Guided Study Program in System Dynamics
System Dynamics in Education Project
System Dynamics Group
MIT Sloan School of Management[1]

Assignment #15

Reading Assignment:

Please refer to Road Maps 5: A Guide to Learning System Dynamics (D-4505-4) and read the following paper from Road Maps 5:

- Dynamic Simulation Models: How Valid are They? by Ray Shreckengost (D-4463)

Please refer to Road Maps 6: A Guide to Learning System Dynamics (D-4506-4) and read the following paper from Road Maps 6:

- Exploring S-shaped Growth, by Leslie Martin (D-4476)

Please refer to Road Maps 9: A Guide to Learning System Dynamics (D-4509) and read the following papers from Road Maps 9:

- Mistakes and Misunderstandings: Table Functions, by Leslie A. Martin (D-4653)
- Graphical Integration Exercises Part Five: Qualitative Graphical Integration, by Manas Ratha (D-4675)

Exercises:

1. Dynamic Simulation Models: How Valid are They?

Please read this paper carefully. This is a short paper, but very important in developing your modeling skills. You do not need to turn in anything for this paper but you will be asked to use the tests in this paper throughout the GSP.

2. Exploring S-shaped Growth

Please read this paper carefully. It covers fundamentals of the S-shaped growth structure that are vital to your understanding of system dynamics. Pay particular attention to the behavior of the net flow in a system generating S-shaped behavior.

A. How does a stock behave if its net flow is:

- positive and increasing in magnitude
- positive and decreasing in magnitude
- negative and increasing in magnitude
- negative and decreasing in magnitude
- positive throughout, first increasing then decreasing in magnitude
- negative throughout, first increasing then decreasing in magnitude

B. Find a way to improve the healthy Immune Response model.[3]
Hint: the formulation for the "destruction" of "Foreign Cells" is flimsy. The time for white blood cells to destroy a foreign cell is not constant, but changes with the density of foreign cells. The correct formulation should not use an IF THEN ELSE statement.

3. Mistakes and Misunderstandings: Table Functions

Please read this paper carefully. You do not have to answer any questions for this paper, but please let us know if you have any questions or comments about it.

4. Graphical Integration Exercises Part Five: Qualitative Graphical Integration

Please read this paper and do all the included exercises. Based on the skills that you acquired from this paper, integrate the following flows.[4] Assume that the initial values of the stocks are zero.
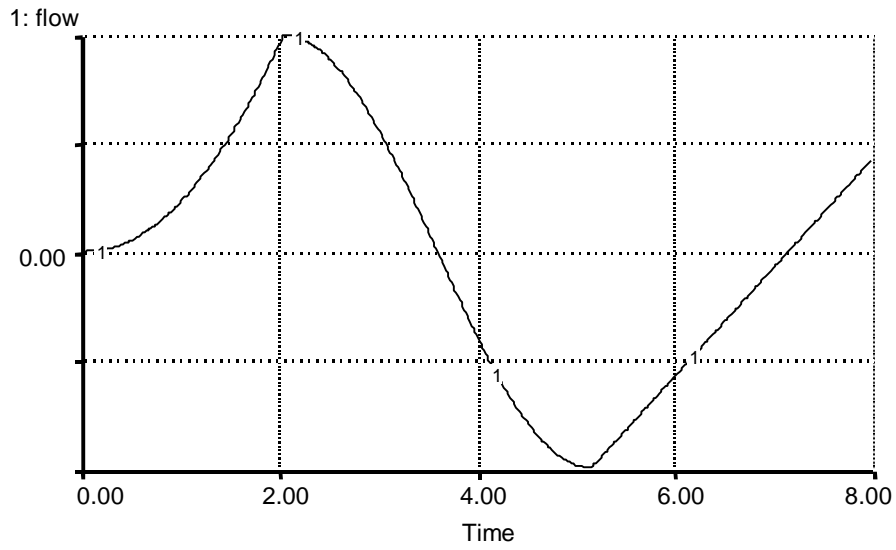
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[3] The model in "Exploring S-shaped Growth" contains a unit error in the formulation of "strength of proliferation." "Antigens" has units of antigens, and both "strength of immune response" and "strength of proliferation" are dimensionless. The "strength of immune response" should have units of 1/antigens. We apologize for the confusion.

A.

1: flow

B.

1: flow

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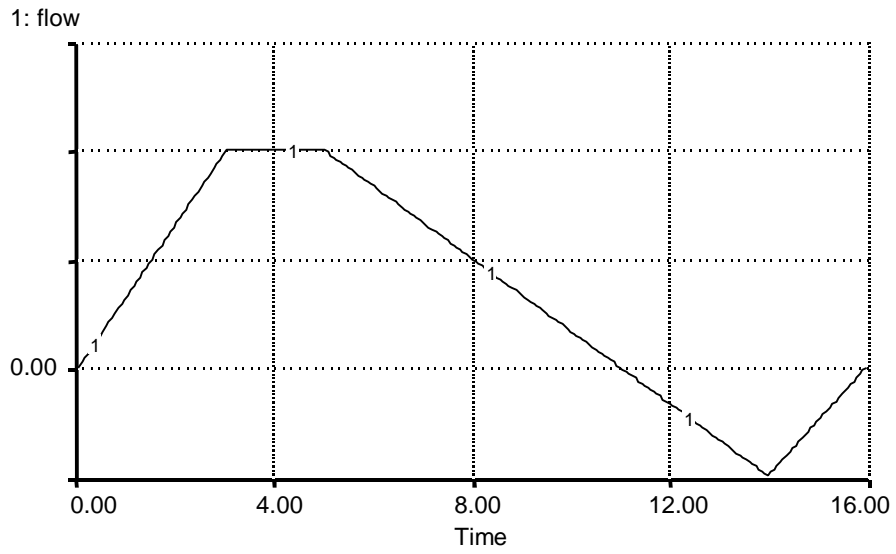
[4] Use a graphics application to create a graph of the stock behavior and then paste the graph into your assignment solutions document. You can also draw the stock behavior by hand and fax it to us at (617) 258-9405, or you can provide a detailed verbal description of the stock behavior.