CSCE482: Senior Capstone Design
Nine Step Model of Design Process

1. Recognizing the need
2. Defining the problem
3. Planning the project
4. Gathering information
5. Conceptualizing alternatives
6. Evaluating the alternatives
7. Selecting the preferred alternative
8. Communicating the design
9. Implementing the preferred design
Gathering Information

• There are vast amounts of information available on any subject.

• It is always better to base your design on existing information rather than relying exclusively on your own ideas

• Sources
  – Technical (Library, Papers, Internet)
  – Creative (Brainstorming)
  – Acquisition (Catalogs)
  – Economic (Market forecasts, etc.)
Gathering Information: Stages

• Identify the kind of information required.
• Physically or electronically gather the information.
• Determine how reliable and credible the information is.
• Decide when to stop looking.
Team work

Personality Characteristics

– Myer-Briggs Type Indicator is designed to classify individuals according to four basic preferences
  1. extraversion versus introversion
  2. sensing versus intuitive
  3. thinking versus feeling
  4. judgment versus perception

– Given the time frame of the project, it is best to accept rather than try to change people’s personalities

Leaders and Followers

– “Born Leaders” myth -- no scientific evidence

– Different leaders may emerge depending on the situation at hand
Roles within the group

Generators
– People who have lots of ideas

Integrators
– Good at integrating other people’s ideas into credible proposals

Developers
– Advance the idea stage into a product or process

Perfector
– Improves the product or process
What does a leader do?

**Task oriented function**

– Organize the group, help define goals, monitor progress, make adjustments to meet the goal

**Relationship oriented function**

– Responsive and considerate to the needs of each group member
Group Tasks

Group project activities operate in a cycle:

- Group meets
- Tasks are assigned to individuals
- Individuals go off and accomplish tasks
- At next meeting, individuals report to group
- Group discusses and evaluates progress
- New tasks are assigned
- Cycle repeats
Group Tasks

Figure 3-1. Traditional lifecycles
Group Tasks

Figure 3-2. XP lifecycle
Elements of Project Planning

• Divide project into tasks, tasks into subtasks, subtasks into ...

• Estimate duration of each task, subtask, ...

• Estimate resource requirements for each task, subtask, ...(budget, personnel, facilities)

• Identify precedence relations among tasks
Benefits of Project Planning

- Communications tool
  - Clients and coworkers

- Resource allocation
  - funds, personnel, facilities, equipment

- Benchmarking
  - progress monitoring
  - required adjustments
Project Planning Tools

- Gantt Chart
- Critical Path Method (CPM)
- Program Evaluation and Review Technique (PERT)

Variations and combinations of the above

Many available software packages contain these tools
Gantt Chart

Durations explicitly listed on the left
The critical path is in red
The slack is the black lines connected to non-critical activities
Diamonds used to mark milestones
Can mark progress along the bars by highlighting fraction complete
\textit{e.g.}, cross-hatching
Critical Path Method (CPM)

• Uses a network flow diagram to depict the precedence relations among activities (tasks)

• Elements of diagram are directed line segments and nodes

• Facilitates identification of activities whose timely completion are “critical” to timely completion of the project
- A precedes D
- A and B precede E
- B and C precede F

- An activity is an ongoing effort on a project task (directed line segment). Consecutive activities connected by events.

- Every activity has an initiating event and a closing event (nodes). Events consume no time.
Critical Path Method (CPM)

• The critical path is the path of activities from the start event to the finish event for which delay in any activity along that path will delay the project finish.

• For projects with a small number of alternative paths, the critical path can be most efficiently identified by finding the longest of the alternative paths.
Critical Path Method (CPM)

Path | Length
--- | ---
A-B-E-J | 12
A-B-F-G-dummy-J | 13
A-B-F-G-H-K | 19
C-D-E-J | 11
C-D-F-G-dummy-J | 12
C-D-F-G-H-K | 18
C-I-K | 10
Program Evaluation and Review Technique

• Based on Critical Path Method

• Replaces single estimate of activity duration by a probability distribution

• Allows estimate of probability of completing project by a specified time

• First developed by the United States Navy in the 1950s
Program Evaluation and Review Technique

The beta distribution can be used to model events which are constrained to take place within an interval defined by a minimum and maximum value.

- \( t_o \)-optimistic estimate; the shortest time within which this activity can be completed assuming everything goes right. This is the left terminus of the pdf.

- \( t_m \)-the most likely time required to complete the activity. This is the mode of the pdf.

- \( t_p \)- pessimistic estimate; the longest time it will take this activity to be completed assuming everything goes wrong. This is the right terminus of the pdf.

(a) Skewed-left Beta distribution  
(b) Skewed-right Beta distribution
Program Evaluation and Review Technique

\[
t_e = \frac{t_o + 4t_m + t_p}{6}
\]

\[
\sigma^2 = \left(\frac{t_p - t_o}{6}\right)^2
\]

Get distribution over the graph by summing \( t_e \) over the paths.
Oral Communication

• Never underestimate the importance of an oral presentation
• Many decisions are made based on the basis of a presentation

Presentation Design:

1. Tell them what you are going to say.
2. Say it.
3. Tell them what you just said.
Oral Communication: Preparation

• Rehearse, rehearse, rehearse...
• Do not exceed available time!
• Become aware of your crutch words

On the average, a picture is worth a thousand words
  – A poorly executed picture can be detrimental

Text in visual aids
  – Each slide should only one idea
Oral Communication: Delivery

- Speak clearly and slowly
- Maintain eye contact
  - But do not fixate on a single person
- As a guideline allow one minute per slide
  - Figure out your “style”
- Presentation Zen, Guy Kawasaki
  - Good video: Authors@Google: Garr Reynolds
- Watch TED talks
THE SHRINKING FAMILY DOCTOR
In California

Percentage of Doctors Devoted Solely to Family Practice

<table>
<thead>
<tr>
<th></th>
<th>1964</th>
<th>1975</th>
<th>1990</th>
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<tbody>
<tr>
<td>27 %</td>
<td></td>
<td>16.0 %</td>
<td>12.0 %</td>
</tr>
</tbody>
</table>

1: 2,247 RATIO TO POPULATION
8,023 Doctors

1: 3,167
6,694

1: 4,232
6,212

Darrell Huff’s
“How to lie with statistics.”
Visual Displays

Edward Tufte has a series of books. The first is “The Visual Display of Quantitative Information”