• Lecture #3
  – Pictorials
  – Visualization
  – Coded Plans
  – Rotation Exercises
Announcement

- Course website is www.me.berkeley.edu/e28
- Lecture slides
  - Do not print in Lab, do it at home
H.W. Assignment #2

• Copy four drawings, downloaded from website, into CAD
  – Place dimensions on a separate layer, red color
  – 4 sheets, 1 drawing per sheet
  – Sketch the indicated pictorial

• Due on Wednesday
“3D” Pictorials

- Advantages: Conveys information quickly
- Disadvantages: Distorted, cannot be scaled
- Types
  - Oblique
  - Isometric
  - Perspective
A Multi-view Drawing
Oblique Drawings

30 or 45 deg
Oblique Drawings
Isometric Drawings

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Isometric Drawings
Perspective Drawings

- Offer the most realistic rendition: things further away look smaller.
- Easy to construct with CAD.
- Parallel lines converge to a vanishing point.
- Can have 1, 2, or 3 vanishing points
Perspective Drawing
Pictorials

Multi-view

Isometric

Oblique

Perspective (2 pt.)
Back to Visualization...
Types of Spatial Skills

• Spatial Perception
  – Ability to identify horizontal and vertical

• Spatial Visualization
  – Ability to mentally transform (rotate, translate, mirror, twist, fold invert) 3-D objects

• Mental Rotations
  – Ability to mentally rotate different objects the same way
Types of Spatial Skills

• Spatial Relations
  – Ability to visualize the relationship between two objects in space

• Spatial Orientation
  – Ability to determine one’s own location and orientation in space
Why Learn Visualization Skills?

- Important for success as an engineer
- Most designs are 3-D, not 2-D
- Important for engineering graphical communication
- Most drawings and plans are multiple 2-D representations of a 3-D object or structure
- Must be able to mentally re-create and manipulate that 3-D structure
- Sketching and visualization have been shown to be important parts of the creative process
Something a bit more basic...

- Simple assessment tests
Spatial Reasoning Ability?
Spatial Reasoning Ability?
Spatial Reasoning Ability?

A is rotated to C

As B is rotated to D
Spatial Reasoning Ability?
Skill Levels

• Simple (2-D)
  – Differences in pictures
  – Shape sorters, different pegs and different holes

• Second Stage (3-D)
  – Mental rotation of objects in space
  – Trajectories in space

• Advanced (3-D, volume with measurement)
  – Transformation of 3-D shapes and volumes
  – Scoops to fill an oddly shaped volume
Developing Visualization Skills

• We all have it, more or less
• Like development of athletic ability
• Some are born with a bit more than others
• The more you use and practice, the better you get
• Lack of any formal training in schools
• The next week or two will be dedicated towards exercising visualization skills
Developing Visualization Skills

- Experience with 3-D fabrication or repair
- Sports
- Legos and the like
- Some video games
- Sketching, 3-D pictorials (not 2-D)
  - Rotation exercises
  - Reflection exercises
  - Symmetry exercises
Coded Plans

CODING PLAN IN
2-D SPACE
Coded Plan in 2-D Space

Coded Plan in 3-D Space

Building from Coded Plan

Isometric Sketch from Coded Plan
Labeled Corners

CODED PLAN IN 2-D SPACE
Corner Views

Coded Plan in 2-D Space
Mental Rotation Test

• Diagnostic tool
  – Won’t affect your grade

• Lack of practice with spatial reasoning can make this class more challenging
  – Techniques can be easily learned
Mental Rotation Test

- Sample problem # 1 (40 seconds)
Mental Rotation Test

• Sample problem #1

[Diagram showing mental rotation of 3D shapes]
Mental Rotation Test

• Sample problem # 2 (40 seconds)
Mental Rotation Test

• Sample problem #2

[Diagram showing a figure labeled A6 to be rotated to the figure labeled E]
Mental Rotation Test

- Sample problem # 3 (40 seconds)
Mental Rotation Test

• Sample problem #3
Mental Rotation Test

• Sample problem # 4 (40 seconds)
Mental Rotation Test

- Sample problem #4
Mental Rotation Test

• Sample problem # 5 (40 seconds)
Mental Rotation Test

• Sample problem # 5
Mental Rotation Test

- Sample problem # 6 (40 seconds)
Mental Rotation Test

• Sample problem # 6
• Questions?

End