

6.2 Transforming Random Variables

Note: the following two pages of notes correspond to pages 358-363

Alternate Example: El Dorado Community College

El Dorado Community College considers a student to be full-time if he or she is taking between 12 and 18 units. The number of units X that a randomly selected El Dorado Community College full-time student is taking in the fall semester has the following distribution.

Number of Units (X)	12	13	14	15	16	17	18
Probability	0.25	0.10	0.05	0.30	0.10	0.05	0.15

Calculate and interpret the mean and standard deviation of X .

At El Dorado Community College, the tuition for full-time students is \$50 per unit. So, if $T =$ tuition charge for a randomly selected full-time student, $T = 50X$. Here's the probability distribution for T :

Tuition Charge (T)	600	650	700	750	800	850	900
Probability	0.25	0.10	0.05	0.30	0.10	0.05	0.15

Calculate the mean and standard deviation of T .

What is the effect of multiplying or dividing a random variable by a constant?

In addition to tuition charges, each full-time student at El Dorado Community College is assessed student fees of \$100 per semester. If $C =$ overall cost for a randomly selected full-time student,

$C = 100 + T$. Here is the probability distribution for C :

Overall Cost (C)	700	750	800	850	900	950	1000
Probability	0.25	0.10	0.05	0.30	0.10	0.05	0.15

Calculate the mean and standard deviation of C .

What is the effect of adding (or subtracting) a constant to a random variable?

What is a linear transformation? How does a linear transformation affect the mean and standard deviation of a random variable?

Alternate Example: Scaling a Test

In a large introductory statistics class, the distribution of X = raw scores on a test was approximately normally distributed with a mean of 17.2 and a standard deviation of 3.8. The professor decides to scale the scores by multiplying the raw scores by 4 and adding 10.

(a) Define the variable Y to be the scaled score of a randomly selected student from this class. Find the mean and standard deviation of Y .

(b) What is the probability that a randomly selected student has a scaled test score of at least 90?

HW: page 378 (37, 39, 40, 41, 43, 45)

6.2 Combining Random Variables

Note: the next 2 pages of notes correspond to pages 364–376

Alternate Example: Speed Dating

Suppose that the height M of male speed daters follows a Normal distribution with a mean of 68.5 inches and a standard deviation of 4 inches and the height F of female speed daters follows a Normal distribution with a mean of 64 inches and a standard deviation of 3 inches. What is the probability that a randomly selected male speed dater is taller than the randomly selected female speed dater he is paired with?

Simulation approach:

Based on the simulation, what conclusions can we make about the shape, center, and spread of the distribution of a difference (and sum) of Normal RVs?

Non-simulation approach (don't worry about the four steps):

Alternate Example: Suppose that a certain variety of apples have weights that are approximately Normally distributed with a mean of 9 ounces and a standard deviation of 1.5 ounces. If bags of apples are filled by randomly selecting 12 apples, what is the probability that the sum of the 12 apples is less than 100 ounces?

Alternate Example: Let B = the amount spent on books in the fall semester for a randomly selected full-time student at El Dorado Community College. Suppose that $\mu_B = 153$ and $\sigma_B = 32$. Recall from earlier that C = overall cost for tuition and fees for a randomly selected full-time student at El Dorado Community College and $\mu_C = 832.50$ and $\sigma_C = 103$. Find the mean and standard deviation of the cost of tuition, fees and books ($C + B$) for a randomly selected full-time student at El Dorado Community College. What is the shape of the distribution?

The mean is $\mu_{C+B} = \mu_C + \mu_B = 832.50 + 153 = \985.50 . The standard deviation cannot be calculated since the cost for tuition and fees and the cost for books are not independent. Students who take more units will typically have to buy more books.

Shape is hard to determine.

If time, do #57 and #58 in class.

HW: page 379 (49, 51, 57, 58, 59, 61, 63, 65, 66)