Decision Matrix

Contents

- Understand Decision Matrix
- Identify Conceptual Design.
- Identify Design Criteria.
- Reminder on Representing each stage of the design process.

Decision Matrix

- If you have several conceptual ideas, then the decision matrix helps you to select the best one, based on multiple evaluation criteria
- The conceptual ideas are rated against criteria the designer decides as relevant to the task.
- Conceptual Ideas go on the rows
- Design Criteria on the columns

Decision Matrix

- The designer decides on importance ratings for each design criteria.
- E.g. 3 Criterias: Long, Fast, Strong
- Long – 35%
- Fast is very important so 50%
- Strong is the least important so 15%
- All criteria weightings must add up to 100%
- This is just an example! You have to come up with your own criteria.

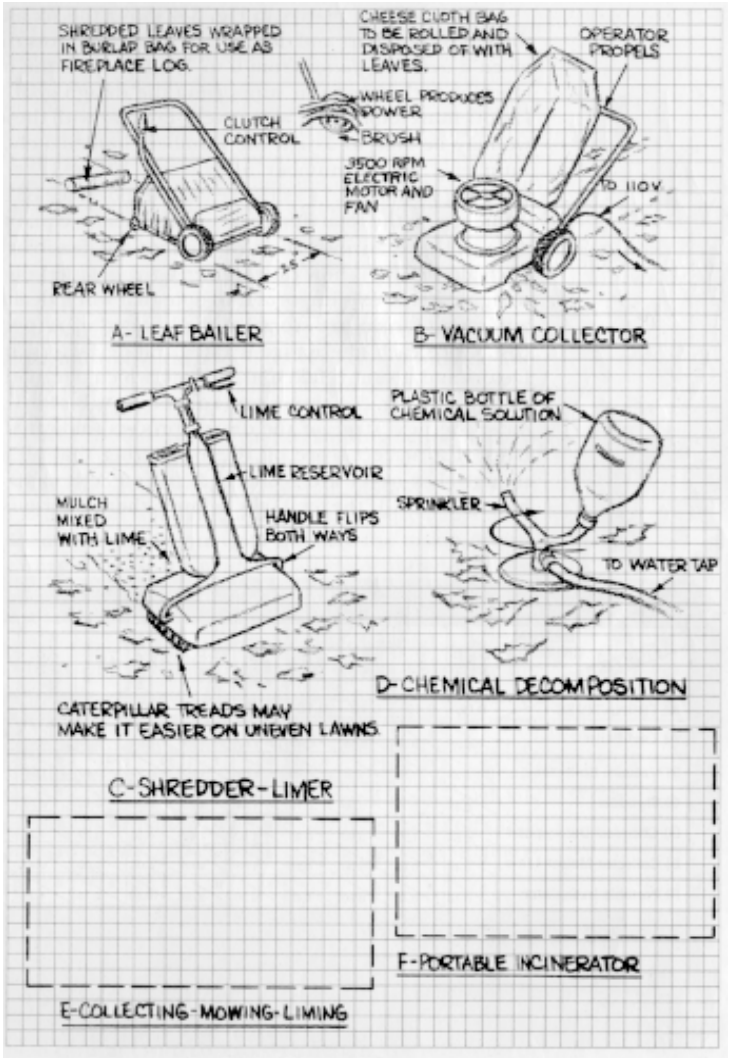
Decision Matrix - Example

- **This example studies several concepts for a garden leaf remover – to remove leaves that have fallen from trees in a garden. Here are the design criteria… The designer decides on this.**

• **Use of standard parts**	**8%**
• **Safety**	**12%**
• **Simplicity and maintenance**	**10%**
• **Durability**	**10%**
• **Public Acceptance**	**18%**
• **Reliability**	**20%**
• **Performance**	**15%**
• **Cost to develop**	**3%**
• **Cost to buyer**	**4%**

Concepts for the Leaf Remover

- So the designer comes up with six conceptual ideas. Which one is better?
- This is where the decision matrix is used.
- For each concept, the designer tries to see how well it achieves each design criteria on a rating from 1 to 10.
- So for example the leaf bailer can be 5 out of 10 safe whereas the vacuum collector can be 10 out of 10 safe and for a portable incinerator 4 out of 10 and so on.



Decision Matrix

Conceptual Design ideas

Design Criteria

Sum of (R.F x W.F) highest number is the best design concept

DESIGN CRITERIA / WEIGHTING FACTOR / ALTERNATIVES	USE OF ST'D PARTS	SAFE	SIMPLICITY AND MAINT.	DURA-BILITY	PIBLIC ACCEPT.	RELIA-BILITY	COST TO DEVELOP	COST TO BUYER	PERFORM-ANCE	SUM
	0.08	0.12	0.10	0.10	0.18	0.20	0.03	0.04	0.14	1.0
A) Leaf Bailer	3 / 0.24	5 / 0.60	2 / 0.20	4 / 0.40	9 / 1.62	6 / 1.20	1 / 0.03	1 / 0.04	3 / 0.45	4.78
B) Vacuum Collector	9 / 0.72	10 / 1.20	10 / 1.00	8 / 0.80	6 / 1.08	7 / 1.40	10 / 0.30	10 / 0.40	8 / 1.24	8.14
C) Shredder	5 / 0.40	6 / 0.72	7 / 0.70	7 / 0.70	/ 1.44	6 / 1.20	3 / 0.09	4 / 0.16	5 / 0.75	6.16
D) Chemical Decomposer	8 / 0.64	10 / 1.20	9 / 0.90	8 / 0.80	9 / 1.62	7 / 1.40	2 / 0.06	8 / 0.32	8 / 1.24	8.18
E) Collector-Mower-Lime	6 / 0.48	8 / 0.96	3 / 0.30	2 / 0.20	6 / 1.08	4 / 0.80	2 / 0.06	2 / 0.08	6 / 0.90	4.86
F) Portable Incinerator	5 / 0.40	4 / 0.48	8 / 0.80	6 / 0.60	5 / 0.90	10 / 2.00	3 / 0.09	4 / 0.16	9 / 1.35	6.78

Weighting Factor (W.F.) = Measure of Relative Importance (0 to 1.0 Σ = 1.0)

Rating Factor (R.F.) = Measured Value of Alternatives Against Design Criteria (0 to 10)

Rating for each concept against the design criteria (R.F)

R.F. x W.F.
e.g. 0.12x4 = 0.48

Decision Matrix

- So the chemical decomposer is 8.18 and the vacuum collector is 8.14. These are the two highest final ratings and as they are very close, either of these designs will do.
- Possibly seeing ways to integrate the two designs to get the best of both is also an idea.
- Remember there is no right or wrong, a lot of this is based on the designer's decisions.

Decision Matrix

- **Design decisions should be based on analysis and logic, not personal opinion.**
- **A decision matrix is a design tool that may be used multiple times throughout a design process.**

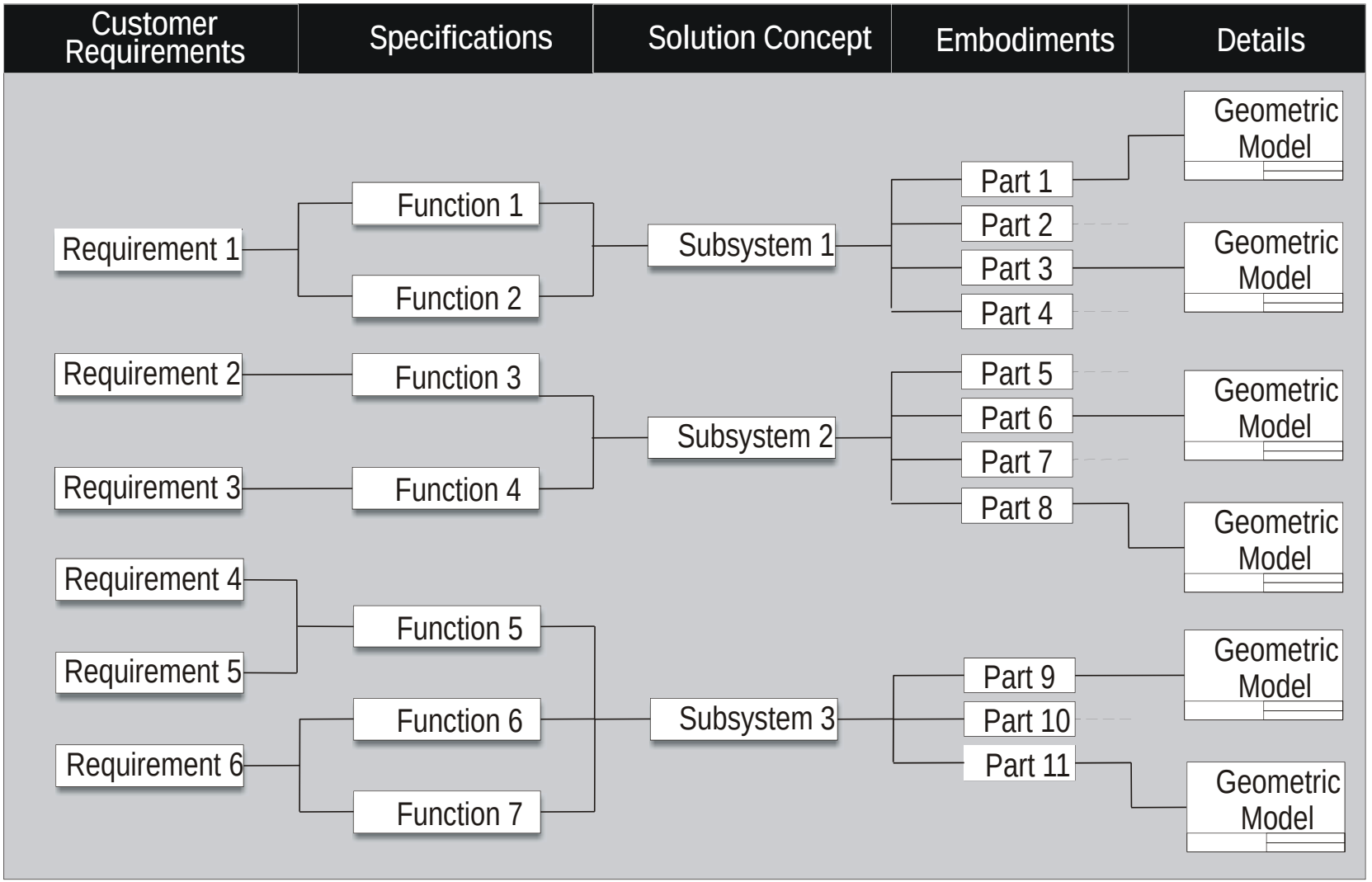
Pugh's Concept Evolution Method

Aimed at selecting a solution concept, based on multiple evaluation criteria and to combine good features to develop a better concept.

+ better, - wrose, s same

Criteria	 Concept 1	 Concept 2	 Concept 3	 Concept 4	 Concept 5	 Concept 6
Ease of use	DATUM	+	+	-	-	S
Aesthetic appeal		-	+	+	-	-
Manufacturability		+	+	-	+	+
Low weight		+	-	+	-	+
Energy efficiency		S	+	-	+	+
Safety		-	+	S	-	+
Σ+		3	5	2	2	4
Σ-		2	1	3	4	1
ΣS		1	0	1	0	1
Net Score	0	1	4	-1	-2	3
Rank	4	3	1	5	6	2
Continue or combine?	Combine	Combine	Yes	No	No	Yes

Representing Each Stage



Term Project - Design Project

Development of an Engineering Product

Select a product or a project that you face in daily base and you think it is ethically problematic. Work with your team members (company) on modifying the project to enhance functionality and energy saving. Use systematic design process (first level QFD) to come with a modified design.

Criteria of evaluation depends on proper way addressing:

- **Design process.**
- **Ethical dilemma and issues.**
- **Team collaboration.**

Term Project Structure

- **Design part:** Apply the design process starting with stakeholders until you come up with minimum three concepts. One of the design concepts could be current method used in cleaning high rise building. The design part needs to include the following:
  a) Requirements
  b) Specifications (recommended to show function tree)
  c) Conceptual Design (QFD and DM)
  d) Embodiment Design
  e) Detailed Design (No need)

- **Ethic part:** Evaluate the highest two conceptual design you have developed in the design part. Choose one of these design based on moral basis by creating the following steps:
  a) Ethical Dilemma: select proper design based on moral basis
  b) Relevant Facts: for the highest two conceptual design
  c) Involved Parties/factors: list the parties
  d) Relevant code of ethics: Use NSPE
  e) Moral framework: Select two frameworks that support your moral decision.

- **Conclusion:** Indicate the Designer selection and the Ethic Engineer selection (indicate if they will agree on one design or not)


QUESTIONS
And
Answers