Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Department of Computer Science
ETH Zürich

Synthetic Biology

Assignment #02

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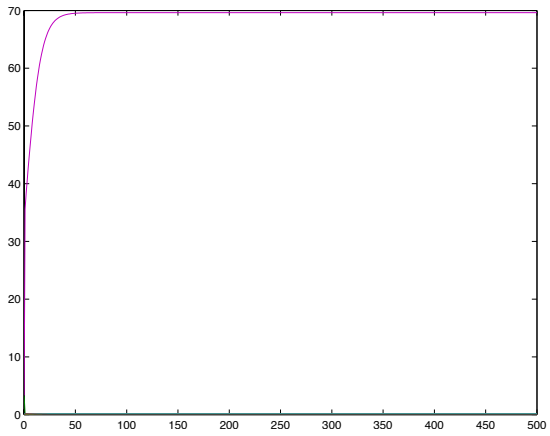
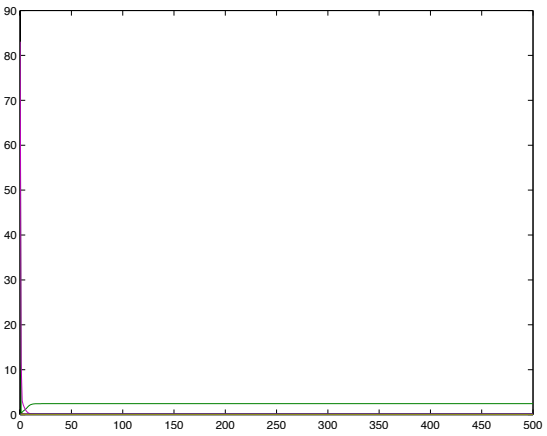
1.1 a-b



(a) $t = 500$, initial cond. X_{01}



(b) $t = 500$, initial cond. X_{02}

	C/(nM)	No.
P_1	0.0392	0
P_2	69.6284	419

(c)

	C/(nM)	No.
P_1	2.4285	14
P_2	0.1400	0

(d)

Figure 1.1: Concentration evolution plots (espressed in nM) for different initial conditions (X_{01} and X_{02}) until $t = 500$. Values of protein P_1 and P_2 levels at steady state.

Bistability is well detected in plot **??** for this set of parameters.

2.1 a

Set of values for the stochastic rate constants ($\hat{k}$).

$$set\_SRC = [k_1\ k_{c1}^{+}\ k_{c1}^{-}\ k2\ k_{c2}^{+}\ k_{c2}^{-}\ k_{c3}^{+}\ k_{c3}^{-}\ d1\ d2] \tag{2.1}$$

$$set\_SRC = [100\ 0.1661\ 1\ 1000\ 0.1661\ 1\ 16.6113\ 1\ 6\ 2]; \tag{2.2}$$

2.2 b

Computed values of the *propensities* associated to each reaction channel at $t = 0$ for initial conditions X_{01}, X_{02}, X_{03}, X_{04}.

	X_{01}	X_{02}	X_{03}	X_{04}
R1	0.0100	0.0100	0.1000	0.1000
R2	0.0003	0.0083	0.0033	0.0830
R3	0.0000	0.0000	0.0000	0.0000
R4	0.1000	0.1000	1.0000	1.0000
R5	0.0003	0.0083	0.0033	0.0830
R6	0.0000	0.0000	0.0000	0.0000
R7	0.0000	0.0000	0.0000	0.0000
R8	0.0000	0.0000	0.0000	0.0000
R9	0.0120	0.3000	0.0120	0.3000
R10	0.0040	0.1000	0.0040	0.1000

Table 2.1: Propensities (all the values have to be multiplied for $1.0E + 04$)

2.3 c

R1	0	1	0	0	0	0	0
R2	-1	0	1	0	-1	0	0
R3	1	0	-1	0	1	0	0
R4	0	0	0	0	1	0	0
R5	0	-1	0	-1	0	1	0
R6	0	1	0	1	0	-1	0
R7	0	-1	0	0	0	-1	1
R8	0	1	0	0	0	1	-1
R9	0	-1	0	0	0	0	0
R10	0	0	0	0	-1	0	0

Table 2.2: State change vectors for each reaction channel

2.4 d

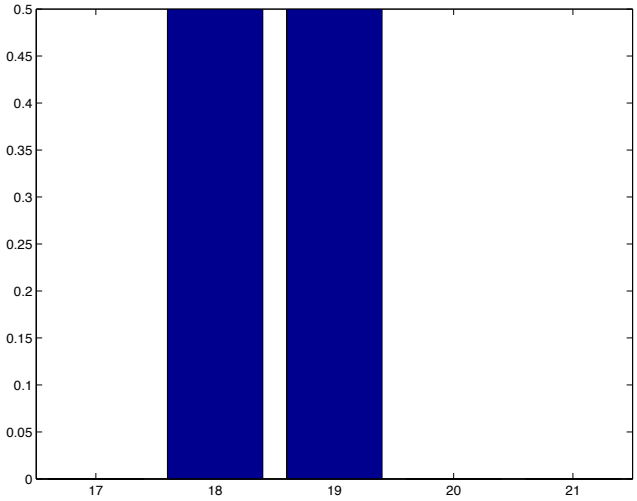
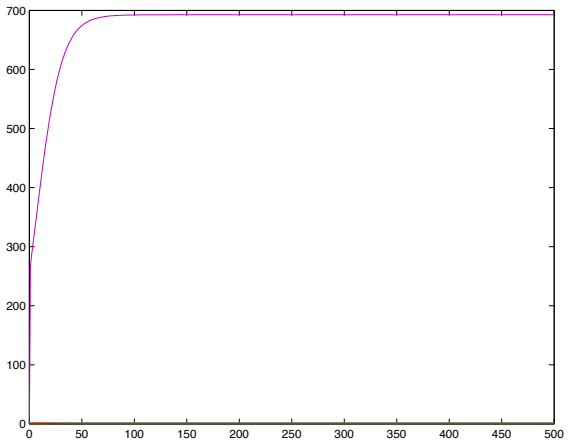
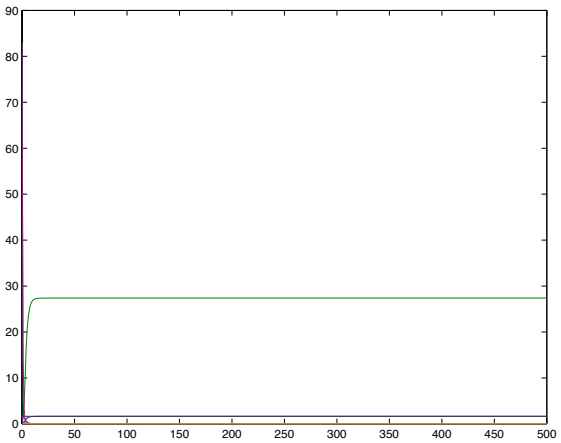


Figure 2.2: Histogram illustrating the probability distribution for the number of molecules of protein P_1 after reaching the steady state.

3.1 Optional



(a) Deterministic simulation for initial conditions X_{03}



(b) Deterministic simulation for initial conditions X_{04}

	C/(nM)	No.
P_1	0.0399	0
P_2	692.5645	4169

(c)

	C/(nM)	No.
P_1	27.3823	164
P_2	0.0111	0

(d)

Figure 3.3: Concentration evolution plots (espressed in nM) for different initial conditions (X_{03} and X_{04}) until $t = 500$. Values of protein P_1 and P_2 levels at steady state.

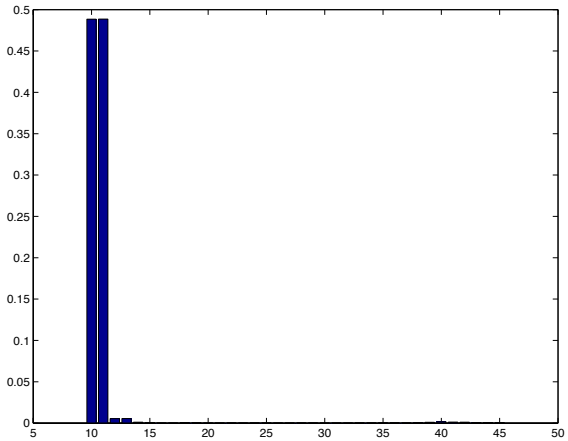


Figure 3.4: Histogram illustrating the probability distribution for the number of molecules of protein P_1 after reaching the steady state for initial condition P_{03}