

# ST 421/521 Fall 2020

## Assignment #3

**2.172** Let  $A$  and  $B$  be any two events. Which of the following statements, in general, are false?

- a**  $P(A|B) + P(\bar{A}|\bar{B}) = 1.$
- b**  $P(A|B) + P(A|\bar{B}) = 1.$
- c**  $P(A|B) + P(\bar{A}|B) = 1.$

**3.14** The maximum patent life for a new drug is 17 years. Subtracting the length of time required by the FDA for testing and approval of the drug provides the actual patent life for the drug—that is, the length of time that the company has to recover research and development costs and to make a profit. The distribution of the lengths of actual patent lives for new drugs is given below:

Years, $y$	3	4	5	6	7	8	9	10	11	12	13
$p(y)$	.03	.05	.07	.10	.14	.20	.18	.12	.07	.03	.01

- a** Find the mean patent life for a new drug.
  - b** Find the standard deviation of  $Y =$  the length of life of a randomly selected new drug.
  - c** What is the probability that the value of  $Y$  falls in the interval  $\mu \pm 2\sigma$ ?
- 3.24** Approximately 10% of the glass bottles coming off a production line have serious flaws in the glass. If two bottles are randomly selected, find the mean and variance of the number of bottles that have serious flaws.
- 3.34** The manager of a stockroom in a factory has constructed the following probability distribution for the daily demand (number of times used) for a particular tool.

$y$	0	1	2
$p(y)$	.1	.5	.4

It costs the factory \$10 each time the tool is used. Find the mean and variance of the daily cost for use of the tool.

- 3.40** The probability that a patient recovers from a stomach disease is .8. Suppose 20 people are known to have contracted this disease. What is the probability that
- a** exactly 14 recover?
  - b** at least 10 recover?
  - c** at least 14 but not more than 18 recover?
  - d** at most 16 recover?
- 3.56** An oil exploration firm is formed with enough capital to finance ten explorations. The probability of a particular exploration being successful is .1. Assume the explorations are independent. Find the mean and variance of the number of successful explorations.

**3.60** A particular concentration of a chemical found in polluted water has been found to be lethal to 20% of the fish that are exposed to the concentration for 24 hours. Twenty fish are placed in a tank containing this concentration of chemical in water.

- a** Find the probability that exactly 14 survive.
- b** Find the probability that at least 10 survive.
- c** Find the probability that at most 16 survive.
- d** Find the mean and variance of the number that survive.

**3.66** Suppose that  $Y$  is a random variable with a geometric distribution. Show that

- a**  $\sum_y p(y) = \sum_{y=1}^{\infty} q^{y-1} p = 1$ .
- b**  $\frac{p(y)}{p(y-1)} = q$ , for  $y = 2, 3, \dots$ . This ratio is less than 1, implying that the geometric probabilities are monotonically decreasing as a function of  $y$ . If  $Y$  has a geometric distribution, what value of  $Y$  is the most likely (has the highest probability)?