AP Statistics

Chapter 6:
Random Variables

Day 3

HW: p. 378-379, #35, 37, 39, 43

Linear Transformations

In Chapter 2, we studied the effects of transformations on shape, center, and spread of a distribution of data.

- Adding or subtracting a constant "a":
  - Adds or subtracts "a" to measures of center (mean and median) and location (quartiles and percentiles).
  - Does not change shape or measures of spread (range, IQR, standard deviation).

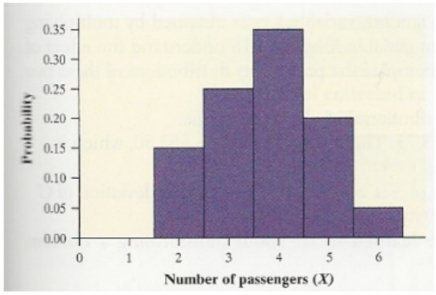
Linear Transformations

- **Multiplying or dividing by a constant "b":**
  - Multiples or divides measures of center (mean and median) and location (quartiles and percentiles) by "b".
  - Multiples or divides measures of spread (range, IQR, standard deviation) by the absolute value of "b".
    - variance $= b^2$
  - Does not change the shape of the distribution.

Example

Pete's Jeep Tours offers a popular half-day trip in a tourist area. There must be at least 2 passengers for the trip to run, and the vehicle will hold up to 6 passengers. The number of passengers on a randomly selected day has the following probability distribution.

No. of Passengers:	2	3	4	5	6
Probability p_i:	0.15	0.25	0.35	0.20	0.05



$$\mu_x = 3.75$$

$$\sigma_x^2 = 1.1875$$

$$\sigma_x = 1.090$$

Example

Pete's charges $150 per passenger. Let C = the total amount of money that Pete collects on a randomly selected trip. Because the amount of money Pete collects from the trip is just $150 times the number of passengers, we can write C = 150X.

From the probability distribution of X, we can see that the chance of having 2 people is 0.15. In that case, C = 150(2) = 300. So one possible value of C is 300, and its corresponding probability is 0.15.

Complete the rest of the table.

Total Collected c_i:	300				
Probability p_i:	0.15	0.25	0.35	0.20	0.05

Example

Find the mean, variance, and standard deviation for the amount of money collected. Then, create a histogram.

Total Collected c_i:	300	450	600	750	900
Probability p_i:	0.15	0.25	0.35	0.20	0.05
	150(2)	150(3)	150(4)	150(5)	150(6)

$\mu_C = 3.75(150) = \$562.50$

$\sigma_X^2 = 1.1875(150)^2 = \$26718.75$

$\sigma_X = 1.090(150) = \$163.5$ or $\sqrt{26718.75} = \$163.50$

Effect on a Random Variable When Multiplying or Dividing by a Constant

Shape: Stays the same

Center: Multiplied by 150

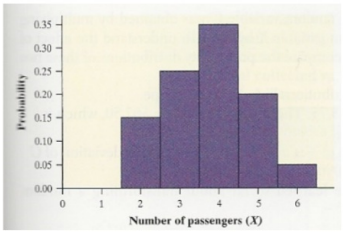
Spread: Variance: multiplied by 150^2

Standard deviation: multiplied by 150.

$\mu_x = 3.75$

$\sigma_x^2 = 1.1875$

$\sigma_x = 1.090$



Example

It costs Pete $100 to buy permits, gas, and a ferry pass for each half-day trip. The amount of profit V that Pete makes from the trip is the total amount of money C that he collects from passengers minus $100. That is, V = C - 100.

Complete the table below.

	300	450	600	750	900
Total Collected v_i:					
Probability p_i:	0.15	0.25	0.35	0.20	0.05

Example

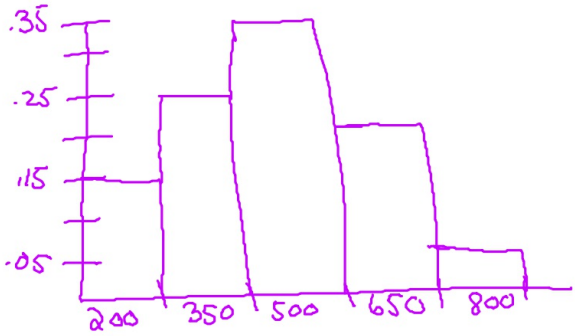
Find the mean, variance, and standard deviation for the amount of money collected. Then, create a histogram.

Total Collected v_i:	200	350	500	650	800
Probability p_i:	0.15	0.25	0.35	0.20	0.05

$\mu_V = \$462.50$

$\sigma_V^2 = \$26,718.75$

$\sigma_V = \$163.50$



Effect on a Random Variable When Adding or Subtracting by a Constant

Shape: Stays the same

Center: subtract by 100

Spread: Stays the same.

$\mu_x = 3.75$

$\sigma_x^2 = 1.1875$

$\sigma_x = 1.090$