**Questionnaire for AS#3**

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**NOTE: Answers for questions shown below should be written in English only. Points may be deducted if the sentence structure is incomplete, grammar is seriously wrong, or it is difficult to understand due to incorrect use of words and terminology.**

1. Describe your function E (concentration of functional enzyme E) here.

| E=z^2/(2+z^2) |
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1. What is the rationale for defining your function this way?

| I think the enzyme reaction will follow the ‘Hill equation’ and Z would be a ligand. If n>1(n is for hill coefficient), it means positively cooperative binding. The enzyme reaction in this situation is positive feedback, so I set the hill coefficient at 2. And I just randomly chose the d value. |
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1. Is the function a mechanistic model? Or phenomenological model? Explain your answer.

| You don’t need to answer this question. |
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1. Explain the parameters used in your function E. Which parameter can adjust the sensitivity of E to the Z concentration?

| The [d,n] would be the parameters because these two values determine the amount of the enzyme according to z. Especially, the n value will affect the enzyme sensitivity because enzyme-ligand cooperativity influences the activation of enzyme. |
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1. What is the cause of the damped or persistent oscillation? Explain the oscillation with your model parameters and equations.

| Positive feedback causes the oscillation. There is another factor(enzyme) in the middle of the reaction, so it can affect the whole system. Although I have not found the parameters perfectly, I will expect them from the result graph. Since (1)z has an initial value of 1, (2)enzymes are activated a lot, (3)x decreases a lot at the beginning, and then (4)y,z decreases as x decreases,and (5)y,z increases again by enzyme. |
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1. (Optional) You may not produce the desired result. Don’t worry. Can you briefly describe what you’ve done to complete this assignment?

| As we learned in the last assignment, we tried to find parameters using the derivative value(ex: dx/dt=0). We tried to use mathematical expressions using features such as (1) the same derivative of y and z, (2) that there are periodically zero derivatives, and (3) that x, y, and z move only within a certain range, but we cannot find parameters with these results. So I kept putting in parameters randomly and eventually got similar oscillating results, but I don't think it was the result I wanted. |
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1. Can you apply the insights you gained from the model simulation to real-world examples of biology?

| As I kept changing the parameters randomly, I saw many times that the oscillation stopped immediately for even a really small change or the change happened in a completely different direction. In addition, the simulation of this assignment can be predicted even roughly because there is only one engineering effect(enzyme), but it was amazing and surprising how complex and detailed examples in reality, such as the circadian clock, are designed. I think the real world example could never be predicted by a person. An analysis using the power of a computer seems to be very helpful. |
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1. What was the most difficult thing to understand while doing this homework? Did you figure it out after all? (It's okay if you don't understand, we can cover it in the Q&A session).

| Our team seems to have the most difficulty in making the same model, and we still haven't solved it. If one person enters the same parameter value when he or she finds the appropriate set of parameters in his or her code, the graph comes out completely differently in my code even though it is the same function and equation. It was frustrating to see that we cannot even know why it doesn’t work and how to solve the problem. Also, I think it was difficult because there were few things we could do to help each other. Also it was not easy to randomly find parameters because the process was actually not intuitive and expectable. |
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1. If you have your team member or outside member who helped you understand, please write the name and what you are grateful for.

| Systematic trio team, Jonghwan Yoon |
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