BRAINSTORMING

## The first step in the engineering design process

Elissa Ledoux and Nicholas Matta, 2024
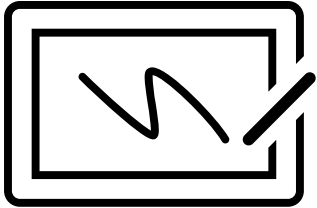
What is Brainstorming?

- (ger): generating a set of creative ideas to solve problems

- Start judgement-free, then evaluate to narrow solution set
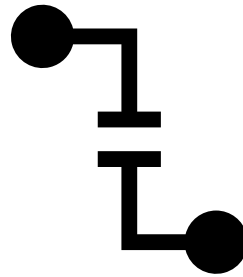
Benefits of Brainstorming

- Produce solutions

- Organize ideas

- Enhance creativity

- Improve problem-solving skills

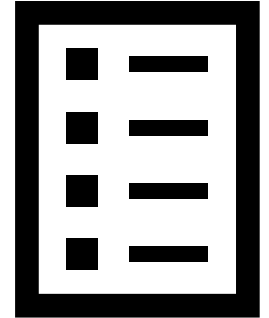- Foster teamwork and collaboration

- Build confidence
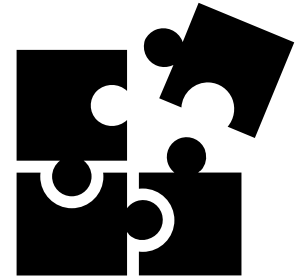
Brainstorming Techniques
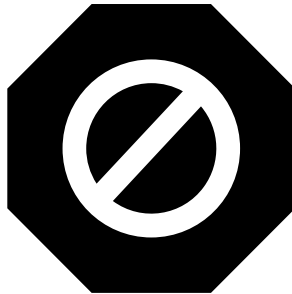
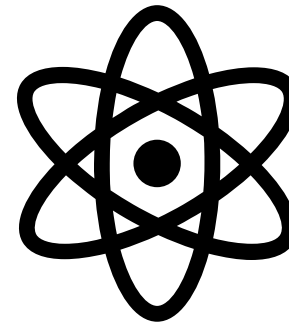**FREEWRITING**   **ANALOGIES**   **SWOT ANALYSIS**

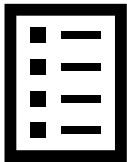**REVERSE BRAINTORMING**   **MIND MAPPING**

Brainstorming Activity 1: Team Name

- Think of team names individually

- Write down all ideas that come to mind

- Think of slogans if you have more time

- Discuss as a team

Brainstorming Time

Quietly write down all your team name and slogan ideas.
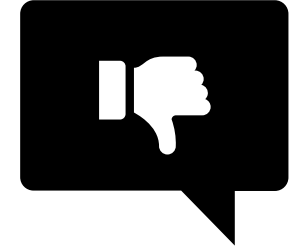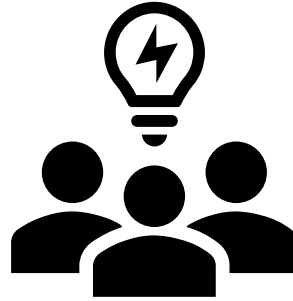
Team Meeting Time

Share and discuss ideas
Collect input from everyone
Vote on favorite team name

Brainstorming Activity 2: Project

Think about solution mechanisms individually
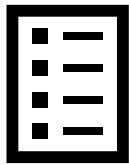
• Write down all ideas for the project that come into your head
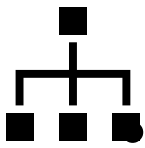
Separate by subsystems

Discuss as a team
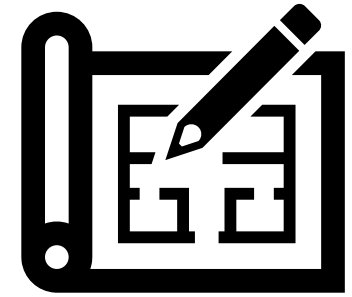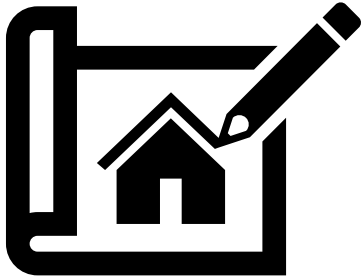
Brainstorming Time

Quietly sketch/write down all your design ideas.
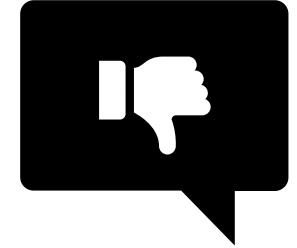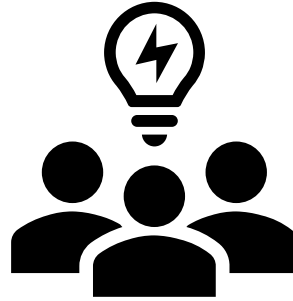
Team Meeting Time

Share and discuss all brainstorm ideas

Choose top 3 for next activity

Design Decision Matrix

- Organized method for making design decisions

0) Sketch and describe each design

1) List important attributes of the design (cost, complexity, manufacturability, feasibility, originality, efficiency, prior experience, ease of integration, durability, modularity, time to build...)

2) Weight each attribute

3) Rate each idea on each attribute

4) Find the weighted scores for each idea

5) Calculate the total score for each idea

Example: *What should I eat for supper?*

1) List important attributes of the design (cost, complexity, manufacturability, feasibility, originality, efficiency, prior experience, ease of integration, durability, modularity, time to build...)

Attribute	Weight	Beans, rice, vegetable	Salad	Ice cream	Cereal
Taste (delicious scores higher)					
Nutrition (healthy higher)					
Cost (cheaper scores higher)					
Prep time (faster scores higher)					
Weighted Total (Max 10)					

Example Decision Matrix

2) Weight each attribute

- Fraction of your design decision influenced by each factor
- Total weight should add to 1.00 (100%)
- Higher weight means more importance

Attribute	Weight	Beans, rice, vegetable	Salad	Ice cream	Cereal
Taste (delicious scores higher)	0.25				
Nutrition (healthy higher)	0.25				
Cost (cheaper scores higher)	0.30				
Prep time (faster scores higher)	0.20				
Weighted Total (Max 10)	1.0				

Example Decision Matrix

3) Rate each idea on each attribute

- Write in the top left triangle of each score box
- Rate the designs 0 – 10 in each category (10 = best, 0 = worst)
- Ok if some criteria have matching ratings

Attribute	Weight	Beans, rice, vegetable	Salad	Ice cream	Cereal
Taste (delicious scores higher)	0.25	8	5	10	8
Nutrition (healthy higher)	0.25	10	10	2	6
Cost (cheaper scores higher)	0.30	9	4	8	9
Prep time (faster scores higher)	0.20	2	3	10	9
Weighted Total (Max 10)	1.0				

Example Decision Matrix

4) Find the weighted score for each idea

- Multiply original rating * weight
- Write in the bottom right triangle of each box

Attribute	Weight	Beans, rice, vegetable		Salad		Ice cream		Cereal	
Taste (delicious scores higher)	0.25	8	2	5	1.25	10	2.5	8	2
Nutrition (healthy higher)	0.25	10	2.5	10	2.5	2	0.5	6	1.5
Cost (cheaper scores higher)	0.30	9	2.7	4	1.2	8	2.4	9	2.7
Prep time (faster scores higher)	0.20	2	0.4	3	0.6	10	2	9	1.8
Weighted Total (Max 10)	1.0								

Example Decision Matrix

5)   Calculate the total score for each idea

- Sum all weighted scores in that column

- Max possible score is 10

- Highest scoring idea wins

Attribute	Weight	Beans, rice, vegetable		Salad		Ice cream		Cereal	
Taste (delicious scores higher)	0.25	8	2	5	1.25	10	2.5	8	2
Nutrition (healthy higher)	0.25	10	2.5	10	2.5	2	0.5	6	1.5
Cost (cheaper scores higher)	0.30	9	2.7	4	1.2	8	2.4	9	2.7
Prep time (faster scores higher)	0.20	2	0.4	3	0.6	10	2	9	1.8
Weighted Total (Max 10)	1.0	7.6		5.55		7.4		8	