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`.

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 $\frac{19}{40}$.

capital = $40
starting capital = $20
prob of winning 19/40

$$ExactPD\left(20, 40, \frac{19}{40}\right);$$

[0.1190277811, 304.7777751]

probability duration

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?

as K↑, time program ran ↑

$$EstPD\left(20, 40, \frac{19}{40}, 100\right);$$

[0.1100000000, 292.0600000]

$$EstPD\left(20, 40, \frac{19}{40}, 1000\right);$$

[0.1310000000, 308.3000000]

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

[0.1234000000, 307.1728000] ← best estimate

bc K represents the # of times simu(n,L,p) runs, and then averages the values. Therefore, the higher the K value, the better the estimate.

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`.

```
with(plots):

plot( [seq(ForPD(n, 100, p)[1], n = [10, 20, 30, 40, 50, 60, 70, 80, 90])], p = 0.45..0.5);
```