CS 182 Lab 6

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I completed this written part of the homework, lab report, or exam entirely on my own.

Exercise 1

Given n = 3, k = 4

$$0.5 = \frac{3-1}{k}$$

k = 4

Given n = 6, k =10

$$0.5 = \frac{6-1}{k}$$

k = 10

Given n = 12, k =22

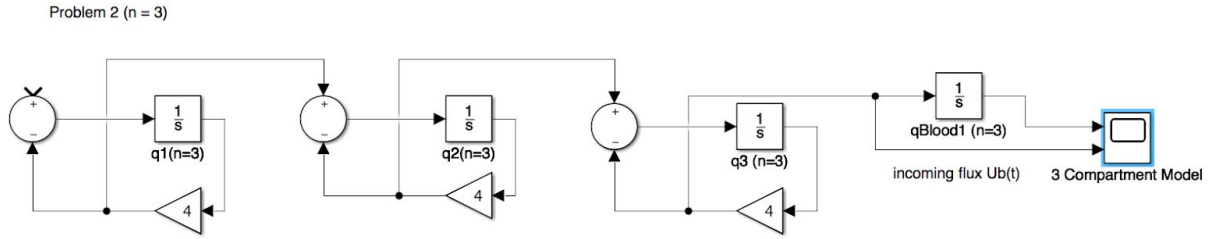
$$0.5 = \frac{12-1}{k}$$

k = 22

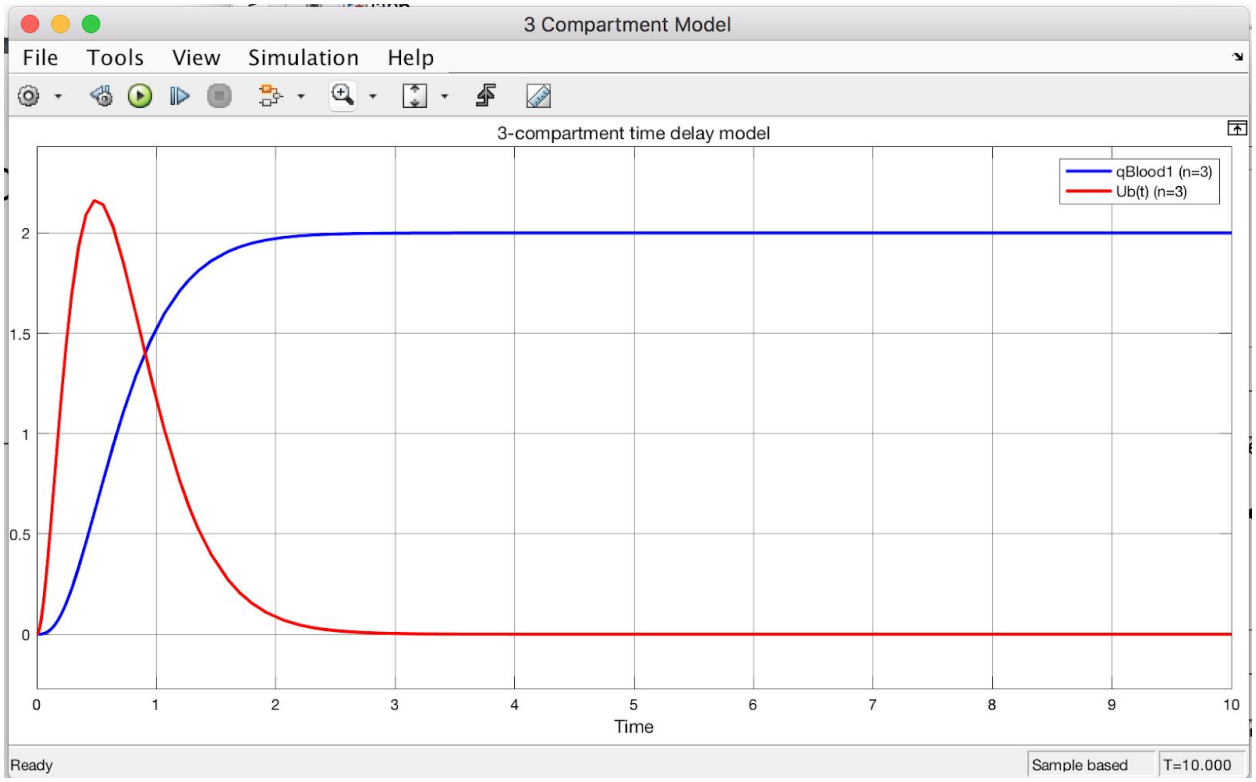
Exercise 2

Model for 3 compartments

Simulink

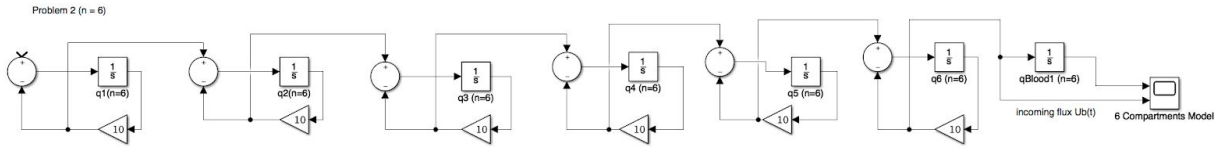


Graph

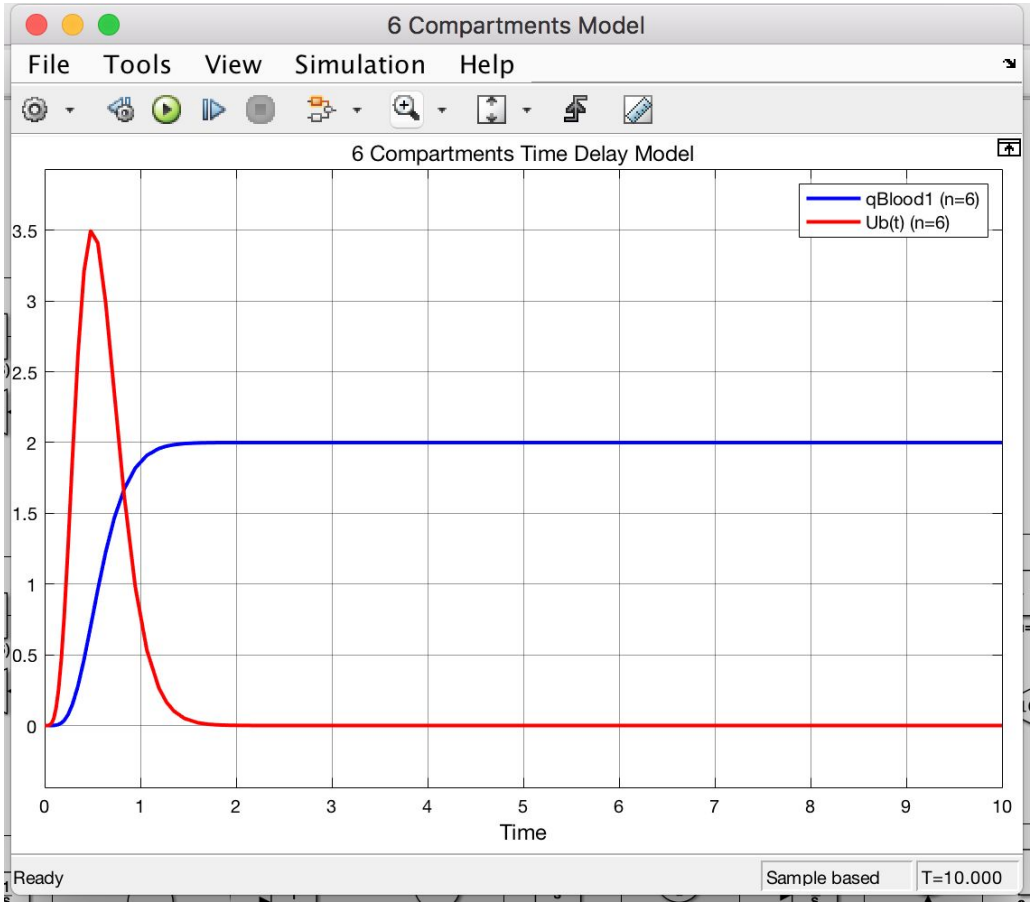


Model for 6 compartments

Simulink

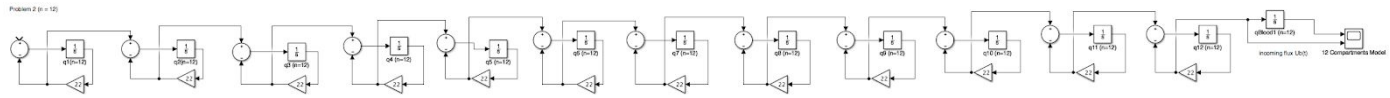


Graph

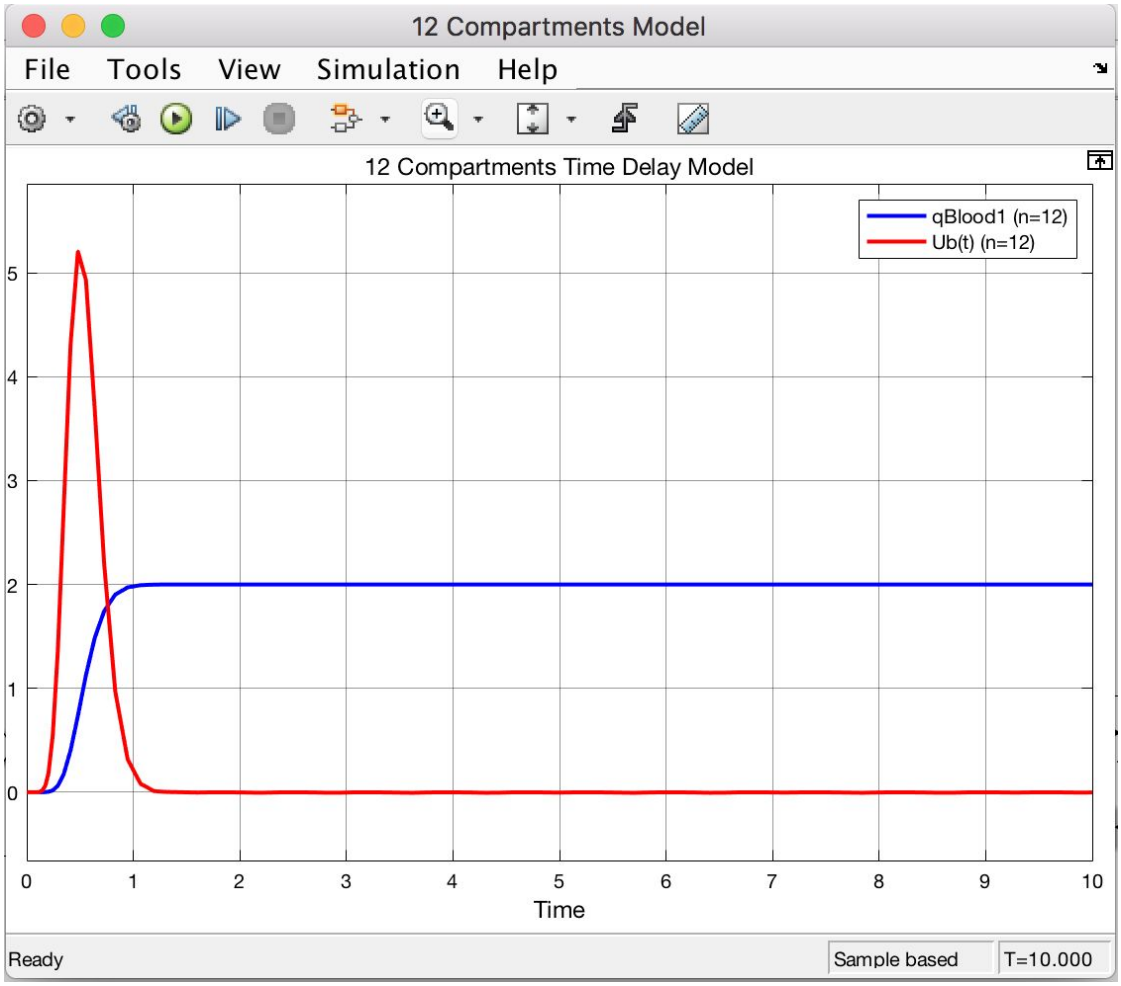


Model for 12 compartments

Simulink



Graph



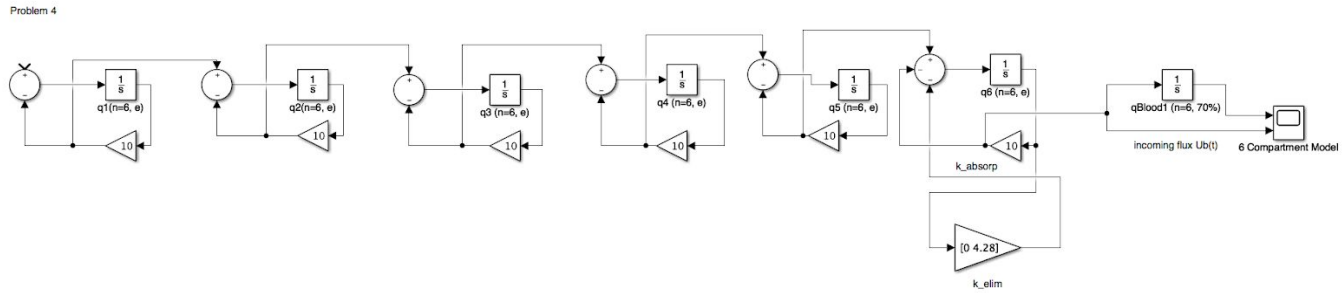
Exercise 3

According to the plots from problem 2, input $U_b(t)$ from 12 compartments, the model appears the sharpest. According to given conditions, the initial impulse input is 2 and there are no other leaks and degradation flux from any of the compartments. Therefore, the total value of flux of the blood compartment is the same as the initial impulse input for the n =3, n = 6, n = 12 compartments model. For n = 12, k = 22 which is the rate of how fast the material transfers between compartments. Since k = 22 which is the highest among the 3 different models, so $U_b(t)$ from 12 compartments appear the sharpest.

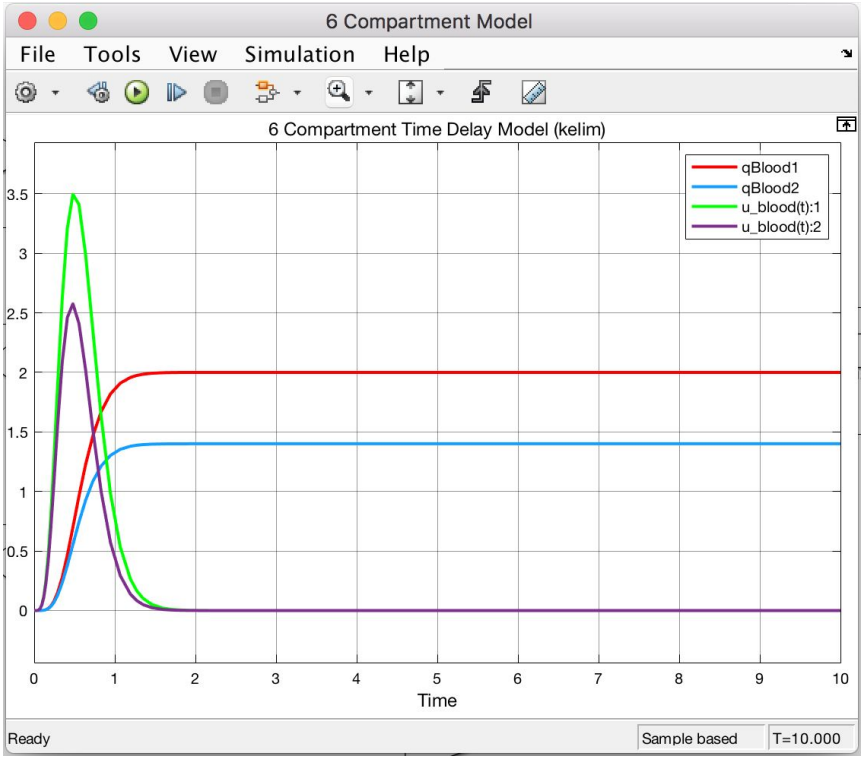
The area under the curve is 2 which is the same as the initial condition. The initial condition refers to the 2mg subcutaneous dose of a drug. The area under the curve is the total value of flux blood which is the initial impulse input 2. According to qBlood from all 3 graphs above, the steady state value of qBlood is 2. For n = 3, n = 6, n = 12, the area under the curve is 2.

Exercise 4

Simulink



Graph



Analysis

$k_{absorb} = 10$
$k_{elim} = 4.28$

Absorption = 10 / (10 + k_{elim})
0.7 = 10 / (10 + k_{elim})

Exercise 5

For problem 4, the steady state value of the blood compartment without elimination flux is 2. On the other hand, the steady value of the blood compartment with elimination flux is 1.4. The values make sense considering the amount of drug available for absorption. It is because the 30% of the dose is degraded with the elimination flux, so 70% of the dose is bioavailable for absorption. Therefore, the amount of drug for absorption is less than 2 which is the initial impulse input and the total value of flux of the blood compartment without any elimination flux.

The math is illustrated below:
(1.4 / 2) * 100% = 70%