

Collaborative Engineering

Concept Evaluation: AHP Technique



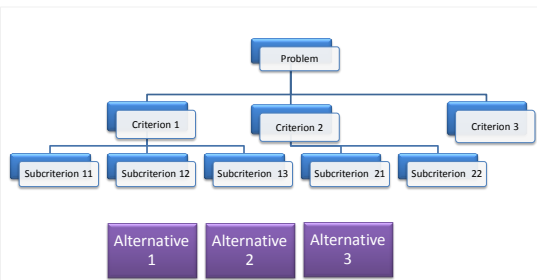
- Evaluation Criteria
- Analytical Hierarchy Process
- Alternative Comparison
- Best alternative

OrthoCAD Lab, I.I.T. Bombay

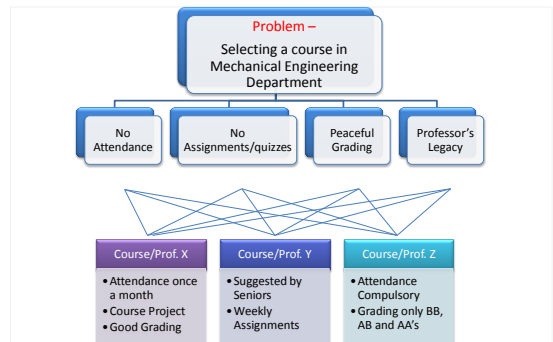
Analytic Hierarchy Process (AHP)

- **Idea**
 - Method for evaluating alternatives
 - Based on relative importance
- **Method**
 - Formulate
 - State the Objective
 - Define the Criteria
 - Identified based on Functional Requirements
 - Pick the Alternatives
 - Calculate
 - Relative Importance of one criterion over another

Formulating the AHP tree

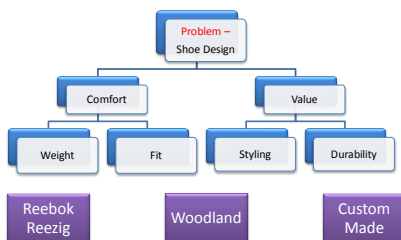


AHP – Example 1



AHP – Example 2

- **Shoe Design:** To compare 3 different type of shoes
- Hierarchal criterions



Assigning Weights to Evaluation Criteria's

	C1	C2	C3	C4	C5	C6	Total	Normalized
C1								
C2								
C3								
C4								
C5								
C6								

- Assigning weights to criteria's
- Comparing alternatives w.r.t. each criteria
- Evaluating sum total of each alternative and finding best

Weight Assigning System

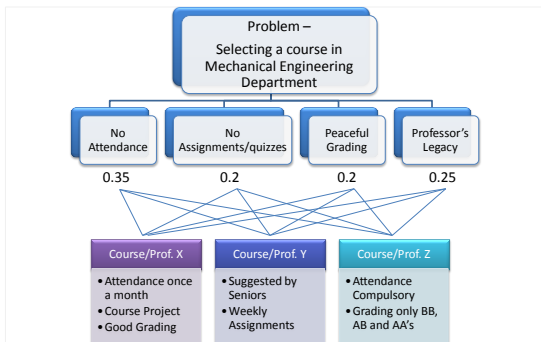
Intensity of importance	Definition	Explanation
1	Equal Importance	Activities contribute equally
3	Moderate Importance	Experience and judgment slightly favors one
5	Strong Importance	Experience and judgment strongly favors one
7	Very Strong Importance	One is strongly favored and its dominance is evident
9	Extreme Importance	The evidence of one favored over other has highest order of affirmation
2,4,6,8	Intermediate Values	When Compromise is needed
Reciprocals	If activity <i>i</i> has one of the above values assigned to it when compared to activity <i>j</i> , then <i>j</i> has a reciprocal value when compared to <i>i</i>	

Assigning Weights to Evaluation Criteria's

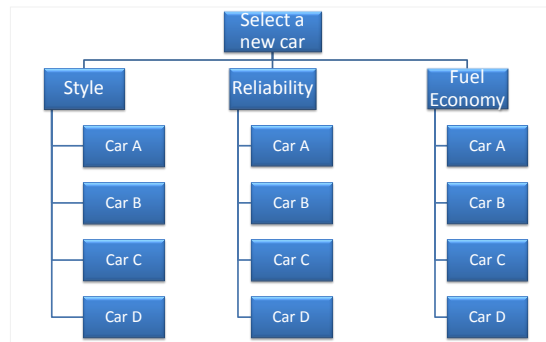
	C1	C2	C3	C4	C5	C6	Total	Normalized
C1	1	4	3	3	3	3	17	0.35299
C2	0.25	1	3	1	1	1	7.25	0.15054
C3	0.33	0.33	1	1	0.33	1	4	0.083056
C4	0.33	1	1	1	0.25	3	6.58	0.136628
C5	0.33	1	3	1	1	3	9.33	0.193729
C6	0.33	1	1	0.33	0.33	1	4	0.083056

- Assigning weights to criteria's
- Comparing alternatives w.r.t. each criteria
- Evaluating sum total of each alternative and finding best

AHP – Example 1



AHP – Example 3



AHP – Example 3

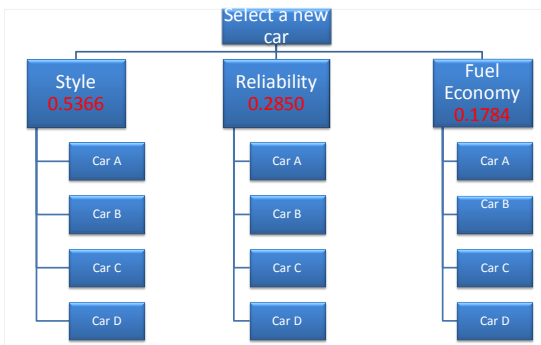
- Use Pairwise comparison to express the relative importance of one criterion over another
- 1 equal 3 moderate 5 strong 7 very strong 9 extreme

	Style	Reliability	Fuel Economy
Style	1/1	4/1	3/1
Reliability	1/4	1/1	3/1
Fuel Economy	1/3	1/3	1/1

AHP – Example 3

	Style	Reliability	Fuel Economy	Total	Normalized
Style	1	4	3	8	0.5366
Reliability	0.25	1	3	4.25	0.2850
Fuel Economy	0.33	0.33	1	2.66	0.1784

AHP – Example 3

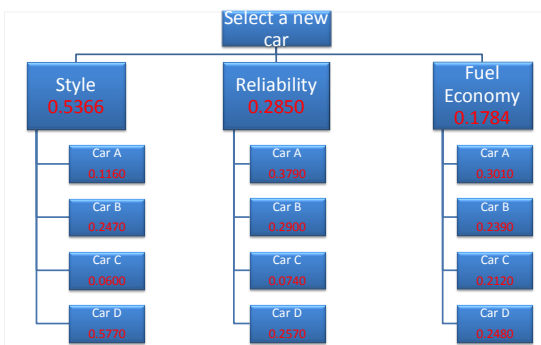


AHP – Example 3

Style

	Car A	Car B	Car C	Car D	Total	Normalized
Car A	1/1	1/4	4/1	1/6	5.416	0.1160
Car B	4/1	1/1	4/1	1/4	9.25	0.2470
Car C	1/4	1/4	1/1	1/5	1.7	0.0600
Car D	6/1	4/1	5/1	1/1	16	0.5770

AHP – Example 3



AHP – Example 3

	Style	Reliability	Fuel Economy	Criteria Ranking	
Car A	0.1160	0.3790	0.3010	0.5366	Style
Car B	0.2470	0.2900	0.2390	* 0.2850	Reliability
Car C	0.0600	0.0740	0.2120		
Car D	0.5770	0.2570	0.2480	0.1784	Fuel Economy

Alternatives	Final Weights
Car A	0.2239
Car B	0.2578
Car C	0.0911
Car D	0.4272

= → Best Car

Summary

- AHP is a structured technique for decision making
- Based on relative importance
- Evaluation Criteria's
 - Identified based on Functional Requirements
 - Hierarchical structure of criteria and alternatives