Week 3

1. Engineers’ Salary Survey
2. Design project (see Design Project Schedule on web)
3. Professionalism and Ethics (chapter 1.10 in book)
Engineering Salary Survey

Source: http://www.abbott-langer.com/asmesummm.html?pn02
The median annual income reported in a recent survey (2004) of the compensation of mechanical engineers was $83,236, with the middle 50% falling between $62,000 and $100,000, according to Dr. Steven Langer, President of Abbott, Langer & Associates, Inc., Crete, IL.
The composite highest-income practitioner in this field (salary plus cash bonus and/or cash profit sharing) is the Research Vice President/Director with a median income of $135,000. Far toward the other end of the income spectrum, Junior Engineers have a median annual income of $50,000.
<table>
<thead>
<tr>
<th>Position</th>
<th>Median Total Cash Compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presidents &quot;B&quot;</td>
<td>$130,500</td>
</tr>
<tr>
<td>Engr. Directors/Vice Presidents</td>
<td>$110,000</td>
</tr>
<tr>
<td>Professors</td>
<td>$106,700</td>
</tr>
<tr>
<td>Principal Consultants</td>
<td>$100,000</td>
</tr>
<tr>
<td>Environmental Managers</td>
<td>$96,990</td>
</tr>
<tr>
<td>Senior Engineers</td>
<td>$79,800</td>
</tr>
<tr>
<td>Sales Representatives</td>
<td>$74,000</td>
</tr>
</tbody>
</table>
Engineering Salary Survey, cont’d

Compensation varies considerably. Median incomes are highest for independent consultants ($99,500), and in financial organizations ($118,000), textile mill product manufacturing ($96,000), and petroleum/coal/natural gas extraction & refining firms ($95,000);
Median incomes are lowest in firms manufacturing home appliances ($63,000) and circuit boards ($63,500), printing firms ($63,800), and state government ($64,000).
When level of education is taken into account, mechanical engineers with a **doctoral degree** earn a median annual income of $93,750, 32% higher than those with a bachelor's degree ($70,950). Mechanical engineers with **under one year of experience** have a median income of $49,900, only about one-half that of the 25-plus-year veteran ($100,000).
Chapter 1.9
Engineering Education

Some personal observations:
• Observe market trends continuously. Internet job sites are an excellent resource.
• The highest demand is typically in new technologies (often the most interesting, but also the most challenging)
Design Project Week 3

Your Assignment:

see Design project web page:
http://www.me.unlv.edu/Undergraduate/courserenotes/egg102/proj-sch.htm
Design project (see Design Project Schedule on web)

This week:
*Lego Design and Programming 1*

Begin Literature Search
*Report 2 due in Week 3 of the semester*
First part of this week’s Lab Assignment: Lego Design and Programming 1

Control and Build a vehicle with one motor and one light sensor. Write a program that lets the vehicle move at a constant speed indefinitely. The vehicle must stop when it encounters a white line.
Second part of this week’s Lab Assignment:

Begin Literature Search

Your Sources:

- Library
- Web
- US Patent office
US Patent example:

United States Patent 6,491,566
Peters, et al.
December 10, 2002

‘Toy Robots’
Legally known as:
“Sets of toy robots adapted to act in concert, software and methods of playing with the same “
Toy robots are provided that act in concert with each other. A player issues high level team commands to a processor. The processor interprets the team command to derive individual low level commands for the toy robots. A transmitter transmits the low level commands to the toy robots, which then act in concert.
Fig. 4

1. Observe action of opponent toy robot(s)

2. Input status of own toy robot(s)

3. Determine plan to counter the observed action

4. Issue team command to effectuate the plan

Sub-processes:

- Encode team command in master signal

- Transmit master signal to master toy robot

- Decode master signal to reproduce team command
Fig. 5

1. Receive next pawn control signal
2. Signal intended for this pawn toy robot?
   - Yes: Decode received pawn control signal, to reproduce pawn control instruction
   - No: Determine whether preset pawn status condition is met
3. Transmit pawn status signal (report status condition)
   - Not met: Execute preset action routine
   - Met: Override reproduced instruction

500  510  520  530  540  550  560  570
What can we learn?
Creativity?
New Ideas?
Conclusion

Patents are an excellent resource for assessing the state of the art, and for generating new ideas.
Second part of this week’s Lab Assignment:
Begin Literature Search

Your Sources:
• Library: Visit the UNLV Library. The library has an on-line catalog. See: http://www.library.unlv.edu/
• Web
• US Patent office
Second part of this week’s Lab Assignment:
Begin Literature Search

Your Sources:
- Library
- **Web**
  - Use search engines such as Google.
  - Also use Image search options
- US Patent office
A final remark:

**Motivation:** Study patents and literature for your own benefit. You will come up with new ideas. Knowledge will make you an expert, and will let you enjoy the project a lot more.
Chapter 1.10 Professionalism

Professional Registration
NEVADA STATE BOARD
OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS
1755 East Plumb Lane, Suite 135, Reno, Nevada 89502
(775) 688-1231  1-800-728-2632 (In Nevada only)

Application for Professional Engineer Licensure

(Discipline) ................................................

☐ Reciprocity (Fee $200)
☐ Exam (Fee $225 – Structural see Fee List)

The Appropriate Application Fee Must Accompany This Application
Applicant’s name: ________________________________

Address: ______________________________________

is seeking licensure as a (discipline) ___________________ Engineer in Nevada and has sent you this request for a professional reference. We understand that you are a Licensed Professional Engineer (license may be in any state) and have personal knowledge of the applicant’s engineering work, character and ethics. Please complete, sign, then stamp or seal this form. Place it in an envelope; seal and sign the envelope according to the instructions, then return the envelope to the Board office. This Reference is confidential and will not be accepted by the Board if not properly completed as instructed. THE NEVADA BOARD HAS ON FILE A NOTARIZED AFFIDAVIT RELEASING ALL REFERENCES, EMPLOYERS AND FORMER EMPLOYERS, NAMED BY THE APPLICANT, FROM ALL LIABILITY FOR ANY DAMAGE WHATSOEVER FOR GIVING INFORMATION AS REQUIRED ON THIS FORM.

Applicant: Describe up to 3 projects you had full or partial responsibility for while working with this professional engineer. Include dates, locations, and descriptive statements defining design work performed.

(Attach an additional sheet if more space is needed)

(1) ____________________________________________

_____________________________________________

_____________________________________________
What is a ‘Professional Engineer (PE)?

Licensing

Obligations
What is a ‘Professional Engineer (PE)?

By acquiring a license from its State Board, a Professional Engineer meets a set of minimal requirements for practicing the engineering profession in his/her field.
What is a ‘Professional Engineer (PE)?

**Obligations:** As other licensed professionals, the PE must protect the ‘safety, health, and welfare of the public’

**Caution:** Your PE stamp of approval makes you legally responsible for the safety of the design bearing your signature. As you shall see, this is a significant responsibility.
CODE OF ETHICS OF ENGINEERS

THE FUNDAMENTAL PRINCIPLES

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:
I. using their knowledge and skill for the enhancement of human welfare;
II. being honest and impartial, and serving with fidelity the public, their employers and clients;
III. striving to increase the competence and prestige of the engineering profession; and
IV. supporting the professional and technical societies of their disciplines.

THE FUNDAMENTAL CANONS

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.

2. Engineers shall perform services only in the areas of their competence.

3. Engineers shall issue public statements only in an objective and truthful manner.

4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.

5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.

6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the profession.

7. Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.

346 East 47th Street New York, NY 10017

*Formerly Engineers' Council for Professional Development. (Approved by the ECPD Board of Directors, October 3, 1977)

Source: Page 70 of your textbook
Design problems are as old as engineering
Chapter 2
Engineering Design – A Process
For your information:

**Wright Brothers:** You can find a collection of short movie clips in Quicktime format on your WebCT page and the web (NASA). See: http://wright.grc.nasa.gov/webcast.htm

I’ll show some of these movies in class. See also links to women in aviation and other related topics.
Drafting example: Monitor Case
Drafting example:
Monitor Case
The three views below define the design.
Show overall dimensions!
Engineering Design – A Process

When is a design complete?
When is a design complete?

Perfection takes both time and effort.
A Design Example

Gizah: Khufu Pyramid and Sphinx
The Mastaba:

Rectangular tomb-chapel belonging to ancient Egypt, beginning from the earliest dynastic era (around 3500 BC). The mastaba both represents the forerunner of the Pyramids, and the simpler alternative to Pyramids. Mastaba are structures with flat roofs, and normally built from mudbrick or stone.
Mastaba Cross Section
Zoser’s Pyramid

Pharaoh Zoser decided he wanted a final resting place more grand than the underground tombs or low, flat brick buildings (mastabas) in which most previous kings had been buried. Zoser had in his service a brilliant architect, Imhotep. Imhotep kept stacking mastabas until Zoser's tomb became a six-tiered pyramid 62 meters (203 ft) high, built of thousands of carefully cut stones and encased in a fine limestone shell.
Zoser Step Pyramid,
Construction Stages
The
Evolution of
Pyramids
Reconstruction of Gizah
Gizah: Khufu (Cheops) Pyramid Detail
Gizah: The Sphinx
Engineering Design –

Engines and Automobiles
The First Otto Engine

Used coal gas,
About 10 m tall,
Free-flying Piston

Operation
Step 1: The gas/air mixture is compressed as the piston falls under its own weight.

Step 2: The compressed gas/air mixture is ignited, driving the piston up. (the work stroke)

This engine was installed in Selters, Germany, to pump mineral (Seltzer) water.
“Silent” Otto Engine
First Designs are often crude.

The Otto engine improved rapidly. Even 140 years after its invention, it is still the dominant power source for automobiles.
A Daimler Engine

A compact and high-speed (900 rpm) version of the Otto engine.

This engine runs on *Benzin*, a liquid fuel which at the time was used mostly as a cleaning fluid and sold by druggists.

Daimler invented the hot-tube ignition.
Rudolf Diesel in his Laboratory, 1896
Science makes for better Engineering: Rudolf Diesel’s “Rational Heat Engine”

• The 2nd law of Thermodynamics predicts the maximum efficiency of a Carnot process.
• Diesel attempted to improve the existing thermal engines of the day on the basis of purely theoretical considerations.
• Diesel raised the temperature of pure air to a very high degree through vigorous adiabatic compression. Diesel engines are approx. 25% more efficient than Otto engines.
Engineering Design is iterative:
You start with an idea, Encounter obstacles, and seek to overcome them until you arrive at the desired product.

1908 Buick
Engineering Design is iterative
<table>
<thead>
<tr>
<th>Design Steps</th>
<th>Activity Time Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage of Total Time</td>
</tr>
<tr>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Identify need</td>
<td>[ ]</td>
</tr>
<tr>
<td>Define problem</td>
<td>[ ]</td>
</tr>
<tr>
<td>Search</td>
<td>[ ]</td>
</tr>
<tr>
<td>Constraints</td>
<td>[ ]</td>
</tr>
<tr>
<td>Criteria</td>
<td>[ ]</td>
</tr>
<tr>
<td>Alternatives</td>
<td>[ ]</td>
</tr>
<tr>
<td>Analysis</td>
<td>[ ]</td>
</tr>
<tr>
<td>Decision</td>
<td>[ ]</td>
</tr>
<tr>
<td>Specifications</td>
<td>[ ]</td>
</tr>
<tr>
<td>Communication</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

A time schedule must be developed early in order to control the design process.
Exemplary engineering: The Wright Brothers

Wright Brothers bike shop in Dayton, OH
The Wright Brothers systematically addressed every design problem.
Design Project Schedule: structured along Chapter 2 of Textbook
How We Made the First Flight
by Orville Wright

“The flights of the 1902 glider had demonstrated the efficiency of our system for maintaining equilibrium. We felt that we were prepared to calculate in advance the performance of machines. Before leaving camp in 1902 we were already at work on the general design of a new machine which we proposed to propel with a motor. “
How We Made the First Flight
by Orville Wright

1902 Glider
How We Made the First Flight
by Orville Wright

Please watch movie:
WRIGHT_01glidbg

Glider
How We Made the First Flight
by Orville Wright

Please watch movie:
WRIGHT_01glidbg

Engine
How We Made the First Flight
by Orville Wright

“Immediately upon our return to Dayton, we wrote to a number of automobile and motor builders, asking whether they could furnish one that would develop eight-brake horse power, with a weight complete not exceeding 200 pounds. Finally we decided to undertake the building of the motor ourselves. “
The Wright Brothers designed and built their own lightweight engine because a suitable engine was not available from manufacturers.

Please watch movie: WRIGHT_mow_03

1903 Flyer
The "Flyer" after it's first 3 1/2 second flight, a failure.
The first manned flight:
December 17, 1903. At 10:35 a.m.
Orville Wright takes off into a 27 mph wind. The distance covered was 120 feet.
First Flight

Please watch movie: WRIGHT_mow_03_f

Aircraft Development continued. The movie WRIGHT_mow_05 discusses innovations until 1905