Lesson Three: Expected Value

Any game/situation where you are gambling or investing an amount of money for a chance at winning more money has what is called an ***expected value***. The expected value of a situation is the *average* amount of money you can expect to win each time you play the game (or encounter the same situation).

There is a small formula that can help you calculate expected value:

$$EV = P(win) \times \$won - cost\ to\ play$$

P(lose) × $ loss

Please note two things related to this formula:

- This formula is NOT included on the exam formula sheet. If you want it for reference, it should be on your self-made resource page.
- You can add "parts" to this formula if there are multiple win conditions. You will see an example of this during this lesson.

Example 1

$ (loss) 1/6

A game is played where a six sided die is rolled. The cost to play the game is $5.00. If a "one" is rolled, the player wins $25. If anything other than a "one" is rolled, the player loses the $5.00 bet.

$ gains (25 − 5 = 20)

a) Calculate the ***expected value*** of this game.

E.V. = P(win) × $ gain − P(lose) × $ loss

$E.V. = \left(\frac{1}{6} \times 20\right) - \left(\frac{5}{6} \times 5\right)$

$E.V. \doteq 3.33 - 4.16 = -0.83$

P(win) = 1/6

$ gain = 25 − 5 = $20

P(lose) = 5/6

$ loss = $5

b) What is the meaning of the expected value you calculated in part a)?

There is a net loss of $0.83 per game

c) How much money could you expect to win (or lose) if you played this game 100 times?

Total win or loss = Expected value × # of games played

$= -0.83 \times 100$

$= -\$83.00$

A loss of $83.00