Elements of Estimation and Engineering Design
Playtesting!

Something your team learned...
Semester workflow

Three ideas presentation
March 7
3 ideas per team

Sketch model review
March 21-23
2 concepts, 4 models

Mockup Review
April 18
1 concept, 2 models

Final PLAYsentations
May 15
1 final prototype
All 4 sketch models to be reviewed in lab!

Sketch Model Critique!

Three ideas presentation
March 7
3 ideas per team

Sketch model review
March 21-23
2 concepts, 4 models

Mockup Review
April 18
1 concept, 2 models

Final PLAYsentations
May 15
1 final prototype
What is the concept?
What is the question you’re trying to address with your sketch model?
How does your model answer those questions?
What did you learn in play testing?

Sketch Model Critique!
Design Critique!

More show, less tell
Design Critique!

More show, less tell
play!
Using the Review to your Advantage

Informal, but prepare!

Revise your sketch model based on the BCM playtesting

Short overview (but quick)

Have a plan. If reviewers don’t have questions, prompt your own

It’s OK to not know!
Questions?

Sketch Model
Design Critique!
To the PDL! (and beyond)

PDL today:
Camel
Crocodile
Goose
Hedgehog
Hippo
Koala
Llama
Lobster

Lecture today:
Meerkat
Moose
Narwhal
Ostrich
Tiger
Panda
Squid
T-Rex

Meet in (3-370) on Wednesday!
Modeling is Estimation
Estimation in Toy Design!

LOOW!
Estimating Julie’s Output

\[ F_{\text{downhill}} = m_{\text{Julie}} \times g \times \sin \theta \]

\[ F_g = m_{\text{Julie}} \times g \]

\[ P_{\text{Julie,uphill}} = F_{\text{downhill}} \times v_{\text{Julie}} \]

\[ P_{\text{Julie,uphill}} = 17 \text{ W} \]

\[ \theta = 5^\circ \]

\[ m_{\text{Julie}} = 20\text{kg} \]

\[ v_{\text{Julie}} = 1 \text{ m/s} \]

Way less than 100W!
What does 17W feel like?

\[ P_{Julie,\text{uphill}} = F_{\text{downhill}} \times v_{Julie} \]

\[ F_{\text{downhill}} = 17 N \]

\[ P_{Julie,\text{uphill}} = 17 W \]

\[ v_{Julie} = 1 \text{ m/s} \]
What does 100W feel like?

\[ P_{\text{Julie, uphill}} = F_{\text{downhill}} \times v_{\text{Julie}} \]

\[ F_{\text{downhill}} = 100N \]
Team Estimation Game

How many Prudential Centers fit lying down across the Harvard Bridge?

What is the cost per popcorn kernel at the movie theatre?

How much energy does it take to brush your teeth (manually)?

Can you power a mechanical bull in your house on a standard wall outlet?

How long will it take to heat a hot dog with an Easy Bake Oven?
Team Estimation Game

How many Prudential Centers fit lying down across the Harvard Bridge?

What is the cost per popcorn kernel at the movie theatre?

How much energy does it take to brush your teeth (manually)?

Can you power a mechanical bull in your house on a standard wall outlet?

How long will it take to heat a hot dog with an Easy Bake Oven?
I know you're with the grammar police, but who's that guy?

He's the corrections officer...

Engineering Design Terminology
Popular Mistakes Game!
nut vs. washer

A nut is a threaded fastener used with a bolt.

A washer is a ring with a hole used for distributing a load and sometimes spacing.
Popular Mistakes Game!

- nut vs. washer
- tap vs. die

A **die** is a tool used to cut threads on a shaft.
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw

**bolts** are externally threaded fasteners designed for insertion through holes tightened with a nut. They require a through hole or a tapped hole.

**screws** are shafts, typically tapered, with a helical groove or thread formed on its surface. They require a pilot hole.
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw
- milling vs. turning

Milling is like drilling but can cut in the sideways directions too.

Turning is machining cylindrical parts on a lathe.
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw
- milling vs. turning
- chamfer vs. fillet vs. round

**chamfer** is a beveled edge connecting two surfaces.

**fillet** is the rounding of an interior edge.

**round** is the rounding of an exterior edge.

not filet!
Popular Mistakes Game!

nut vs. washer
tap vs. die
bolt vs. screw
milling vs. turning
chamfer vs. fillet vs. round
bevel vs. bezel

a bevel is a face detail of a product

a bezel is also an engraved, flattened side of a ring

a bezel is a groove holding the cover of a product in position
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw
- milling vs. turning
- chamfer vs. fillet vs. round
- bevel vs. bezel
- boss vs. boss vs. boss

**boss** is a protruding feature on a work piece

**boss** means supercool, fly, or awesome to the max

**boss** is a not fun teammate

I'm not bossy, I just know what you should be doing.
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw
- milling vs. turning
- chamfer vs. fillet vs. round
- bevel vs. bezel
- boss vs. boss vs. boss
- flange vs. collar

A **flange** is a protruding rim of an object.

A **collar** is an added rim around an object.
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw
- milling vs. turning
- chamfer vs. fillet vs. round
- bevel vs. bezel
- boss vs. boss vs. boss
- flange vs. collar
- standoff vs. standoff

A standoff is used to raise PCBs off of a surface.
Also a standoff...
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw
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A standoff is used to raise PCBs off of a surface.
Popular Mistakes Game!

- nut vs. washer
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- flange vs. collar
- standoff vs. standoff
- parting line vs. parting line

A parting line is where two halves of a mold meet.

A parting line is a line whose main action is to part.
Popular Mistakes Game!

nut vs. washer

inexpensive vs. cheap

tap vs. die

cheap includes a low quality connotation

bolt vs. screw

inexpensive means relatively low cost for the product

milling vs. turning

bevel vs. bezel

boss vs. boss vs. boss

flange vs. collar

standoff vs. standoff

parting line vs. parting line

inexpensive vs. cheap
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
- bolt vs. screw
- milling vs. turning
- chamfer vs. fillet vs. round
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- boss vs. boss vs. boss
- flange vs. collar
- standoff vs. standoff
- parting line vs. parting line
- inexpensive vs. cheap
- engine vs. motor

**engines** produce kinetic energy from a fuel source

**electric motors** convert electricity into mechanical motion
Popular Mistakes Game!

- nut vs. washer
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- bevel vs. bezel
- boss vs. boss vs. boss
- flange vs. collar
- standoff vs. standoff
- parting line vs. parting line
- inexpensive vs. cheap
- engine vs. motor
- silicone vs. silicon

**silicone** is a manmade rubber-like polymer

**silicon** is an element that makes up sand and is used to make semiconductor wafers
there are many metals which are basic elements

steel is a metal alloy of iron and carbon
Popular Mistakes Game!

- nut vs. washer
- tap vs. die
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- milling vs. turning
- chamfer vs. fillet vs. round
- bevel vs. bezel
- boss vs. boss vs. boss
- flange vs. collar
- standoff vs. standoff
- parting line vs. parting line
- inexpensive vs. cheap
- engine vs. motor
- silicone vs. silicon
- metal vs. steel

**stiffness** how a material deforms when loaded

**strength** refers to materials ability to withstand load without failure

**toughness** is the amount of energy per volume before failure, or resistance to fracture

**stiff vs. strong vs. tough vs. swole**
Toy-pardy!
What does the moose say?
What does the meerkat say?
What does the narwhal say?
What does the panda say?
What does the Tiger say?
What does the Ostrich say?
What does the t-Rex say?
What does the Squid say?
Toy-pardy!
Vote on Blade boxes

**BABY BLUES** by Rick Kirkman & Jerry Scott

Assembly Instructions

**STEP 1**
Obtain a master’s degree in mechanical engineering from M.I.T.

**STEP 2**

UH-OH...

SHOULD I PUT ON SOME MORE COFFEE?