6.2 - Transforming & Combining Random Variables

Notes provided by E. Kelly Pendleton from Ardrey Kell High School, including:

-linear transformations
-combining random variables

adjust as you wish
email elizabethk.pendleton@cms.k12.nc.us if you need the flipchart version

Warm-Up

Complete the half-sheet.

[supplemental material provided in Activities section of Canvas course]

1. What is the difference between a discrete random variable and a continuous random variable? countable vs. measurable

2. Continuous probability distributions assign what probability to every individual outcome? 0

3. What does N (.72, .05) mean? Normal with mean 0.72 & st.dev. 0.05

a. Find P(p < 0.64) 0.0548

b. Find P(p > 0.80) 0.0548

c. Find P(p < 0.64 or p > 0.80) 0.1096

4. Of the students that drive at Pendleland High School, 20% have received no parking tickets, 45% have received 1 ticket, and 23% have received 2 tickets. The rest of the students have received 3 tickets.

a. Define X in terms of the problem & give the probability distribution.

X = # of parking tickets

X	0	1	2	3
P(X)	0.2	0.45	0.23	0.12

b. What percent have received 3 tickets? P(X = 3) = 12%

c. What percent have at least 1 ticket? P(X ≥ 1) = 80%

d. What percent have less than 1? P(X < 1) = 20%

e. Find and interpret the mean number of tickets?

E(X) = 0(.2) + ... + 3(.12) = 1.27 tickets

On average, each student gets 1.27 parking tickets at PHS.

f. Find and interpret the standard deviation for the number of tickets.

St. Dev. = $\sqrt{(0-1.27)^2(.2) + \ldots + (3-1.27)^2(.12)} = 0.915$

On average, each student varies from the mean amount of tickets by about 0.915 tickets.

*average *variation *from the mean

5. Parking for the year costs $25 at Pendleland High School and each parking ticket costs $10. Let Y = total cost paid at the end of the year.

a. Write an equation for Y.

b. Give the probability distribution of Y.

c. Find and interpret the mean price paid at the end of the year.

d. Find and interpret the standard deviation for the price at the end of the year.

6.2 - Transforming & Combining Random Variables

Linear Transformations - for "**conversions**" of units and/or **formulas**

$$\text{Let } Y = a + bX$$

mean: $\mu_Y = a + b\mu_X$

st. dev.: $\sigma_Y = |b|\sigma_X$

variance: $\sigma_y^2 = b^2\sigma_x^2$

*same rules as Linear Transformations in Chapter 2--DON'T ADD/SUBTRACT FROM SPREAD!

Combining Random Variables

-The mean of a sum or difference is the sum or difference of the means.

$$\mu_{X\pm Y} = \mu_X \pm \mu_Y$$

-The variance of a sum or difference is the sum of the variances.

$$\sigma^2_{X\pm Y} = \sigma^2_X + \sigma^2_Y$$

for independent variables

-The standard deviation is the square root of the variance.

$$\sigma_{X\pm Y} = \sqrt{\sigma^2_X + \sigma^2_Y}$$

← the formula we'll use the most

↑ ALWAYS PLUS!

My morning commute is Normally distributed with a mean of 20 minutes and a standard deviation of 3 minutes. My evening commute is Normally distributed with mean 25 minutes and standard deviation 5 minutes. Find the probability that I spend over an hour in the car on any given day.

Step 1: Define the variable.

Step 2: Find the mean and standard deviation of the variable.

Step 3: Set up a probability statement.

Step 4: Draw & shade the Normal curve.

Step 5: Use normalcdf to answer.

Step 6: Answer with a sentence.

My morning commute is Normally distributed with a mean of 20 minutes and a standard deviation of 3 minutes. My evening commute is Normally distributed with mean 25 minutes and standard deviation 5 minutes. Find the probability that I spend more time in the car in the morning than in the evening.

Step 1: Define the variable.

Step 2: Find the mean and standard deviation of the variable.

Step 3: Set up a probability statement.

Step 4: Draw & shade the Normal curve.

Step 5: Use normalcdf to answer.

Step 6: Answer with a sentence.

Combining the Same Variable Multiple Times

For Random Variables...

$$X + X + X \neq 3x$$

What you mean is

$$X_1 + X_2 + X_3$$

Ex) Reminder: My morning commute has the distribution: N(20, 3). Find the probability that my morning commute for the week is less than 2 hours.

Classwork
pg. 380 #35, 37, 41, 43, 46-48, 62-64