STAT 614 Chapter 4 SAMPLING DISTRIBUTIONS (Discrete and Continuous Random Variables)

A sampling distribution of a value(statistic) is a probability distribution that specifies probabilities that the value or statistic can take.

Use the following to answer questions
The Department of Animal Regulations released information on pet ownership for the population consisting of all households in a particular county. Let the random variable *X* = the number of licensed dogs per household. The distribution for the discrete random variable *X* is given below:

Value of *X*	0	1	2	3	4	5
Probability	0.52	0.22	0.13		0.03	0.01

1. The probability for *X* = 3 is missing. What is it?
A) 0.07
B) 0.09
C) 0.1
D) 0.0
Answer:

2. What is the probability that a randomly selected household will have two dogs?

3. What is the probability that a randomly selected household from this community owns at least one licensed dog?
A) 0.22
B) 0.26
C) 0.48
D) 0.52
Answer:

4 What is the mean (average number) of licensed dogs per household in this county?

$$\sum X_i P_i$$

$$0(.52) + 1(.52) + 2(.13) + 3(.09) + 4(.03) + 5(.01) =$$

A) 0 dogs
B) 0.92 dogs
C) 1 dog
D) 1.22 dogs
Answer:
Topic: 4.4 Means and Variances of Random Variables

5. Find the standard deviation for the probability distribution for dogs in a household.

$$\sum (X_i - U_x)^* 2 \; P_i$$

$$(0 - 1.22)^2(.52) + (1 - 1.22)^2(.22) + (2 - 1.22)^2(.13) + (3 - 1.22)^2(.09) + (4 - 1.22)^2(.03) + (5 - 1.22)^2(.01) =$$

Another Example

A concealed jar contains 4 red balls and 4 blue balls. Four of these balls are randomly selected from the jar. Lets produce a Sampling Distribution for a discrete random variable X for specifically selecting blue balls at random.

First, find all of the possible outcomes for randomly selecting blue balls ?

One blue ball
BRRR RBRR RRBR RRRB

Two blue balls
BBRR BRRB RBBR RRBB BRBR RBRB

Three blue balls
BBBR BRBB RBBB BBRB

Four blue balls
BBBB

No blue balls
RRRR

There are **16** possible outcomes for randomly selecting blue balls if four blue balls are randomly chosen.

Sampling Distribution

X	0	1	2	3	4
Fraction	1/16	4/16	6/16	4/16	1/16
P(X)	.0625	.25	.375	.25	.0625

Sampling Distribution

X	0	1	2	3	4
Fraction	1/16	4/16	6/16	4/16	1/16
P(X)	.0625	.25	.375	.25	.0625

Find the probability that you will get exactly one blue ball.

Find the probability that you will get at least 3 blue balls

Find the mean of the probability distribution above.

Does the Sampling Distribution appear to be normal, skewed left,, or skewed right?

What other statistical measure can we immediately determine ?

Find the standard deviation for the Sampling Distribution.

Sampling Distribution of a Sample Proportion

X	0	1	2	3	4
Fraction	1/16	4/16	6/16	4/16	1/16
P(X)	.0625	.25	.375	.25	.0625
SP	0	.25	.5	.75	1

SP -- > Sample Proportion

Sampling Distrbutions (Continuous Random Variables)

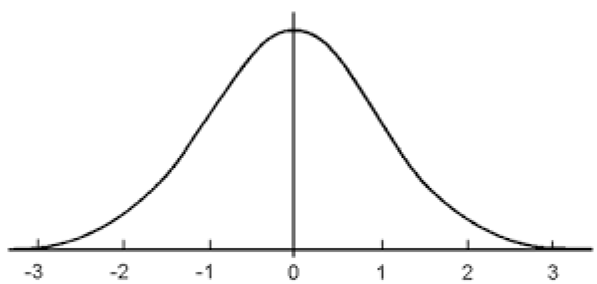
A sampling distribution that features a continuous random variable involves a data set that has unlimited values.

Z (z scores) is an example of a continuous random variable. Z can randomly take on an uncountable number of variables. Z is typically referred to as **the Standard Normal Distribution.** Probabilities are generally given as intervals. The probability of a single value for a continuous random variable is 0.

The most important continuous distribution is the Standard Normal Distribution

It is so important the Random Variable has its own special letter **Z**.

The graph for Z is a symmetrical bell-shaped curve: mean = 0 , sd = 1



Usually we want to find the probability of Z being between certain values or for a designated interval. The bell shaped curve generated is called a density curve The area under a density curve for a continuous random variable has an area of 1.

Example1 : P(0 < Z < 0.45) (What is the probability that Z is between 0 and 0.45 ?)

R code:

pnorm(.45, mean=0, sd=1, lower.tail = T) **- pnorm**(0, mean=0, sd=1, lower.tail = T)

P(0 < Z < 0.45) = 0.1736

Example2 : P(Z > 1.67) (What is the probability that Z is greater than 1.67 ?)

R code:

pnorm(1.67, mean=0, sd=1, lower.tail = F)

P(Z > 1.67) = .0474