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Economic Dynamics: Final Examination	
<i>Prepared by: David Wheat</i>	<i>Date: 12 December 2019</i>
<i>Maximum Duration: 2 hours</i>	Grade: _____
<i>During the examination the students are required to behave in accordance with the norms of the academic ethics.</i>	

Procedures for taking the exam:

1. As a condition of being allowed to take this exam and having it graded, you must not communicate in any way—including electronic communication—with another person, except the person administering the exam.
2. You may use an English dictionary during the exam. Nothing else is allowed on your desk during the exam (no phone, no calculator, no computer, no notes, etc.).
3. If you have questions during the exam, raise your hand to get attention. The person administering the exam is only permitted to clarify exam questions or tasks; i.e., what you are required to do. She cannot answer any other questions.
4. Write your name on each page of the exam.
5. Write (or print) legibly. If your answers are difficult to read, they may be read incorrectly and your grade will suffer.

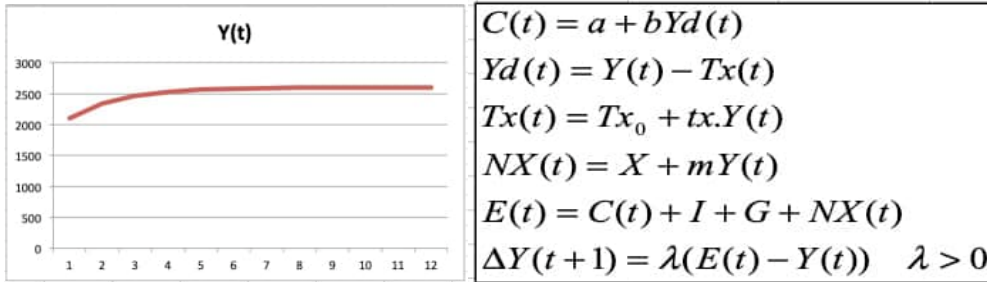
6. Sign this Honor Pledge:

I did my own work on this exam. I did not receive help during the exam, and I did not give help to anyone else. I understand that if I sign this pledge falsely, I will not qualify for a passing grade on the exam and I will not qualify for course credit.

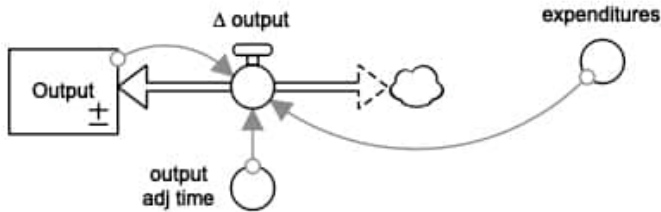
signature

#1 (20 points)

Spreadsheet Model Behavior and Structure:



1.1 Given the behavior and structure of the spreadsheet model above, which SD equation would be consistent with the last equation in the spreadsheet structure?



Circle A or B:

(A) $\Delta \text{ output} = (\text{expenditures} - \text{Output}) / \text{output adj time}$

(B) $\Delta \text{ output} = (\text{Output} - \text{expenditures}) / \text{output adj time}$

1.2 Explain your choice.

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#2 (20 points)

2.1 Suppose you wanted to test the effect of a sudden increase in the value of a parameter. For example, suppose interest rate = 5. How would you write the equation to make the interest rate equal to 6 in year 2?

interest rate =

2.2 Why is it necessary for every feedback loop to contain at least one stock?

2.3 What is a 'wishful thinking link'? Give an example to illustrate your answer.

2.4 A model can have three types of equations. Give an example of each type (including units):

- constant

- definition (or identity)

- behavioral hypothesis

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#3 (20 points)

In *Urban Dynamics* (1969), J.W. Forrester wrote: “First . . . generate a model that creates the problem. Only if we understand the processes leading to the difficulties can we hope to restructure the system so that the internal processes lead in a different direction.”

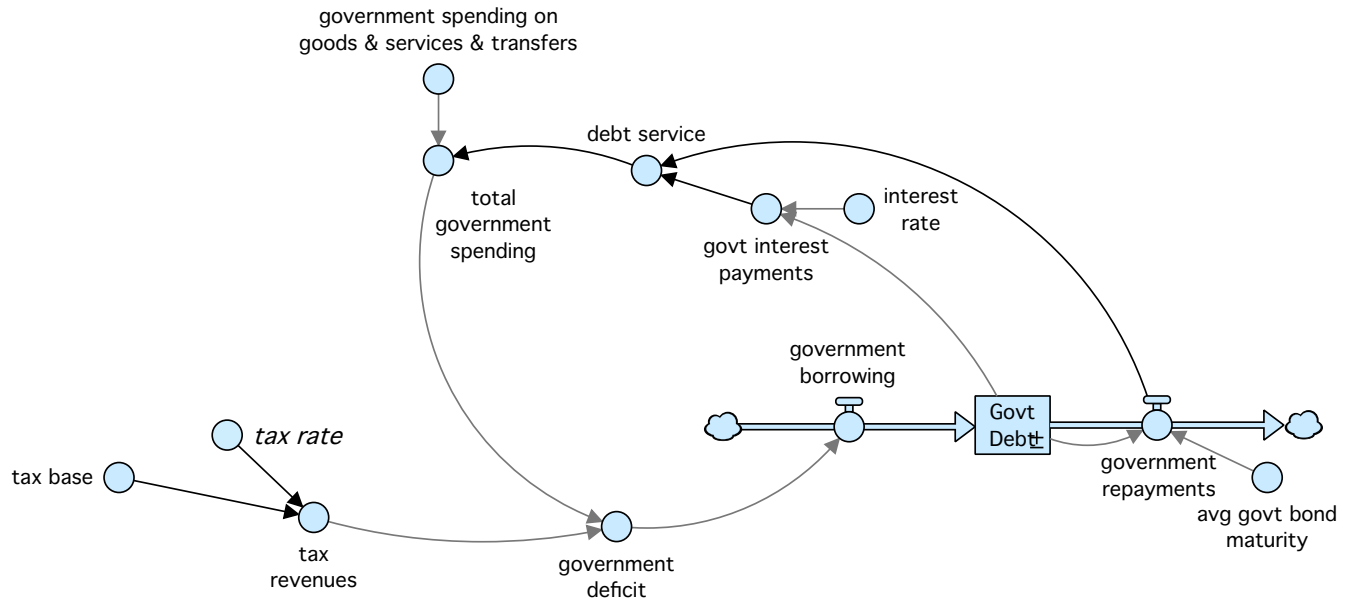
Forty years later in an email, Forrester wrote: “A model should demonstrate how the symptoms are being generated. . . Only by clearly understanding what is causing the problem can one begin to see where [policy] attention should be focused.”

What does this advice really mean, and how can it be useful advice to you, as a modeler?

#4 (40 points)

Add policy model structure to this model so that it creates a wishful thinking feedback loop to reduce Govt Debt. You can assume the goal for government debt = 60% of GDP, and that GDP = 1000 USD/year. In a recent lecture, we used the tax rate as our policy instrument to reach the goal. On this exam, you can use *either* the tax base *or* government spending on goods & services to reach the goal.

(4.1) Draw the new structure in this diagram so that it describes your policy. (Be neat!)



(4.2) write these equations and show the units for each equation:

goal for debt =

debt gap =

desired government adjustment rate =

desired borrowing =

Either:

desired gov't spending on goods, services, and transfers =

Or:

desired tax base =

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(4.3) On this graph, draw the goal for Govt Debt and draw the behavior of Govt Debt that you expect from your policy model. (Assume the new policy begins in year 10.)

