Name: _____
BSAD 210—Montgomery College

EXAM 2

- There are 110 possible points on this exam. The test is out of 100.
- You have one class period to complete this exam, but you should be able to complete it in less than that
- Please turn off all cell phones and other electronic equipment.
- Be sure to read all instructions and questions carefully.
- Remember to show all your work. You may print your formulas in Excel using the Show Formulas option in the Formulas tab. Printed versions of your work showing formulas ***and*** showing the results counts as showing your work. But you must include both with your test for "showing your work" to count this way. Write your name on both printouts.
- Note the last sheet lists some helpful Excel commands.
- *Please print clearly and neatly.*

Part I: Matching. *Write the letter from the column on the right which best matches each word or phrase in the column on the left. You will not use all the options on the right and you cannot use the same option more than once.*

2 points each.

1. ___ Binominal distribution
2. ___ Independent
3. ___ Mutually exclusive
4. ___ Poisson distribution
5. ___ Prediction market
6. ___ Risk averse
7. ___ Risk loving

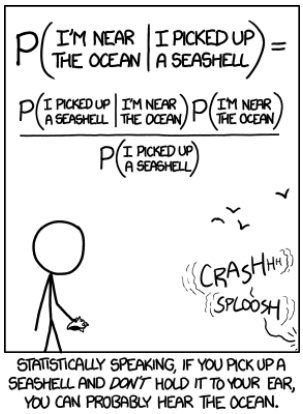
A. Defined by if the sample size is less than 5% of the population
B. Defined by if the likelihood of a success changes with each trial
C. Used if wondering the probability of three machines (out of 50 identical ones) breaking
D. Used if wondering the probability of ten neighborhood burglar alarms going off in a week.
E. Means probabilities of events can be added together
F. Means probabilities of events can be multiplied together
G. State lotteries make money based on this idea
H. Warranties make money based on this idea
I. Prices can be interpreted as probabilities

Part II: Multiple Choice. *Choose the best answer to the following.*

4 points each.

8. The ***most important*** difference between a binomial distribution and a hypergeometric distribution is based on what?
    a. If the size of the sample relative to the population is large or not.
    b. If the standard deviation of the population is constant or not.
    c. If the interval between events is constant or not.
    d. If the chance of success is high or not.
    e. None of the above

9. It's commonly suggested that if you hold a seashell to your ear, you can hear the ocean. This xkcd comic[1] suggests this is a poor conclusion. What statistical tool is used to make this point?
    a. Expected value
    b. Bayes' Theorem
    c. Discrete probability function
    d. Learned Hand Rule
    e. None of the above



[1] http://xkcd.com/1236/

10. Consider a Poisson distribution. If $\lambda=2$, how does the probability of getting two events in the time period compare with getting one event in that same time period?
    a. More likely to get one event
    b. Equally likely
    c. More likely to get two events
    d. It is impossible to tell with the information provided
    e. None of the above

11. An expected cost is an expected value but with a negative payoff. Therefore, one of the lessons of this unit is that a rare event that comes with a high cost can discourage bad behavior as well as a common event that comes with a low cost. Which of the following is a rare event that comes with a high cost?
    a. Getting arrested because you were pulled over but didn't have your driver's license.
    b. Being late for class and getting disappointing looks from your professor and classmates.
    c. Getting caught after murdering someone in full view of dozens of witnesses and video cameras and then being sent to jail for a long time.
    d. B & C
    e. None of the above

12. A test that's 100% specific and 0% sensitive:
    a. Will *never* have a false positive
    b. Will *never* have a false negative
    c. Will *never* have a true positive
    d. A & C
    e. B & C

13. It's conventional wisdom that prevention is always better than a cure because it's often cheaper to prevent a bad thing from happening than correcting a bad thing after it happened. But the Learned Hand Rule suggests that's not true. How?
    a. A cost for non-problems must also be incurred; that's why p matters.
    b. Burden only matters when there's negligence.
    c. The expected value is often negative.
    d. Sensitivity is greater than specificity.
    e. None of the above

14. Which of the following pairs are pairs of independent probabilities?
    a. The chance of rain and the chance that there will be heavy traffic
    b. The likelihood of a child being bitten by a dog and the chance that the child has a hot dog in her pocket.
    c. The probability that an employee stole something from your stole and the probability that your security system is broken.
    d. A & C
    e. None of the above

15. If two events are mutually exclusive, then one can sum the probability of each event to find the chance that at least one of the events occur. If the events are ***not*** mutually exclusive, how could you determine the chance that at least one of the events occur?
    a. Multiply the probabilities together.
    b. Add the probabilities together and then divide by the probability that both occur.
    c. Add the probabilities together and then subtract the probability that both occur.
    d. Add the probabilities together and then subtract 1.
    e. You can't determine this.

16. Suppose Greg slipped on some spilled juice at a grocery store and he sued the store for damages because they didn't post a wet floor sign fast enough. According to the Learned Hand Rule, if Greg had slipped on some spilled juice at a hair salon, how would chances of the court ruling in Greg's favor changed?
    a. Better, because B is higher.
    b. Better, because p is lower.
    c. Worse, because B is higher.
    d. Worse, because p is lower.
    e. Chances would be about the same / It is impossible to tell with the information provided.

17. Which of the following products depend on people being risk averse?
    a. Extended warranties
    b. Car insurance
    c. The lottery
    d. A & B
    e. None of the above

18. Jason works quality control in a textiles factory. His job is to reject any fabric with more than one error per yard of fabric. Suppose there's a 1% chance of getting an error. Jason wants to know if the textiles machinery is working properly and wonders how likely it would be to find three errors in one yard. If Jason pulls 100 yards of fabric, what probability function should he use?
    a. Binominal
    b. Hypergeometric
    c. Poisson
    d. It is impossible to tell given the information provided
    e. None of the above

19. A risk loving person _____.
    a. ***Always*** chooses the riskiest option.
    b. Would ***never*** pick the same option as a risk averse person.
    c. Prefers a 10% chance to win $50 than a five dollar bill.
    d. A & B
    e. All of the above

Part III: Short Answer. *Answer the following.*
16 points each.

20. The 2014 "Weird Al" Yankovic song *Word Crimes* describes the proper use of grammar. It begins:

> If you can't write in the proper way
> If you don't know how to conjugate
> Maybe you flunked that class

A class in English is a sort of test on how well you know grammar (among other things). Suppose 3% of people do not know proper grammar. Also suppose that the "test" of an English class is 95% sensitive and 99% specific. If someone flunks English (they failed the test), what is the probability they do not know proper grammar?

21. Mary would like to grow vegetables in a small plot of land in her backyard and sell the crops to restaurants. She buys some bell pepper seeds online for $20. They cannot be returned. She later finds out that the seeds are bad 25% of the time; nothing will grow. But if they do grow, she'll make money based on how many peppers her crop yields and how good the crop is. She plants one hundred square feet of bell peppers.

Quality	*Probability*	*Price Per Pepper*
Good	80%	$0.25
Excellent	20%	$0.60

The first table indicates the chance each possible quality will occur and the price per pepper for that quality. The second table indicates the how likely various quantities of peppers would grow per square foot. Assume yield probabilities are independent with respect to quality probabilities.

Quantity Per Square Foot	*Probability*
1	5%
2	35%
3	50%
4	10%

What is the expected profit (value) of this venture? Assume seeds are the only cost. (Remember to show your work. If using Excel, you may do this by selecting Show Formulas, under the Formulas tab, and printing off a copy to include with your exam. Be sure to put your name on the print out.)

22. Alfonso works for a fruit company. He's in charge of quality control for bananas. It's too expensive to test every banana bunch in a crate so he requires his fellow workers to select a sample. Suppose he has them selects three banana bunches from each crate containing six banana bunches. Suppose, in one instance, the chosen box has three bad banana bunches. What is the probability that the sample from that crate will have exactly two bad banana bunches? Be sure to include any commands you put into Excel.

Equation and Information Sheet

Function or Command	*Output*
ABS	The absolute value of an input
AVERAGE	Arithmetic mean of a dataset
BINOM.DIST	Binominal distribution for x number of successes
CORREL	Correlation coefficient of two variables
CTRL + `	Show formulas
CTRL + F	Find
CTRL + P	Print
CTRL + X	Cut highlighted area
CTRL + C	Copy highlighted area
CTRL + V	Paste highlighted area
CTRL + Z	Undo
F4	Makes cell reference absolute
GEOMEAN	Geometric mean of a dataset (adjustments must be added manually)
HYPGEOM.DIST	Hypergeometric distribution for x number of successes
LARGE	Larger values of a dataset (k=1 is largest, k=2 is second largest, k=3 is third largest…)
MAX	Maximum value of a dataset
MEDIAN	Median of a dataset
MIN	Minimum value of a dataset
MODE	Mode of a dataset
POISSON	Poisson distribution for x number of successes
QUARTILE	The 0^{th} to 4^{th} quartile of a dataset
SMALL	Smaller values of a dataset (k=1 is smallest, k=2 is second smallest, k=3 is third smallest…)
STDEV.S	Standard deviation of a sample

Coefficient of Variation

$$CV_{sample} = \frac{s}{\bar{x}}(100)$$

Bayes' Theorem

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\sim A)P(\sim A)}$$

Learned Hand Formula

$$B < pL$$

Binominal Distribution

$$\mu = np,\ \sigma = \sqrt{npq}$$

Hypergeometric Distribution

$$\mu = \frac{nR}{N},\ \sigma = \sqrt{\frac{nR(N-R)}{N^2}}\sqrt{\frac{N-n}{N-1}}$$

Poisson

$$\mu = \lambda,\ \sigma = \sqrt{\lambda}$$