Marcus Crowder
CIS-3920

Lecture Notes Exercise 10

7.5 How is the expected value of the average of two rolls related to the expected value of a single roll? Answer this question in complete sentence(s).

The expected value of the average of two rolls is the same as the expected value of a single roll. This goes to enforce the comment that the expected values(or probability) of rolls do not change from roll to roll. But it doesn't mean that you will roll a 3.5 on one roll (or a 7 in two) The more you roll a die the closer the average of those rolls will get to 3.5.

7.6 How is the variance of the average of two rolls related to that of one roll? Again, answer in complete sentences. Hint: what is the ratio of the two values?!

The variance on the average of two rolls halved from one roll. This change occurred from one roll to the average of two rolls because the numbers variance changed from 1 to .5. The difference between numbers turned from 1,2,3,4,5,6 to averages of 1,1.5,2,2.5,3,3.5,4,4.5,5,5.5,6. The Variance went down as the points increased and additionally the fact that we took the weights of their probability accounts for the lower number. Weights of their probability with regard to which numbers have a higher chance of occurring and it was seen that the numbers closer to the expected value of rolls had a higher probability of happening over the long run. The numbers on the edges of the probability distribution had a higher variance from the center but were given less weight compared to the roll of one die making the overall variance lower.

7.7 What would guess would be the expected value and variance for the average of 9 rolls? Explain your reasoning in complete sentences.

The expected value of 9 rolls would be the same as the expected value of one roll or the expected value of the average of two rolls. The number does not matter because the long term expected value stays the same, and as we average that number the weight will be the same(ex. (3.5+3.5+3.5)/3=3.5).

I would expect the variance to be lowered by 1/9 because now we are taking the average of 9 rolls mean the variance between rolls can be as small as (10/9 = 1.11, 11/9 = 1.22). the difference between numbers will be as small as .11 because the numbers have a chance to equal 10,11,12 and we average those numbers out of 9. The ratio should become 2.92*1/9 = .324 = .32. I fully expect the variance of the average of 9 rolls to be .32.

7.8 Consider finding the average of the *difference* between two rolls. For example, for the sample point (1,4), the average difference is (1-4)/2 = -3/2 = -1.5. Find the probability distribution of the average difference in two die rolls, and then the expected value and the variance. How are those related to the expected value and variance of the *average* of two rolls?

The expected value of the average difference in two die rolls of a fair 6-sided die is equal to 0. This was different from the average expected value of two die rills but it was to be expected with the inclusion of negative numbers. The most repeated difference was 0 which happened to occur more times than any other point. There is no real relation to the original expected value except for the shift that occurred. The E(x) shifted to the left and can be said to equal 0 whenever we have to find the differences of points with the same upper and lower range.

The Variance of the average difference in two die rolls are the same as the average variance of two rolls. These two Variances both include 36 points that are separated by a value of .5.