# lucas labwalkthrough.tex

Henrik Linder

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## 1 Stochastic sims

### 1.1 Fix timestep

–timestep $\Delta t$is fixed ? what $\Delta t$ should be used?

can be changed throughout the simulation.

look at $P_i$

In lab 1:

$$k_p^{mrna} = \frac{1}{600}[s^{-1}] \tag{1}$$

$$k_d = \frac{1}{1800}[s^{-1}] \tag{2}$$

$$\begin{aligned} P_p^{mRNA} &= k_p^{mRNA}\Delta t \\ P_d &= k_d \Delta t \end{aligned} \tag{3}$$

two options: $P_i <= 1$ and $P_i << 1$

in the first case you will get the wrong results, the second will give slow results.

rule of thumb:

$$\max(P_i) \approx 50\% \tag{4}$$

### 1.2 Gillespie method

chance of nothing happeing is

$$1 - r\frac{t}{n} \tag{5}$$

read in the book or the paper by gillespie.

in modsim: when population goes to infinity, your solution becomes exact but it is very unstable.

# 2 Labs

## 2.1 Traffic model

Protein production by translation

The tRNA will bind and unbind several times very quickly, decreasing the error rate

the process uses 25 times more energy than it should, compared to a computer where that number is 100s of thousands.

algo:

-pick $\Delta t$ -build a list if all events -shuffle -go through

task3 : go to t=10 000. expect, staggering

J is about .5

task4 looks about right, and the histogram doesnt really matter

lower the timestep!!

## 2.2 AUM model

$\Delta t = 1$

$\alpha$: prob of active conversion

`if rand() < α: n1 : random site n2 : radnom site if n1==M and n2==U or F: n2 =m or U else: n1 : rand move on AUM`

$$F = \frac{\alpha}{1-\alpha} \tag{6}$$

$$(1-\alpha) = \alpha <=> F - \alpha F = \alpha$$

$$\alpha = \frac{F}{1+F} \tag{7}$$

either active or random!!!

If the active event doesn't happen, the inactive should happen!!