Problem 1: $ExactPD\left(20, 40, \frac{19}{40}\right)$ $EstPD\left(20, 40, \frac{19}{40}, 100\right);$ $EstPD\left(20, 40, \frac{19}{40}, 1000\right);$ $EstPD\left(20, 40, \frac{19}{40}, 1000\right);$ $\left[0.1190277811, 304.7777751\right]$ $\left[0.1190277811, 304.7777751\right]$

As K increases:

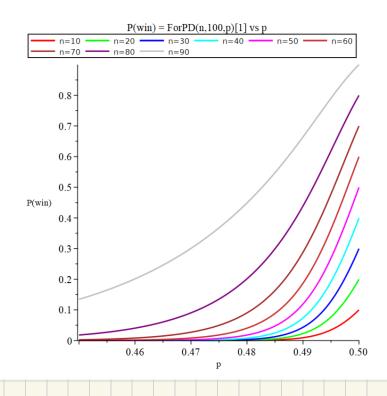
 $EstPD(20, 40, \frac{19}{40}, 5000);$

The probability estimate gets closer to 0.119 almost exact at K=5000. The expected duration converges toward \approx 305 as well.

What this means is as the number of simulations K increases, it converges to the true expected value. When K is small (like 100), it leads to high variance. This means it fluctuates to a few "lucky" or "unlucky" runs which ever on dominates the average. When K is large, (like 5000) the large K averages over many more games reduces the effect of random fluctuation and giving a stable estimate.

The best estimate is K = 5000, because it's closest to the theoretical (ExactPD) values. The reason is simply that larger K = 1000 more simulations = smaller sampling error.

Problem 2:



307.17280000

[0.1216000000, 30 10000]