

# Guided Study Program in System Dynamics

System Dynamics in Education Project  
System Dynamics Group  
MIT Sloan School of Management<sup>1</sup>

## Assignment #28

Assigned on: Friday, June 4, 1999

Due by: Monday, June 14, 1999  
12:00 PM (Noon)<sup>2</sup>

WE WILL REVIEW THE RESPONSES ON MONDAY  
AFTERNOONS, BOSTON TIME.  
LATE SUBMISSIONS WILL NOT RECEIVE FULL  
ATTENTION.

*Please email assignment solutions, questions, or comments to:*

*[gsp@sysdyn.mit.edu](mailto:gsp@sysdyn.mit.edu)*

*Save solutions with the filename XYZ-S28.doc  
(where XYZ are your initials)*

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### **Reading Assignment:**

Please refer to Road Maps 6: A Guide to Learning System Dynamics (D-4506-3) and read the following paper from Road Maps 6:

- Economics Supply and Demand, by Jody Whelan and Kamil Msefer (D-4388)

Please refer to Road Maps 7: A Guide to Learning System Dynamics (D-4508-1) and read the following paper from Road Maps 7:

- Modeling Exercises: Section 2, by Joseph Whelan (D-4451-1)

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<sup>2</sup> The deadline is in United States Eastern Time, equivalent to Greenwich Mean Time minus 4 hours during US daylight savings time, and Greenwich Mean Time minus 5 hours for the rest of the year.

## **Exercises:**

### 1. Economics Supply and Demand

- A. How does the system dynamics model presented in this paper resemble or differ from your own mental model of supply and demand? Do you think the model accurately and realistically captures consumer behavior? Why or why not?
- B. Build the supply and demand model in Figure 10 on page 20. In your assignment solutions document, include the model diagram and documented equations.
- C. Do exercises 5.1 through 5.3 from the paper, using the model you built in part B. Did you get the answers that you expected?
- D. The supply and demand model produces damped oscillations, as we can see from the graphs in Section 7.2. Trace through the causal relationships and feedback loops. Explain what causes the damped oscillations. What structural elements make this model different from the generic structure for sustained oscillations?
- E. Has this paper prompted you to think of other phenomena in economics differently? If so, we would love to hear about any interesting perspectives you may have discovered.

### 2. Modeling Exercises: Section 2

- A. Build the urban growth model. In your assignment solutions document, include the model diagram, documented equations, graphs of lookup functions, and a graph of the base run behavior.
- B. Examine the rate equation for “In Migration.” What factors does the “In Migration Normal” represent? What factors does the “Job Attractiveness Multiplier” represent? What additional factors influence migration in the real world?
- C. Equilibrium employment conditions in the urban growth model are insensitive to most parameter changes. What parameter changes can alter the equilibrium value of the “Labor Availability” ratio? Are the parameter changes reasonable? Why or why not? What do such changes represent in the real world? Explain how the parameter changes that you made change the “Labor Availability” and substantiate your explanations with graphs of the behavior produced by the different scenarios.
- D. Under conditions of job shortage or low wages, some people may choose not to participate in the labor force. Add equations to the urban growth model to permit the “Labor Participation Fraction” to change according to fluctuations in the “Labor Availability” ratio. What dynamic behavior do you expect? Simulate the model. Does the model behave as you expected? Why or why not? In your assignment solutions

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document, include the modified model diagram, documented equations, graphs of lookup functions, and a graph of the model behavior.