Engineering Systems Analysis for Design

Introduction

GOOD MORNING

BONJOUR!
GUTEN MORGEN!
O HAYO GOZAIMASU!
SELAMAT DATANG!
G’DAY, MATES!
¡BUENOS DIAS!
КАЛЫ МЕРА!
NI HAO MA!
BOM DIA!
Welcome!

- It is a pleasure to be with you
- We will be covering much new material
- Looking forward to learning with you
- Hope to make some long-term friends

Introduction of Teachers

- Richard de Neufville
  - Prof. of Engineering Systems and of Civil and Environmental Engineering
  - Course Organizer

- Michael “Mike” Hanowsky
  - Teaching Assistant – recitations and portfolios
  - Doctoral Student in Engineering Systems Division
  - …. with extensive experience (and has passed generals)

- Richard-Duane Chambers
  - Teaching Assistant – grading
  - Technology and Policy 2nd Year student
Introduction of Students

- Please fill out sign-up sheets being passed around

- Please indicate if you are
  - taking course
  - shopping around

ENGINEERING SYSTEMS ANALYSIS FOR DESIGN

- Central Idea: Using Analysis to Configure Engineering Systems for best long-term performance

- Means: “Real Options”, i.e., physical things that system managers and designers can do to add flexibility
  - To avoid bad outcomes (acts like insurance)
  - To seize opportunities for improvement
  - Overall, to maximize expected performance in uncertain world

- MIT School-Wide Elective, with many numbers:
  ESD 71, 1.146, 2.192, 3.56, 16.861, 22.821

Choose what meets your course requirements
Logic of the Course

- Engineering Systems exist in Uncertainty
  - Technical -- New Developments
  - Economy -- Boom, Recession, Prices, Competition
  - Social -- New Regulations, Political Changes

- Engineering Systems Need to Adapt
  - Take advantage of Opportunities
  - Avoid Hazards, Risks

- Flexibility is Essential Part of Design
  - How do we value flexibility?
  - How much is enough?

- “Real Options” provides Answers

New Material

- Brand-new Approach to Engineering Design
  - Use of “Real Options” may lead to Paradigmatic Change

- Revolutionary possibilities
  - Explicit consideration of flexibility, not possible earlier
    => savings (or increase in performance) of order of 30% !

- Approach derived from “Options Theory”
  - Nobel Prize-winning development in finance

- Modified to fit engineering realities
  - Lack of historical data
  - Need for Approximate Procedures

- Idea is to develop coherent road-map for design
New Course Structure

- Field is moving rapidly...
- ... So 2006 is changed from 2005 (and before)
- The hope is to make it much better for everyone
- Your help is needed – please provide feedback on your experience
  - Too fast? Or too slow?
  - Something missing? Errors on Slides?
  - Better examples needed?
- You are partners in this cutting-edge learning

Structure of Material – 5 Parts

1. Benchmark: Analysis Assuming Certainty
   -- this is the traditional standard
2. Analysis Recognizing Uncertainty
   -- this shift alone leads to different solutions
3. Decision Analysis Approach
   -- A practical approach to uncertainty
4. Real Options Analysis: Theory
   -- The sophisticated approach
5. Real Options Analysis: Models for Engineering
   -- Adapting theory to practice – current examples
Prerequisites

- Syllabus assumes
  - comfort with basic calculus, probability, statistics
  - familiarity with some advanced concepts of Excel used in course

- To see if you are sufficiently on top of Excel material, take self-assessment test posted on course site at http://ardent.mit.edu/real_options/ROcse_Excel_latest/Excel_class.html

- If exercise is too difficult for you, come to:
  ESD 70 – next Mon, Tues, Wed, Thurs; 5 – 7 pm; This Room 32-144
  Listener is recommended, 3 units credit possible

Course Materials

- Many lectures refer to chapters from my text, Applied Systems Analysis (out of print) and research articles. All can be downloaded in pdf from course web site:

- Web: http://ardent.mit.edu/Real_Options

- Detailed Syllabus, assignments accessible directly from here. Note carefully: Site updated weekly!

- Bulletin Board: under web site. Will be used to make announcements, respond to questions. CONSULT REGULARLY!!
Assignments

- See Web site for details
- Problem Sets, Exercises throughout semester
- Best to do them as you go along
- However, only need to turn in on due date
- “Application Portfolio” designed to help you apply RO to your interests – Hope you like it
- Mid-semester Quiz
- Final Exam -- Date set by Registrar end of September

Academic Honesty

- To avoid confusion with expectations elsewhere, note the standards that apply in this subject:
- Anyone found cheating will get ZERO for quiz or exam.
- Do graded Assignments individually. We expect students to discuss the problem sets. However, you should then prepare your own reports for each assignment, in your own format and words.
- Demonstrated evidence of copying will result in zeros for EACH paper with this evidence.
Weekly Recitation Sessions

- They will show how to solve problems
- Give alternative explanations of concepts
- Review for Quiz and Final

Meeting with Instructors

- Use Bulletin Board at any time
  - Answers should be prompt
  - Share information with others
- Teaching Assistant office hours to be arranged
- Prof. de Neufville “office hours” after class; “office” in café outside of classroom. Appointments Tuesdays and Thursdays for specific issues.
QUESTIONS?

- THANK YOU FOR YOUR ATTENTION

- WE ARE NOW AVAILABLE FOR DISCUSSIONS

Times for Recitations?

- Wednesday 9........
- Wednesday 10......
- Wednesday 11.....
- Wednesday 3........
- Wednesday 4......

- Tuesday 3..........  

- Thursday 3.........