Engineering 5:
Introduction to Engineering Practice

Overview of Information and Systems Engineering

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What is this ISE thing all about?

- ISE stand for Information and Systems Engineering.

- What is a system?

- And why would we want to engineer it?

- What does all this have to do with information?

- These are all important questions.

- I hope you will find answers to them in the next five weeks.

- Some of these questions will be answered today.

- Please feel free to raise any questions that occur to you as we go along.

The World According to Thomas Friedman

- First, a little history.

- Who is Thomas Friedman?

- According to Thomas Friedman, the world has been undergoing a second industrial revolution that began with the fall of the Berlin Wall.

- The first industrial revolution was largely enabled by improvements in the world's transportation infrastructure.

- These improvements shrank the world a few sizes.

- The current revolution has largely been enabled by improvements in the world's information infrastructure.

- These improvements have shrunk the world a few more sizes.

- Both companies and countries increasingly trade in information.

How Much Does Information Weigh?

- During the cold war, the economy of a country was measured by the total weight of their exports.

- The more tonnage leaving your country's ports, the stronger your economy.

- Today, a company's worth has more to do with intellectual property than physical property.

- One no longer asks how heavy a country's total exports are, but how light.

- There is a high negative correlation between the weight of a country's exports per dollar of GDP and the country's prosperity.

- The value added is information.

The Speed of Information

- Information moves much more quickly than physical goods.

- In today's economy, the winners are companies that can keep up with the speed of information.

- Those who take advantage of the information revolution to improve engineering practices will be successful.

- Those who continue to practice traditional engineering will be left behind.

- Efficient use of information allows companies to be leaner, faster, and more efficient.

- It's no longer about how big a company is, but how fast.

The Rise and Fall of IBM (A Brief History)

- From the 1950s through the 1980s, International Business Machines had profits of 10-15% and grew at a rate of 10-15% a year.

- In 1981, when IBM introduced the IBM PC, it was an industry leader.

- By 1985, IBM had revenues of $50B and over 400K employees.

- Compaq, which didn't even exist in 1981, had revenues of $0.5B and less than 2K employees.

- When Intel released its 386 chip in 1986, IBM balked and told Intel it was not ready for the chip.

- Compaq took the chip and invented the world's first "portable" PC.

- Compaq also took a huge chunk of IBM's market share and became the fastest growing company in history.

- By 1995, Compaq overtook IBM as the number one PC manufacturer.

- By 1998, Compaq had 50 times more revenue than it had in 1985, whereas IBM's had only grown 50%.

- Compaq was the Forbes Company of the Year in 1997 and the industry leader in PC shipments for 1998.

The Rise and Fall of Compaq

- Compaq was smaller than IBM, but it took market share by being faster, more agile, and more adaptable to change.

- Compaq soon got a taste of its own medicine.

- Founded in 1984, Dell computer overtook both Compaq and IBM to become the number one PC manufacturer in the U.S. in 1999.

- By 1999, IBM's U.S. market share was down to 5.5% and

- Dell did this by being even leaner and faster than Compaq.

- The Dell revolution

  - Take orders over the Internet.
  - Commoditize every PC component.
  - Build new PCs on demand to customer specs.

The Rise of Google

- Google is a company whose entire business is to help people find and use information fast.

- The estimated worth of the company is $25B.

- Question: What is Google's product?

- Answer: Information.

- Underlining Google's importance to the new economy, the company was featured on the cover of Newsweek last week.

Enterprise Resource Planning

- Companies can be viewed as large, complex systems consisting of thousands of interconnected components.

- Increasingly, companies are being run using software called *Enterprise Resource Planning* (ERP) software.

- ERP software helps a company allocate its resources efficiently by organizing information centrally for access by decision makers.

- ERP software is one of the fastest growing segments in the business software market.

- *Advanced Planning and Scheduling* (APS) software works with ERP software to help decision-makers make better decisions.

Lehigh's Information and Systems Engineering Program

- Tom Magnanti, Dean of Engineering at MIT, in a speech at Lehigh last week, listed four emerging "hot" areas of engineering.

  - Bio: Bioengineering, computational biology
  - Info: Information systems, information technology
  - Nano: Nanotechnology, micro-manufacturing
  - Macro: Large-scale, complex systems

- The ISE major lies at the intersection of Macro and Info and focuses on:

  - systems engineering in the information age,
  - using information and information technology to solve problems,
  - analyzing large-scale systems to improve their performance, and
  - using information to make better business decisions and improve traditional engineering practices.

Systems Engineering Applications

- **Logistics Systems**

  - Design of Distribution Networks
  - Facility Location

- **Communications Networks**

  - Internet
  - Wireless

- **Manufacturing Systems**

  - Production Scheduling
  - Shop Floor Layout

- **Financial Systems**

  - Mutual Funds
  - Pensions

- **Biological Systems**
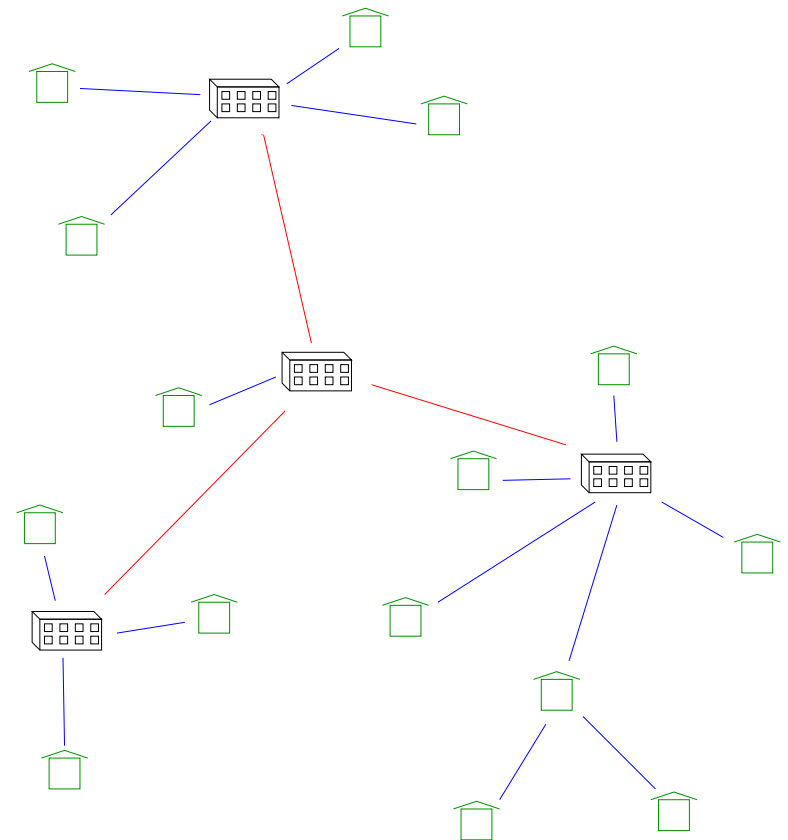
Main Components of Program

- Course emphasis areas

  - Information Systems and Technology: Emphasizes necessary skills in computing, software systems, and networking/communications.
  - Business and Finance: Emphasizes the broader context of business and analysis of economic and financial issues.
  - Operations Research and Systems Engineering: Emphasizes the modeling and analysis of complex, large-scale systems.

- Other requirements

  - Industrial internship
  - Capstone design course

What can I do with an ISE degree?

- Because of ISEs inherently multi-disciplinary nature, the options are highly varied.

- Some examples

  - Systems/operations analyst
  - Management consultant
  - Financial analyst
  - IT Specialist
  - Systems integrator

- With strong business and technical skills, ISEs eventually move to leadership roles in the companies they work for.

Some Buzzwords to Remember

- Operations Research

- Management Science

- Mathematical Programming

- Supply Chain Management

- Enterprise Resource Planning

- Advanced Planning and Scheduling