Section 9-8 Mathematical Expectation

At a school carnival, students are awarded points for winning games. At the end of the evening, they may trade in points for prizes. You roll a single die. (game is 50 points to play)
Payoffs are:

Number	Probability	Points won(payoff)	Mathematical Expectation
1	1/6	-50	$\frac{1}{6}(-50) = -8.3$
2	1/6	10	$\frac{1}{6}(10) = 1.67$
3	1/6	-50	$\frac{1}{6}(-50) = -8.3$
4	1/6	10	$\frac{1}{6}(10) = 1.67$ +
5	1/6	-50	$\frac{1}{6}(-50) = -8.3$
6	1/6	100	$\frac{1}{6}(100) = 16.67$
			-4.89 *

* means "on average" for each roll you can expect to get -4.89 pts.

This is why some games are rigged at carnivals and casinos!

Mathematical Expectation

is found by multiplying the probability by the payoff and adding them.

$$E=\sum P(A_1)a_1 + P(A_2)a_2 + P(A_3)a_3 + P(A_4)a_4 \ldots P(A_n)a_n$$

- For the mutually exclusive events $A_1, A_2, A_3, \ldots, A_n$ in the experiment.
- The values a_1, a_2, a_3, …, a_n correspond to the outcomes of $A_1, A_2, A_3, \ldots, A_n$

It is the *weighted average* for a random experiment each time it is run.

Skeeball	**E**
P(10) = 0.5	$.5(10) = 5$
P(20) = 0.25	$.25(20) = 5$
P(30) = 0.15	$.15(30) = 4.5$ +
P(40) = 0.07	$.07(40) = 2.8$
P(50) = 0.03	$.03(50) = 1.5$
	18.8

* "on average" for each roll can expect to get 18.8 pts.