } B) = 0.2$ ,  $P(A \text{ or } B) = 0.7$ , find:
  - (a)  $P(B)$
  - (b)  $P(A | B)$

2. [6 points] The radioactive gas radon, found in some homes, poses a health risk to residents. To assess the level of contamination in their area, a county health department wants to test a few homes. If the risk seems high, they will publicize the results to emphasize the need for home testing. Officials plan to use the local property tax lists to randomly select 25 homes in the county for testing. Identify the following as precisely as possible:

\* The population:

\* The sample:

\* The parameter(s) of interest:

\* The statistic(s):

3. [6 points] Each of the following questions describes a method for choosing a sample. Write the letter corresponding to the sampling strategy in the blank next to each.

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|------------|--|-----------------------|
| _____ i.   | An insurance research organization wants to study driving patterns among different age groups. They randomly select 200 drivers under the age of 25 years, 400 drivers between 25 and 60, and 150 drivers over the age of 60.                                  | A. convenience        |
| _____ ii.  | A pollster uses a computer to randomly select 5000 names from the list of registered voters in an area.  | B. stratified random  |
| _____ iii. | An apple orchard is divided into 18 regions. Management randomly selects 2 regions, counts all the apples produced in those, and uses that to estimate the number of apples produced in the whole orchard.   | C. simple random      |
| _____ iv.  | A government auditor is tasked with choosing and auditing 36 companies in a state. She lists all the company names in alphabetical order, randomly selects 3 letters of the alphabet, and randomly picks 12 companies with names from each of those alphabets. | D. cluster            |
|            |  | E. multistage         |
|            |  | F. systematic         |
|            |  | G. voluntary response |

4. [8 points] Box A and Box B are filled with green and blue marbles as shown. Each box is shaken thoroughly.

**BOX A**

**6 Green**  
**4 Blue**

**BOX B**

**60 Green**  
**40 Blue**

(a) We are allowed to randomly pick one marble from one of the two boxes. We want to get a green marble. Which box will give us the best chance? Why?

(b) Suppose we are allowed to randomly pick three marbles from Box B. Find the probability of getting at least one green.

(c) If we pick 3 marbles from Box B, what is the probability of getting the same color?

5. [8 points] To play a game, you must pay \$10 per play. There is a 10% chance you will win \$20, and a 40% chance you will win \$15. The rest of the time you win nothing.

(a) Create a probability model for your net winnings per play.

(b) Find the expected amount you'll win.

(c) Find the standard deviation of the amount.

If you are unsure whether you got the right answer to (a), assume the probability model is

X (in \$)	-2	5	8	12
P(X)	0.15	0.2	0.3	0.35

Note, this is NOT the correct answer to part (a); however, feel free to use it to solve parts (b)-(c) of this question.

6. [8 points] A company's records show that on any given day about 1% of their day shift employees and 2% of their night shift employees will be absent. Sixty percent of the employees work the day shift.
- (a) Find the probability that a randomly selected employee will be absent on any given day.
  - (b) Find the probability that an employee who is absent, works the day shift.
  - (c) Find the probability that an employee who is not absent, works the night shift.
  - (d) Are employees' absence and the shift they work disjoint, independent, neither, or both?

7. [8 points] A nutrition lab wants to study the effect of storage time on the amount of Vitamin C that is present in freeze dried fruit. They conduct an experiment in which 12 packages of freeze dried fruit are randomly divided into groups of 4, and stored for the following periods (in months): 0, 6, 12. At the end of each storage period, the amount of Vitamin C present in the corresponding packages is estimated (in milligrams of Vitamin C per 1000 milligrams of fruit). Identify each of the following as clearly & precisely as possible in this study:

\* Experimental units:

\* Factor(s) and levels:

\* How many treatments? Name them.

\* Response variable(s):

\* Control of variability - name at least one form employed in the study: