Expected Value:

Thank you Mr. Chair. Good evening fellow toastmasters and honored guests.

My speech today is called “the Beauty and Power of Math: Expected Value”. Imagine that you’re feeling lucky at a casino. You have just won over a million dollars at a slot machine and you decide to quit while ahead and walk around the casino. Suddenly you see a new game that has just been open. The game is this: you pay 1$ to play the game and you get to roll two die. If the die pairs – that is, if the two die have the same number, then you win 5$. You lose 1$ all other times. Do you or do you not play the game?

To answer this question, we need to know 3 very important topics in the world of math. These three topics are: Valuation, Probability and Expected Value.

In math, valuation is the idea of assigning a value to a variable. If we were walking around a mall and we see a t-shirt priced at 10$ one week and then we see the same t-shirt priced at 5$ the next week, this means that the owners valued the t-shirt at 10$ one week, and 5$ at another week. In our game example, valuation means assigning a value to a particular outcome. If we get the same numbers on both die, we win 5$; however, for all other combinations, we lose 1$.

These outcomes do not occur equally, we need to know at what frequency these events happen. This is probability. Probability is the chance that something will happen. If the weather forecast announces that there is a 90% chance of rain tomorrow, this means that it is very likely it will rain tomorrow. In our game example, the probability that we get the same number on both die is 1/6. This is the probability of getting the same number on both die, which is 1/36, multiplied by the number of pairs we can get, which is 6.

I have now talked about valuation and probability. Expected value is a combination of these two concepts. Expected value is the sum of the probabilities of each outcome multiplied by the outcome’s value. Let me show you this through an example. I flip a coin. If it lands heads, I pay you one dollar, but if it lands tails, you pay me two dollars. What is your expected value in playing this game? Your expected value is (+1)*(1/2) + (-2)*(1/2) = ½ -1 = -1/2. So your expected value in playing this game is you losing 50 cents every time you play. So, you shouldn’t play this game.

But, should you play the casino game that I mentioned before? We’ve done most of the work already and now we need to find out what our expected value in playing the casino game is. We win 5$ every time we roll a pair and we lose 1$ every time we do not roll a pair. Our expected value is (+5)*(1/6) + (-1)*(5/6) = 5/6 – 5/6 = 0. This means that we expect to not win or lose anything every time we play this game. So, the next time you are faced with multiple outcomes and are trying to decide between them, consider, your expected value.