ESD.36 System Project Management **Fall 2003**
System Design and Management Program (SDM)
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Homework 4
System Dynamics 1: Brook's Law

Out: September 30, 2003
Due: October 9, 2003, 3pm

Learning Objectives

In this homework you will use a system dynamics model of a project to analyze staffing decisions. You will understand how the feedback structure and characteristics of the project can create unintended consequences, and therefore how the decisions made by project managers affect its success or failure. *Excluding any Vensim output, 2-3 pages of text are sufficient to answer this assignment; brevity and clarity are a plus. Only include Vensim output where it is necessary to make your points.*

Resources

1. Vensim PLE – download from www.vensim.com (free)
2. Class4.mdl – download from server
3. Vensim Tutorial by Nelson Repenning – download from server
4. [Optional] Brooks, Frederick P. Jr. The Mythical Man-Month. Reading, MA Addison Wesley, 1995.

Assignment

1. Download the Class4 model from the server. Simulate the model with no hiring (willingness to hire = 0). Now simulate the model with hiring (willingness to hire = 1) *[Only 2 simulations are required to answer this question.]* (a) How does hiring affect the cost and the schedule performance of the project? *[Cost is measured in this simple model by cumulative person-months spent on the project.]* (b) Why does the project cost more? *[Be sure to include Vensim output which explains why costs (person-months) increase]* (c) Why does the project still finish behind schedule? *[Again be sure to include Vensim output which explains your answer.]*

2. In 1975 Frederick Brooks wrote a book entitled The Mythical Man Month, in which he described his experiences managing IBM's development of the mainframe 360 hardware and software (updated in 1995).[1]" In that book, he coined what came to be known as "Brook's Law:" "Adding manpower to a late software project makes it later." In this question, you will use the Class4 simulation model to assess the validity of the Law. The parameters in the model which directly relate to the law are relative productivity of new staff;

[1] Brooks, Frederick P. Jr. The Mythical Man-Month. Reading, MA, Addison Wesley, 1995.

relative quality of new staff; hiring delay; and time to gain experience. Assuming that these parameters are sufficient, design a set of experiments to test the validity of the law. I.e., simulate the model with higher and lower values for these parameters *[Be sure to test extremes; for simplicity, you can assume that the relative quality and productivity of new staff always move together.]* Under what conditions does his "law" hold (briefly explain why)? When is his "law" invalid (again, why)? *[No more than 6-8 additional simulations are required to answer this question. Provide summary tables/graphs and selected simulation output to support your answer.]*

3. Brook's Law deals only with schedule. What are the cost implications of adding manpower to a development project? Do they differ from the schedule implications? Is there a cost-schedule tradeoff? *[Probably no additional simulations are required to answer this question.]*

4. Comment on the implications/applicability of these results for different types of projects – software projects, hardware projects, projects like the unmanned aerial vehicle in the previous assignments, and typical projects in your organization. Specifically: How strong is the effect of "experience" on productivity and quality in the different types of projects; why do you think this *[Remember that in this relatively simple model experience is used as a proxy for a number of separate effects, including different types of experience (on the project, on similar projects, as an engineer); dilution of experienced staff time; size, and changes in the size, of the organization]*? How are other parameters you found important likely to differ between the types of projects? What recommendations would you make for managers of the different types of projects about adding staff if their projects fall behind schedule, and why.