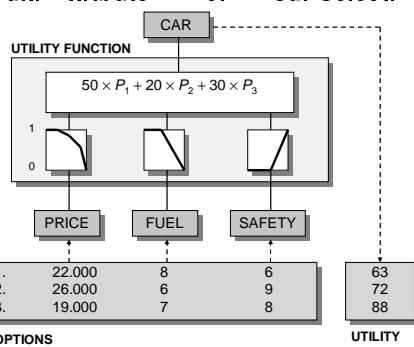


Notes on Aggregation and Utility Functions

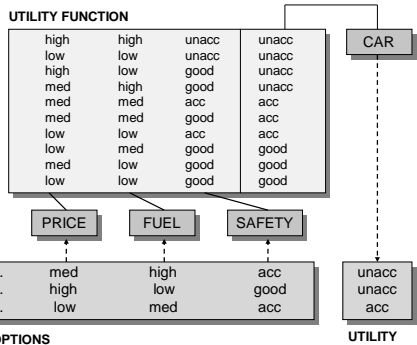
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Quantitative Multi-Attribute Model for Car Selection



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Qualitative Multi-Attribute Model for Car Selection



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Aggregation Functions in Math

$$y = \text{Aggreg}(x_1, x_2, \dots, x_n)$$

$$\text{Aggreg} : [0,1]^n \rightarrow [0,1]$$

Conditions:

1. *Identity when unary:*

$$\text{Aggreg}(x) = x$$

2. *Boundary conditions*

$$\text{Aggreg}(0, \dots, 0) = 0$$

and

$$\text{Aggreg}(1, \dots, 1) = 1$$

3. *Non-decreasing*

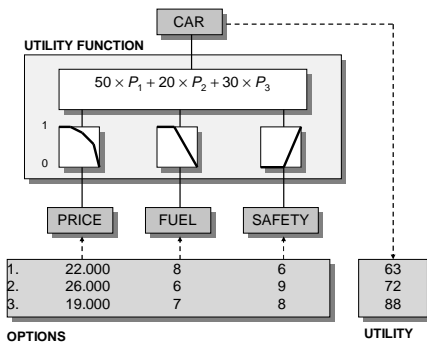
$$\text{Aggreg}(x_1, \dots, x_n) \leq \text{Aggreg}(y_1, \dots, y_n) \text{ if } (x_1, \dots, x_n) \leq (y_1, \dots, y_n)$$

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Utility Functions

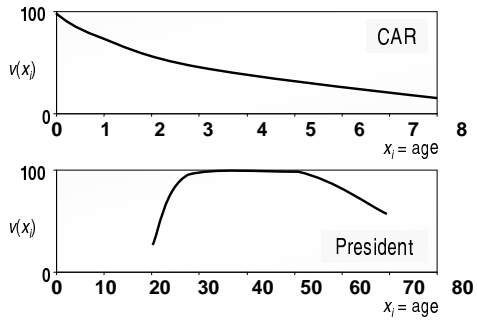
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Quantitative Multi-Attribute Model for Car Selection



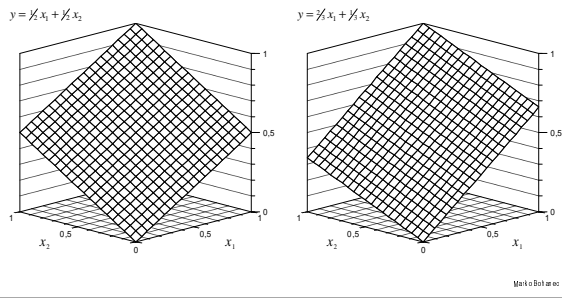
Utility Function of a Single Attribute

Modelling of Preferences

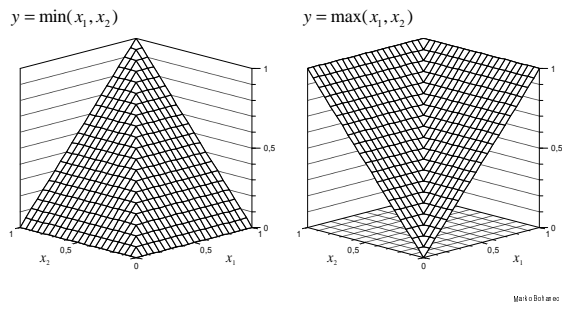


Linear Aggregation Functions

$$y = v(x_1, x_2, \dots, x_n) = \sum_{i=1}^n w_i x_i \quad \sum_{i=1}^n w_i = 1$$



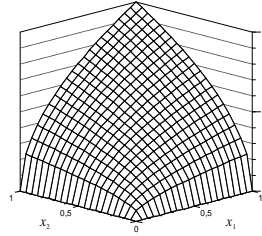
Minimum and Maximum



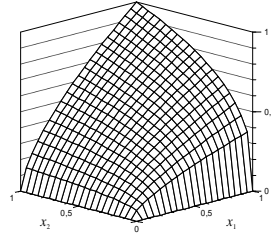
Multiplicative Aggregation Functions

$$y = v(x_1, x_2, \dots, x_n) = \prod_{i=1}^n x_i^{w_i} \quad \sum_{i=1}^n w_i = 1$$

$$y = x_1^r x_2^r$$



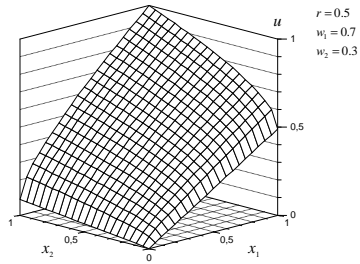
$$y = x_1^r x_2^r$$



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Continuous Logic Functions

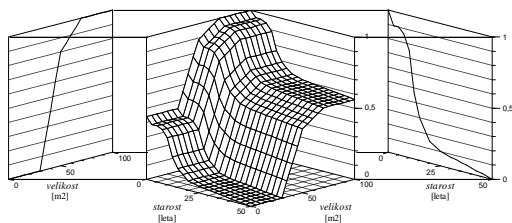
$$y = v(x_1, x_2, \dots, x_n) = \left(\sum_{i=1}^n w_i x_i^r \right)^{1/r} \quad \sum_{i=1}^n w_i = 1$$



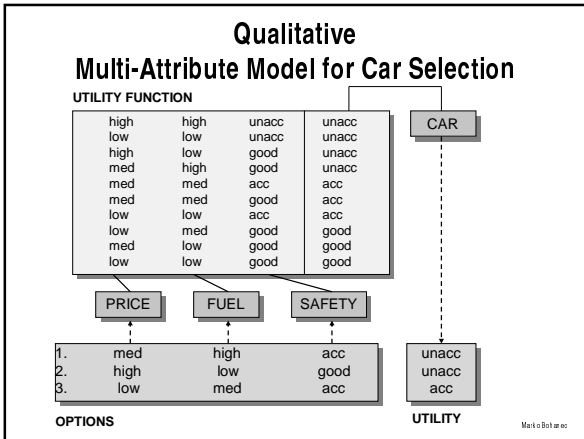
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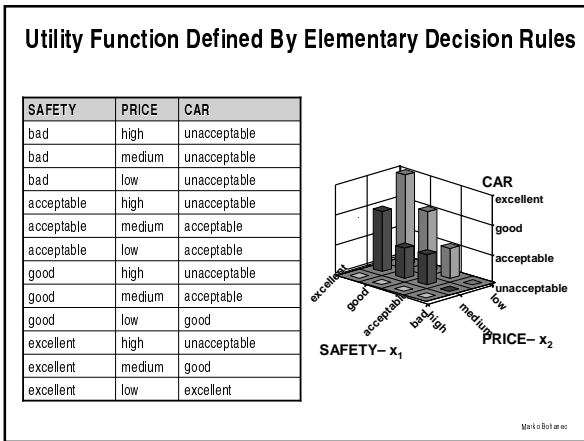
Linear Aggregation of Partial Utility Functions

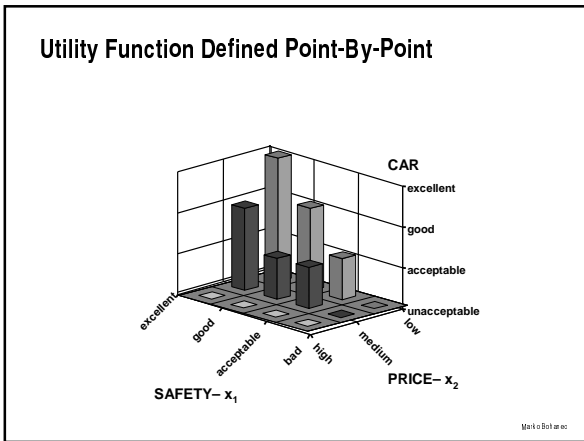
$$y = v(p_1(x_1), p_2(x_2), \dots, p_n(x_n))$$



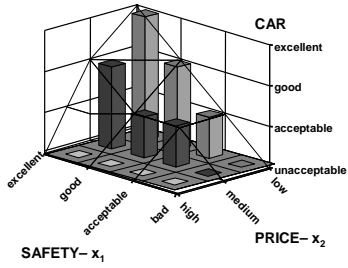
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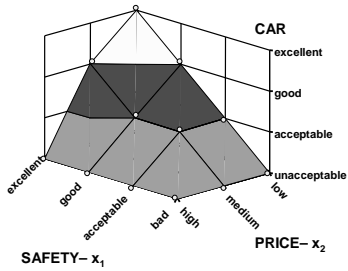


Utility Function Defined Point-By-Point - Interpolated



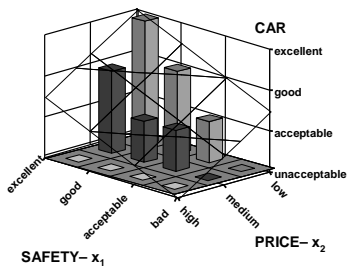
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Non-Linear Aggregation of Attributes



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Utility Function Defined Point-By-Point - Linearised



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