Implementation of an Online Software Tool for the Analytic Hierarchy Process

AHP-OS

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AHP Online Software AHP-OS

Objectives

- Develop a free AHP software tool
- for educational and research purposes
- Methods and algorithms well documented and validated
- Capable to analyze and study AHP projects under different parameters

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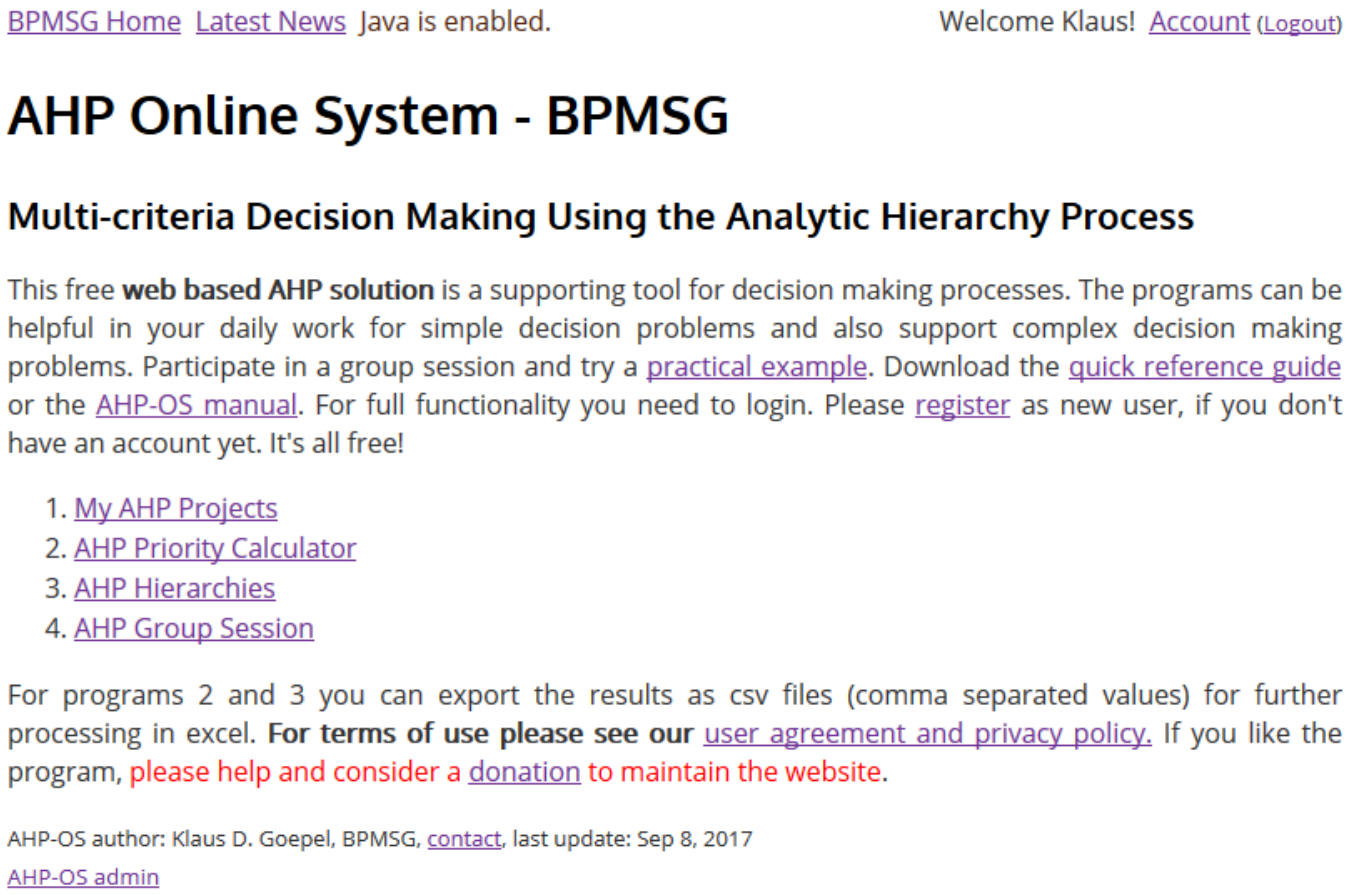
- Web based tool
- Realized in php
- SQL database
- Classical AHP
- Users need to register (free)
- After 3 months Inactive users are removed (deleted)



BPMSG Home Latest News Java is enabled. Welcome Klaus! Account (Logout)

AHP Online System - BPMSG

Multi-criteria Decision Making Using the Analytic Hierarchy Process

This free **web based AHP solution** is a supporting tool for decision making processes. The programs can be helpful in your daily work for simple decision problems and also support complex decision making problems. Participate in a group session and try a practical example. Download the quick reference guide or the AHP-OS manual. For full functionality you need to login. Please register as new user, if you don't have an account yet. It's all free!

1. My AHP Projects
2. AHP Priority Calculator
3. AHP Hierarchies
4. AHP Group Session

For programs 2 and 3 you can export the results as csv files (comma separated values) for further processing in excel. **For terms of use please see our** user agreement and privacy policy. If you like the program, please help and consider a donation to maintain the website.

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AHP-OS admin

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Features (1)

- Flexible definition of decision hierarchies as text input, following a simple syntax with multi-language support using Unicode character coding
- Weight calculation (hierarchy mode) and alternative evaluation (alternative mode) using the AHP eigenvector method
- Pairwise comparison input, highlighting the top-3 most inconsistent judgments
- *A posteriori* application of different AHP judgment scales

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Features (2)

- Group decision making using weighted geometric mean aggregation of individual judgments (WGM-AIJ).
- Group consensus calculation based on Shannon α and β-entropy.
- Weight uncertainty estimation using Monte Carlo simulation
- Sensitivity analysis
- Weighted sum model (WSM) and weighted product model (WPM) for the aggregation of alternatives
- Export of input and result data as comma separated value (CSV) files for further processing or presentation in a spreadsheet program

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- **Hierarchy definition Syntax**

```
<hierarchy> → <branch>; [{<branch>;}]
<branch>    → <node>: <leafs>, <leafs> [,<leafs>]
<leafs>     → {<leaf> [ = <weight>]}
```

- Example

```
AHP-project: Crit-1=0.3, Crit-2=0.7;
Criterion-1: Sub-crit A, Sub-crit B;
Criterion-2: Sub-crit C, Sub-crit D;
```

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- Example Hierarchy

Decision Hierarchy		
Level 0	Level 1	Level 2
優質物業管理主任適任性評量分析-3	行政能力管理構面	發文公告文書資料
		法務(民刑訴訟程序及公寓大廈管理法事務處理)
		住戶溝通應對技巧(客氣和善圓融性)
		會議主持及社區修繕工程等採購
		社區總體營造及規劃(近中遠程規畫
	人格特質管理構面	責任感(對事情承擔責任能耐)
		執行力(執行事情事否撤底)
		抗壓性(面對挫折轉正能量應對)
		創新開創性(接受新知突破事務)
		未來規劃能力(能放眼未來)
	專業能力管理構面	事務機具整合操控能力(故障排除)
		office (word excel Powerpoint 操控)
		財務能力(社區財報會計基本能力)
		安控門禁對講等弱電系統基本認識及故障排除
		機電消防基本認識及故障排除

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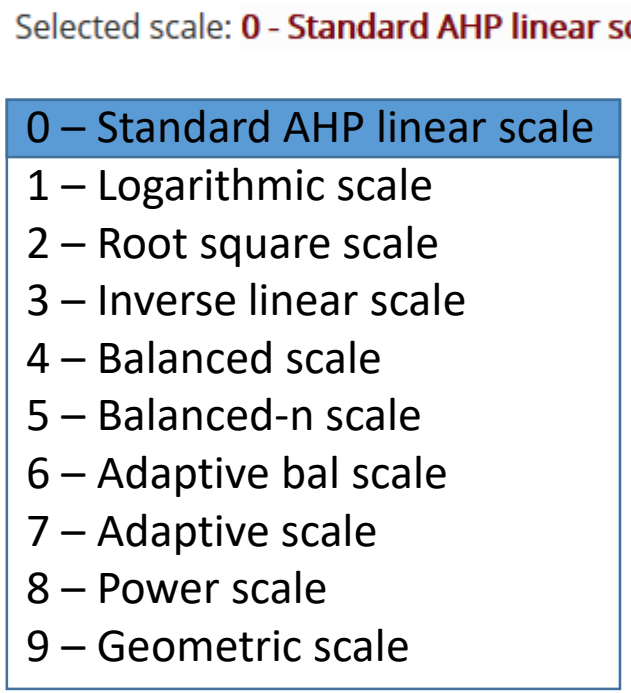
A posteriori application of different AHP Judgment Scales

- AHP fundamental Scale
- Logarithmic, Root Square, Inverse Linear Scale
- Balanced, Generalized Balanced, Adaptive Balanced Scale
- Adaptive, Power and Geometric Scale



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Group decision making and Group Consensus

- Providing a web link to participants
- Aggregation of Individual Judgments
- Consensus using Shannon entropy and its partitioning in α and β-entropy
- Consensus indicator from 0% (no consensus) to 100% (full consensus)
- Consensus categorized in five categories
  1. very low,
  2. low,
  3. moderate,
  4. high and
  5. very high

AHP group consensus: 91.8% very high

Consolidated Decision Matrix

Aggregation of judgments for 2 Participant(s)

	1	2	3	4	5	6	7
1	1	1.00	1.00	0.58	1.00	0.58	1.00
2	1.00	1	1.00	1.00	2.00	0.58	1.41
3	1.00	1.00	1	0.41	1.73	0.50	1.00
4	1.73	1.00	2.45	1	3.46	1.00	3.00
5	1.00	0.50	0.58	0.29	1	0.33	1.00
6	1.73	1.73	2.00	1.00	3.00	1	2.45
7	1.00	0.71	1.00	0.33	1.00	0.41	1

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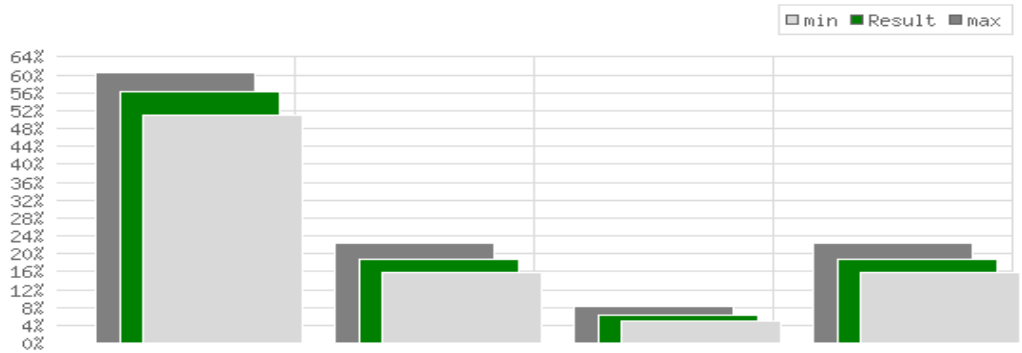
Weight Uncertainties

- Randomized variations (± 0.5) of the original judgments
- Provides estimated weight uncertainties for all criteria or alternatives



Consolidated Priorities

Consistency Ratio CR: 1.4%

	Category	Priority	Rank	(+)	(-)
1	Budget	11.4%	5	3.0%	2.2%
2	Sales Potential	14.4%	3	3.3%	3.1%
3	Market Trend	11.4%	4	2.2%	2.1%
4	Competitive Advantage	23.0%	1	3.2%	3.1%
5	Technical Success	8.0%	7	1.9%	1.3%
6	Commercial Success	22.5%	2	2.9%	3.0%
7	Risk	9.4%	6	2.2%	1.9%

Estimated weight uncertainties based on 1000 judgment variations.

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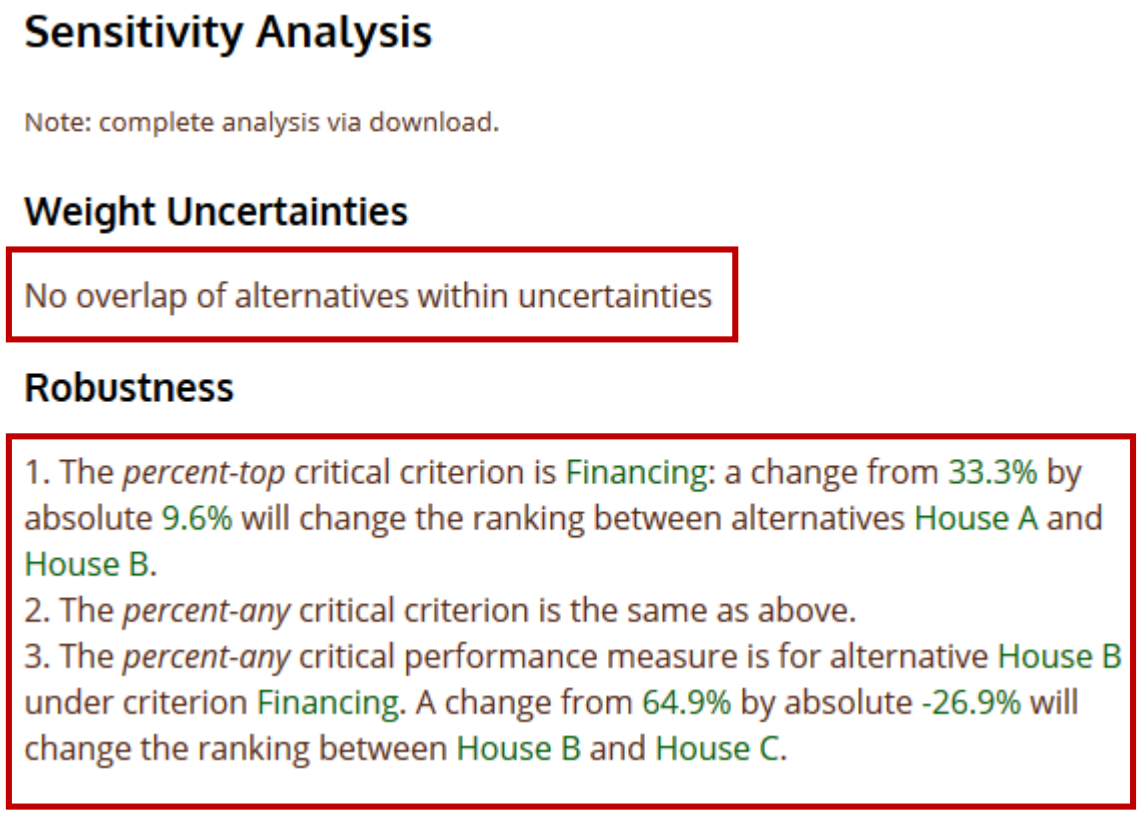
Sensitivity Analysis (Triantaphyllou, 1997)

- Which is the most critical criterion, and
- Which is the most critical performance measure

1. Percent-top critical criterion
2. Percent-any critical criterion
3. Percent-any critical performance measure

Complete sensitivity tables will be exported



Sensitivity Analysis

Note: complete analysis via download.

Weight Uncertainties

No overlap of alternatives within uncertainties

Robustness

1. The *percent-top* critical criterion is Financing: a change from 33.3% by absolute 9.6% will change the ranking between alternatives House A and House B.
2. The *percent-any* critical criterion is the same as above.
3. The *percent-any* critical performance measure is for alternative House B under criterion Financing. A change from 64.9% by absolute -26.9% will change the ranking between House B and House C.

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Data export

- Comma separated value file (csv)
- Can be opened with Excel
- Either “.” or “,” as decimal separator
- Group results
- Priorities by participants
- Decision matrices
- Sensitivity tables

Software Validation

- 10,000 lines source code
- Checklist for unit, integration & system testing
- Test cases for black box testing
- Comparing results with manually calculated results and results published in literature

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Demo

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- Online Software Tool for the Analytical Hierarchy Process AHP-OS https://bpmsg.com/academic/ahp.php
- Full paper: https://bpmsg.com/wordpress/wp-content/uploads/2017/09/ahp-software.pdf

  Goepel, K. D. (2017). Implementation of an Online Software Tool for the Analytic Hierarchy Process – Challenges and Practical Experiences. Working paper prepared for publication, Singapore July 2017

- 7000 Users – 600 active – 9000 projects – up to 300 participants per project

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Thank You!