Key

REVIEW

You should be able to

- Distinguish between discrete and continuous random variables
- Determine if a distribution is a probability distribution
- Construct a discrete probability distribution and its graph (histogram)
- Find the mean, variance and standard deviation of a discrete probability distribution (recall: use L1, L2, etc)
- Find the expected value of a discrete probability distribution
- Determine if a probability experiment is a binomial experiment
- Find binomial probabilities
- Construct a binomial distribution and its graph (histogram)
- Find the mean, variance, and standard deviation of a binomial probability distribution
- Find probabilities using the geometric distribution
- Find probabilities using the Poisson distribution

1. In words, describe the differences between the value of x in a binomial distribution, a geometric distribution, and a Poisson distribution. Binomial → x is different values of # of successes in fixed # of trials
   Geometric → x is # of trial when first success occurs
   Poisson → x is # of occurences in an interval

2. Determine the type of probability distribution (binomial, geometric, or Poisson) that applies to the following (just state the type, don't work out this problem):
   a. The probability that a student passes the written test for a private pilot's license is 0.75. What is the probability that a student will fail on the first attempt and pass on the second attempt? Geometric
   b. 54% of US adults think Congress should place size limits on carry-on bags. In a survey of 110 randomly chosen adults, people are asked "Do you think Congress should place size limits on carry-on bags?" What is the probability that exactly 60 of the people answer yes? Binomial
   c. In Tampa, Florida, the mean number of days in July with 0.01 inches or more precipitation is 16. What is the probability that Tampa has 20 days with 0.01 inches or more precipitation next July? Poisson

3. Determine if the following random variables x are discrete or continuous:
   a. Hours spent sleeping each day Continuous
   b. Amount of carbon dioxide emitted from a car's tailpipe each day Continuous
   c. Number of fish caught during a fishing tournament discrete

4. Determine if the following distribution is a probability distribution. If it is not, state the reason.
   The random variable x represents the number of tickets a police officer writes out each shift.

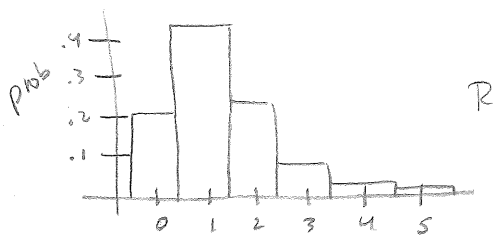
x	0	1	2	3	4	5
$P(x)$	0.09	0.23	0.29	0.16	0.21	0.18

No $\Sigma P(x) = 1.16 \neq 1$

5. The number of hits per game played by a baseball player during a recent season is shown below:

Hits	Games f
0	29
1	62
2	33
3	12
4	3
5	1

Hits, x	$P(x)$
0	.207
1	.443
2	.236
3	.086
4	.021
5	.007



Right-skewed

a. Use the frequency distribution table to construct a probability distribution. Write your answer in the space above.
b. Graph the probability distribution using a histogram and describe the shape (symmetric, left skewed or right skewed). Write your answer above.
c. Find the mean, variance, and standard deviation of the probability distribution

(By calculator) $\mu = 1.29$ $\sigma^2 = 1.003$ $\sigma = 1.001$

6. A local pub has a chicken wing special on Tuesdays. The pub owners purchase wings in cases of 300. The random variable x represents the number of cases used during the special. Find the expected value of the random variable x.

x	1	2	3	4
$P(x)$	$\frac{1}{9}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{18}$

$E(x) = \mu = 2.5$ (By calculator) OR $E(x) = \mu = (1 \cdot \frac{1}{9}) + (2 \cdot \frac{1}{3}) + (3 \cdot \frac{1}{2}) + (4 \cdot \frac{1}{18}) = 2.5$

7. Decide whether the following experiments are binomial or not:
   a. Bags of plain M&M's contain 24% blue candies. One candy is selected from each of 12 bags. The random variable represents the number of blue candies selected. Binomial
   b. A fair coin is tossed repeatedly until 15 heads are obtained. The random variable x counts the number of tosses. Not binomial (not a set # of trials)

8. A population count shows that the average number of rabbits per acre living in a field is 3.6. Find the probability that seven rabbits are found on any given acre of the field.

$P(7) = \text{poissonpdf}(3.6, 7) = .042$

9. One in four adults is currently on a diet. You randomly select five adults and ask them if they are currently on a diet. Find the probability that the number who say they are currently on a diet is
   a. Exactly three $P(3) = \text{binompdf}(5, .25, 3) = .088$
   b. At least three $P(x \geq 3) = 1 - P(x < 3) = 1 - P(x \leq 2) = 1 - \text{binomcdf}(5, .25, 2) = .1035$
   c. More than three $P(x > 3) = 1 - P(x \leq 3) = 1 - \text{binomcdf}(5, .25, 3) = .0156$

10. Two thousand trout are introduced into a small lake. The lake has a volume of 20,000 cubic meters. Find the probability that three brown trout are found in any given cubic meter of the lake. (assume the trout will evenly distribute throughout the lake)

$\mu = \frac{2000 \text{ trout}}{20{,}000 \text{ m}^3} = .1 \text{ trout/m}^3$

$P(3) = \text{Poissonpdf}(.1, 3) = .00015$

11. The first successful suspension bridge built in the United States, the Tacoma Narrows Bridge, spans the Tacoma Narrows in Washington State. The average occupancy of vehicles that travel across the bridge is 1.6. The following probability distribution represents the vehicle occupancy on the bridge during a five-day period. What is the probability that a randomly selected vehicle has two occupants or fewer?

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$P(x \leq 2) = \text{Poissoncdf}(1.6, 2) = .783$

12. One in four people in the US owns individual stocks. You randomly select 5 people and ask them if they won individual stocks. Find the probability that the number who say they own individual stocks is
    a. Exactly 2 $P(2) = \text{binompdf}(5, .25, 2) = .264$
    b. Less than 2 $P(x < 2) = P(x \leq 1) = \text{binomcdf}(5, .25, 1) = .633$
    c. At least 2 $P(x \geq 2) = 1 - P(x < 2) = 1 - P(x \leq 1) = 1 - \text{binomcdf}(5, .25, 1) = .367$

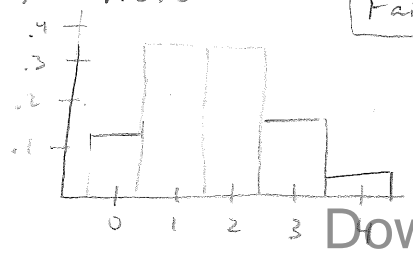
13. 22% of former smokers say they tried to quit four or more times before they were habit-free. You randomly select 10 former smokers. Find the probability that the first person who tried to quit four or more times is
    a. The third person selected $P(3) = \text{geometpdf}(.22, 3) = .134$
    b. The fourth or fifth person selected $P(4 \text{ or } 5) = P(4) + P(5) = \text{geometpdf}(.22, 4) + \text{geometpdf}(.22, 5) = .186$
    c. Not one of the first seven people selected $P(x > 7) = 1 - P(x \leq 7) = 1 - \text{geometcdf}(.22, 7) = .176$

14. It is estimated that sharks kill 10 people each (per) year worldwide. Find the probability that at least 3 people are killed by sharks this year.

$P(x \geq 3) = 1 - P(x < 3) = 1 - P(x \leq 2) = 1 - \text{poissoncdf}(10, 2) = .997$

15. In a recent year, forty percent of trucks sold by a company had diesel engines. You randomly select four trucks sold by the company and check if they have diesel engines.
    a. Construct a binomial distribution
    b. Graph the binomial distribution using a histogram and describe its shape
    c. Find the mean, variance, and standard deviation of the binomial distribution
    d. Determine which values of the random variable x that you would consider unusual

x	$P(x)$
0	$\text{binompdf}(4, .40, 0) = .1296$
1	.3456
2	.3456
3	.1536
4	.0256



Fairly symmetric, slightly right-skewed

$\text{mean} = np = (4)(.4) = 1.6$
$\sigma^2 = npq = (4)(.4)(.6) = .96$
$\sigma = \sqrt{npq} = \sqrt{(4)(.4)(.6)} = .98$

Yes, unusual