Homework for Lecture 10 of Dr. Z.'s Dynamical Models in Biology class

Email the answers (as .pdf file) to

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by 8:00pm Monday, Oct. 13, 2025.

Subject: hw8

with an attachment hw8FirstLast.pdf and/or hw8FirstLast.txt

Using

`http://sites.math.rutgers.edu/~zeilberg/Bio25/DMB10.txt`

1. Using procedure `ExactPD` find the probability of winning, and expected duration of the game in a Gambler's Ruin with max. capital 40 dollars, starting capital 20 dollars and prob. of winning a dollar at any one round $\frac{19}{40}$.

Now using `EstPD`, estimate it with (i) `K=100`, (ii) `K=1000` (iii) `K=5000` (Warning: this may take some time) Which of them gives the best estimate? Can you explain why?

2.

Plot `ForPD(n,100,p)[1]` from `p=0.45` to `p=0.5` for `n=10,20,30,40,50,60,70,80,90`.

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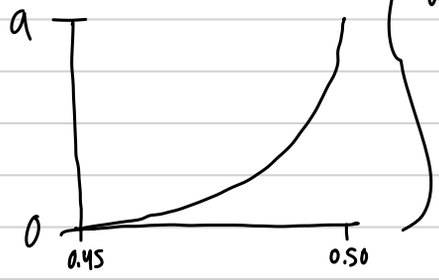
① Using ExactPD we get 0.119 as the win probability and 304.78 as the expected duration in rounds. Estimating with EstPD:

→ $h = 100$ gave 0.16 prob & 300.26 rounds
→ $h = 1000$ gave 0.122 prob & 30.3.20 rounds
→ $h = 5000$ gave 0.1186 prob & 307.5 rounds

The highest h is the closest to the theoretical win probability & duration because it tests the simulation many more times. As the number of times you run the simulation increases, fluctuations from the true average probability decrease. Note that running the EstPD for $h = 5000$ twice yielded 307 rounds both times, which I assume is erroneous or a "fluke".

② Maple is being very uncooperative as I try to take screenshots so I will explain what I see:

All graphs took this form:



where a (as shown in Maple) is:

for $n = 10$, 0.1	for $n = 60$, 0.6
20, 0.2	70, 0.7
30, 0.3	80, 0.8
40, 0.4	90, 0.9
50, 0.5	

Note that the curve became closer to linear at higher n →

This indicates that n is affecting the rate at which k increases as it goes from 0.45 to 0.5, and the rate of change has a positive correlation w/ n.