

**FRAMEWORKS AND MODELS IN ENGINEERING SYSTEMS  
ENGINEERING SYSTEMS DESIGN (ESD.04J / 1.041J)**

**SPRING 2007**

**PROFESSOR JOSEPH M. SUSSMAN**

**3-1-8, U (SPRING)**

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**IN-CLASS MIDTERM EXAM**

**OPEN BOOK AND OPEN NOTES; NO COMPUTERS**

**MARCH 22, 2007 2:30-4PM**

**100 point scale**

<b>Question</b>	<b>Points</b>	<b>Time guidance</b>
<b>1</b>	<b>42</b>	<b>40 minutes</b>
<b>2</b>	<b>42</b>	<b>40 minutes</b>
<b>3</b>	<b>16</b>	<b>10 minutes</b>

This exam asks you to consider two unrelated CLIOS Systems and then compare and contrast them. The associated questions are designed to allow you to demonstrate your understanding of CLIOS Systems, and how one thinks about them. And as you already know, *there is no one right answer*. So read the articles carefully and dive in!

Good luck!

This question builds upon the attached *New York Times* article dated February 19, 2007 entitled “With New Pipeline Plan, Alaska’s Governor Enters Precarious Territory”.

The CLIOS System we are interested in deals with the building of a new natural gas pipeline in Alaska, its role in providing natural gas to the lower 48 states, and the impact of this project on the State of Alaska. The article gives you some background, but you should feel free to draw upon your own broader understanding of the issues surrounding this CLIOS System. Use the article as a starting point for a creative treatment of the issues.

1. First, prepare the three CLIOS process checklists—characteristics (6 items maximum); opportunities/ issues/ challenges (3 items maximum); preliminary CLIOS System goals (3 items maximum). (12 points)
2. To simplify matters, assume the physical domain of your CLIOS System has only one comprehensive subsystem. Please draw it.

To give you a sense of scale, 12 components is about right. (12 points)

3. Identify the major actor groups for your CLIOS System. And then, identify the actors. (6 points)
4. We have spent time in class discussing both nested complexity and evaluative complexity as characteristics of the CLIOS Systems with which we deal. Describe, in a few sentences for each, how these two types of complexity appear in your CLIOS System. (6 points)
5. “*Uncertainty is everywhere; deal with it*” has been a touchstone of this class so far. There are a number of uncertainties in this CLIOS System. Identify what you think are the two most important ones and discuss briefly—a sentence or two for each. (6 points)

Question II Urban Transportation-related CLIOS System 42 points

The question builds upon the attached article from the *New York Times*, dated March 20, 2007 entitled “Costs Expand for Digging of New Subway”.

The CLIOS System is concerned with the 2<sup>nd</sup> Avenue Subway in New York and its role in the urban transportation system in that city. You should draw on the article as well as what you learned about this environment from the video we showed in class a few weeks back.

The article and the video give you some background, but you should feel free to draw upon your own broader understanding of the issues surrounding this CLIOS System. Use the article and video as a starting point for a creative treatment of the issues.

1. First, prepare the three CLIOS process checklists—characteristics (6 items maximum); opportunities/ issues/ challenges (3 items maximum); preliminary CLIOS System goals (3 items maximum). (12 points)
2. To simplify matters, assume the physical domain of your CLIOS System has only one comprehensive subsystem. Please draw it.

To give you a sense of scale, 12 components is about right. (12 points)

3. Identify the major actor groups for your CLIOS System. And then, identify the actors. (6 points)
4. We have spent time in class discussing both nested complexity and evaluative complexity as characteristics of the CLIOS Systems with which we deal. Describe, in a few sentences for each, how these two types of complexity appear in your CLIOS System. (6 points)
5. “*Uncertainty is everywhere; deal with it*” has been a touchstone of this class so far. There are a number of uncertainties in this CLIOS System. Identify what you think are the two most important ones and discuss briefly—a sentence or two for each. (6 points)

Question III                      16 points

The two CLIOS Systems you have considered deal with two different critical contemporary issues, energy and urban transportation.

1. Here we ask you to think creatively, identifying 3 similarities and 3 differences between these two CLIOS Systems, describing each in a sentence or two. (12 points)
2. Finally, think imaginatively about how these two apparently unrelated CLIOS Systems are interconnected (one short paragraph). (4 points)