Engineering Systems Analysis for Design

Introduction

GOOD MORNING!

BONJOUR!
GUTEN MORGEN!
O HAYO GOZAIMASU!
SELAMAT DATANG!
¡BUENOS DIAS!
КАЛМ 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

Today's class has 3 sections

- General Organization Introduction
- Discussion of Paradigm Shift
- Illustrative Example – Garage Case
Introduction of Teachers

- Richard de Neufville
  - Prof. of Engineering Systems and Civil Eng’r’g
  - Course Organizer
  - Sabbaticals abroad: England, France, Japan, Australia … latest Portugal… and California

- Michel-Alexandre Cardin
  - Teaching Assistant – recitations and portfolios
  - Doctoral Student in ESD, TPP graduate
  - work experience in Canada, Singapore and UK

- Tommy Rand-Nash

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 expected long-term performance

- Means: Flexibility, that is, physical things that system managers and designers can do to make it possible to
  - 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, 3.56, 16.861, 22.821

Choose number that 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?

- Course provides Methods to Determine Answers
New Material

- **New Approach to Engineering Design**
  - Recognition of Uncertainty and Use of Flexibility may lead to Paradigmatic Change in Engineering Design Process

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

- **Related to “Real Options”, but different**
- ** Procedures developed to fit engineering realities**
  - Lack of historical data
  - Need for Approximate Procedures

- **Idea is to develop coherent road-map for design**

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New Course Structure

- 2008 is deeply reorganized and improved (I hope!)

- This new version represents content of new textbook being written for MIT Press as part of ESD Series

- Your help is appreciated! Thank you in advance!!
  - Please provide feedback on your experience
    - Too fast? Or too slow?
    - Logic needs improvement? Errors on Slides?
    - Better examples needed?

- You are partners in developing cutting-edge learning
Structure of Material – 3 Parts

1. Basics:
   -- Recognition of Uncertainty
   -- Valuation Fundamentals
   -- Timing issues

2. Key Methods:
   -- Uncertainty Modeling
   -- Flexibility Valuation Methods

3. Flexibility Identification Methods “in” Systems

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](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; 5:30 – 7:30 pm;
  Room 32-155
- Listener is recommended, 3 units credit possible
Course Is Web-based

- All materials on web:
  - Draft Chapters of New Text, Professional Papers
  - Copies of Lectures; Assignments
  - See Detailed Course schedule on course web site
  - http://ardent.mit.edu/Real_Options
  - Note carefully: Site updated weekly!

- Bulletin Board is available for class discussions
  - Instructors will answer questions directly here
  - Students can provide each other tips

Assignments

- See Web site for details

- Focus on “Application Portfolio” -- designed to help you apply course to your interests – Hope you like it

- Exercises to support above

- Problem Sets – do on your own, consult solutions on web for immediate feedback (to be posted)

- Mid-semester Quiz

- Final Exam -- Registrar sets Date September 18
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 course and issues. 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 Stata Center café
- Appointments Tuesdays and Thursdays for specific issues.

QUESTIONS?

- THANK YOU FOR YOUR ATTENTION

- WE ARE NOW AVAILABLE FOR DISCUSSIONS
Times for Recitations?

- Wednesday 1...
- Wednesday 2....
- Wednesday 3....
- Tuesday 1....
- Tuesday 2....
- Tuesday 3...
- Tuesday 4...
- Thursday 9...