

AHP: Methodology and Software

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AHP

AHP: Analytic Hierarchy Process (Thomas Saaty, 1980)

Characteristics:

- based on multiple attribute hierarchies
- assessing *weights* by a pairwise comparison of *attributes*
- assessing *preferences* by a pairwise comparison of *alternatives*
- consistency analysis

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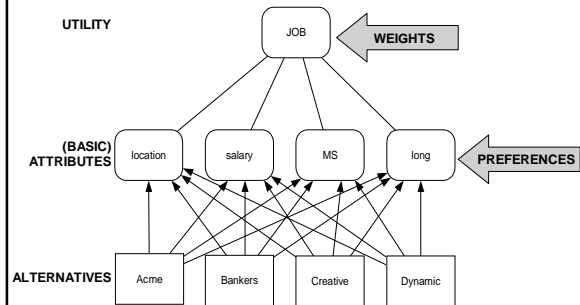
Working Example

One Thursday morning, Charles, instead of attending his Management Science Techniques for Consultants class, was mulling over his four job offers. His offers came from: *Acme Manufacturing*, *Bankers Bank*, *Creative Consulting*, and *Dynamic Decision Making*. He knew that factors such as *location*, *salary*, *amount of management science* (which he loved), and *long term prospects* were important to him, but he wanted some way to formalize the relative importance, and some way to evaluate each job offer.

Adapted from: Michael A. Trick, Analytic Hierarchy Process, <http://mat.gsia.cmu.edu/mstc/multi/ab/nod94.html>

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Hierarchy of Attributes



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Pairwise Comparison Values

- 1 Items *i* and *j* are of equal importance (preference)
- 3 Item *i* is weakly more important (better) than *j*
- 5 Item *i* is strongly more important (better) than *j*
- 7 Item *i* is very strongly more important (better) than *j*
- 9 Item *i* is absolutely more important (better) than *j*

2, 4, 6, 8 are intermediate values

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Assessing Weights

	Location	Salary	MS	Long
Location	1	1/5	1/3	1/2
Salary	5	1	2	4
MS	3	1/2	1	3
Long	2	1/4	1/3	1

1. Normalize the columns so that the sum equals 1
2. Take the average of rows.

	Location	Salary	MS	Long	Average
Location	.001	.102	.091	.059	.086
Salary	.455	.513	.545	.471	.496
MS	.273	.256	.273	.353	.289
Long	.182	.128	.091	.118	.130

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Assessing Preferences (Scores)

For each attribute, e.g., Location, compare alternatives:

	A	B	C	D
A	1	1/2	1/3	5
B	2	1	1/2	7
C	3	2	1	9
D	1/5	1/7	1/9	1

1. Normalize the columns so that the sum equals 1
2. Take the average of rows.

	A	B	C	D	Average
A	.161	.137	.171	.227	.174
B	.322	.275	.257	.312	.293
C	.484	.549	.514	.409	.489
D	.032	.040	.057	.045	.044

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Assessing Preferences (Scores)

Scores for all the attributes:

	A	B	C	D
Location	.174	.293	.489	.044
Salary	.050	.444	.312	.194
M\$.210	.038	.354	.398
Long	.510	.012	.290	.188

Evaluation:

Acme: $(.174)(.086) + (.050)(.406) + (.210)(.280) + (.510)(.130) = .164$

Banks: $(.293)(.086) + (.444)(.406) + (.038)(.280) + (.012)(.130) = .256$

Creative: .335

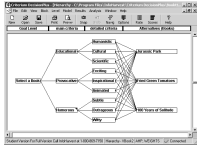
Dynamic: .238

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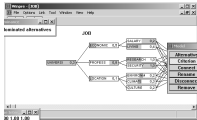
AHP Software

Criterion DecisionPlus

<http://www.infoharvest.com/>



Expert Choice <http://www.expertchoice.com/>



WinPre

<http://www.hut.fi/Units/SAL/Downloads/winpre.html>

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Web-HIPRE Software

<http://www.decisionarium.hut.fi/>

Web-HIPRE slides: <http://www.hut.fi/Units/SAL/Publications/ppi-files/WebHIPRE.ppt>

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Homework

1. Run Web-HIPRE
2. Load one of the existing models (e.g., Cellular Phone)
3. Look at all Web-HIPRE's features for
 - describing alternatives
 - assessing alternatives' preferences and scores
 - assessing attributes' weights
4. Do the following:
 - evaluation of alternatives
 - sensitivity analysis
5. Try to make some changes to the model: structure, preferences, weights (but no need to save)

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