

# 9. Večkriterijski modeli

# Večkriterijski modeli: Zakaj?

## Metode primerjave alternativ

- neposredna primerjava alternativ
- (ne upoštevamo lastnosti alternativ)

## Odločitvena drevesa

- vrednotenje alternativ po eni sami lastnosti (npr. dohodek)
- upoštevamo negotovost

## Metode večkriterijskega modeliranja

- vrednotenje alternativ po *več kot eni lastnosti*
- negotovost upoštevamo ali pa ne

London, Sept. 19, 1772

Dear Sir, [*Joseph Priestley*]

In the affair of so much importance to you, wherein you ask my advice, I cannot, for want of sufficient premises, advise you what to determine, but if you please I will tell you how.

When those difficult cases occur, they are difficult, chiefly because while we have them under consideration, all the reasons pro and con are not present to the mind at the same time; but sometimes one set present themselves, and at other times another, the first being out of sight. Hence the various purposes or inclinations alternatively prevail, and the uncertainty that perplexes us.

To get over this, my way is to divide half a sheet of paper by a line into two columns; writing over the one Pro, and over the other Con. Then, during three or four days consideration, I put down under the different heads short hints of the different motives, that at different times occur to me, for or against the measure.

When I have thus got them all together in one view, I endeavor to estimate their respective weights; and where I find two, one on each side, that seem equal, I strike them both out. If I find a reason pro equal to two reasons con, I strike out the three. If I judge some two reasons con, equal to some three reasons pro, I strike out the five; and thus proceeding I find at length where the balance lies; and if, after a day or two of further consideration, nothing new that is of importance occurs on either side, I come to a determination accordingly.

And, though the weight of reasons cannot be taken with the precision of algebraic quantities, yet, when each is thus considered, separately and comparatively, and the whole lies before me, I think I can judge better, and am less liable to make a rash step; and in fact I have found great advantage from this kind of equation, in what may be called moral or prudential algebra.

Wishing sincerely that you may determine for the best, I am ever, my dear friend, yours most affectionately,

B. Franklin

Marry

(This is the Question)

Not Marry

Children (if Please God) - Constant Companion,  
 who will feel <sup>loved in one</sup> - <sup>ought to be</sup> - <sup>better than a dog anyhow</sup> -  
 beloved & played with - Home & someone  
 to take care of house - <sup>claim of money</sup>  
<sup>for</sup> <sup>one's</sup> <sup>health</sup> - <sup>has</sup> <sup>to</sup> <sup>visit</sup> <sup>successive</sup>  
 relations but terrible loss of time -

My God, it is <sup>unpleasant</sup> to think of  
 spending one's whole life, like a <sup>beetle</sup>  
 bee, working, working & <sup>nothing</sup> after  
 all - no, no, won't do - <sup>imagine</sup> <sup>living</sup>  
 all one's days <sup>in</sup> <sup>one's</sup> <sup>own</sup> <sup>little</sup> <sup>house</sup> <sup>in</sup> <sup>the</sup> <sup>city</sup> <sup>of</sup> <sup>London</sup>  
 House - <sup>only</sup> <sup>pleasure</sup> <sup>to</sup> <sup>yourself</sup> <sup>a</sup> <sup>nice</sup>  
 wife on a sofa with good fire,  
 & books & music perhaps - <sup>compare</sup> <sup>this</sup>  
 vision with the dingy reality of St. Mark's  
 Marry - Marry Marry L.E.D.

No children, (no second life) no one to care for  
 one in old age. - what is the use of working  
 is without sympathy from near & dear friends -  
 who are near & dear friends to <sup>the</sup> <sup>old</sup> <sup>people</sup>  
relations Freedom to go where one likes -  
 choice of Society & little of it - <sup>consort</sup>  
 of clever men at clubs - not forced to  
 visit relations, & to bend in every trifling  
 to have the expense & anxiety of children  
 perhaps travelling - Loss of time - cannot  
 read in the evenings - <sup>fatigue</sup> & <sup>idleness</sup> -  
 anxiety & responsibility - <sup>up</sup> <sup>money</sup> <sup>for</sup> <sup>books</sup> <sup>or</sup>  
 if many children forced to <sup>strain</sup> <sup>one's</sup> <sup>head</sup>...  
 (But then it is very bad <sup>for</sup> <sup>one's</sup> <sup>health</sup> to work too much)  
 Perhaps my wife won't like <sup>freedom</sup>, then  
 the sentence is banishment & degradation  
 into indigent, idle folk -



**Marry**

**This is the question**

**Not Marry**

- Constant companion
- Friend in old age
- Object to be beloved and play with
- Someone to take care of house
- Charms of music and female chit-chat
- Children to care for one in old age
- Better than a dog anyhow

- No Quarrelling
- Freedom to go where one likes
- Choice of society and little of it
- conversation of clever men at clubs
- Not forced to visit relatives
- Not forced to bend to every trifle
- More money for books
- Time to read books in the evening
- No expenses and anxiety of children

to my mind it is intolerable to think of  
 spending one's whole life, like a wretched  
 bee, working, working, & sitting upon  
 it. - No, no, won't do. - Imagine being  
 all one's day at home with half a dozen  
 house - Only pleasure to yourself a nice  
 wife on a sofa with good face,  
 & books & music perhaps - Compare this  
 vision with the dingy reality of St Bartholomew  
 diary. May. Marry 2.2.5

to have the expense & anxiety of children  
 perhaps quarrelling - Life of time - cannot  
 read in the evening - fatigue & sleep -  
 anxiety & responsibility - less money for books  
 & many children forced to give up reading  
 (But then it - my bed to work too hard)  
 Perhaps my wife won't like freedom, then  
 the sentiment in banishment & degradation  
 will indelible, idle fool -

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Charles Darwin, 1838

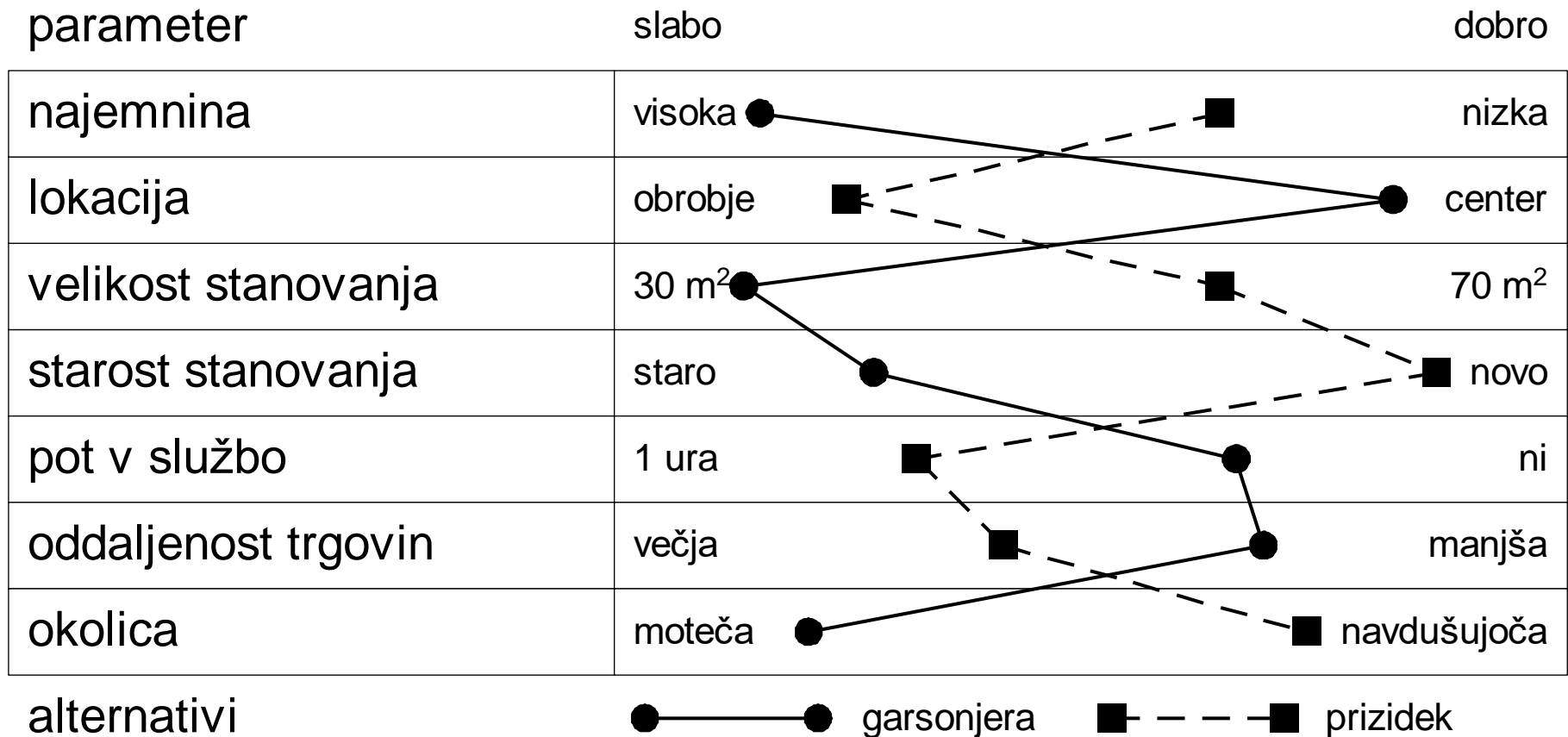
# Analiza prednosti in slabosti

	<i>alternativi</i>	
	<i>garsonjera</i>	<i>prizidek</i>
<b>prednosti</b>	lokacija v središču mesta bližina trgovin in lokalov bližina službe	novogradnja prostorno stanovanje lepa okolica z zelenjem razgled na bližnje hribe prijazni lastniki stanovanja
<b>slabosti</b>	malo prostora staro stanovanje visoka najemnina hrup podnevi in ponoči	oddaljenost od mesta slabe povezave z mestom oddaljenost trgovine ni ločenega vhoda

# Metoda PMI (Plus/Minus/Implications)

	<i>alternativi</i>	
	<i>garsonjera</i>	<i>prizidek</i>
<b>prednosti</b>	lokacija v središču mesta (+2) bližina trgovin in lokalov (+1) bližina službe (+1)	novogradnja (+1) prostorno stanovanje (+1) lepa okolica z zelenjem in razgled na bližnje hribe (+1) prijazni lastniki stanovanja (+1)
<b>slabosti</b>	malo prostora (-1) staro stanovanje (-2) visoka najemnina (-5) hrup podnevi in ponoči (-1)	oddaljenost od mesta (-1) slabe povezave z mestom (-3) oddaljenost trgovine (-1) ni ločenega vhoda (-1)
<b>posledice</b>	več stikov z ljudmi (+3) nujna selitev po poroki (-1)	nakup prevoznega sredstva (-3) manj prostega časa (-1)
<b>točke</b>	<b>-3</b>	<b>-6</b>

# Metoda ABACON



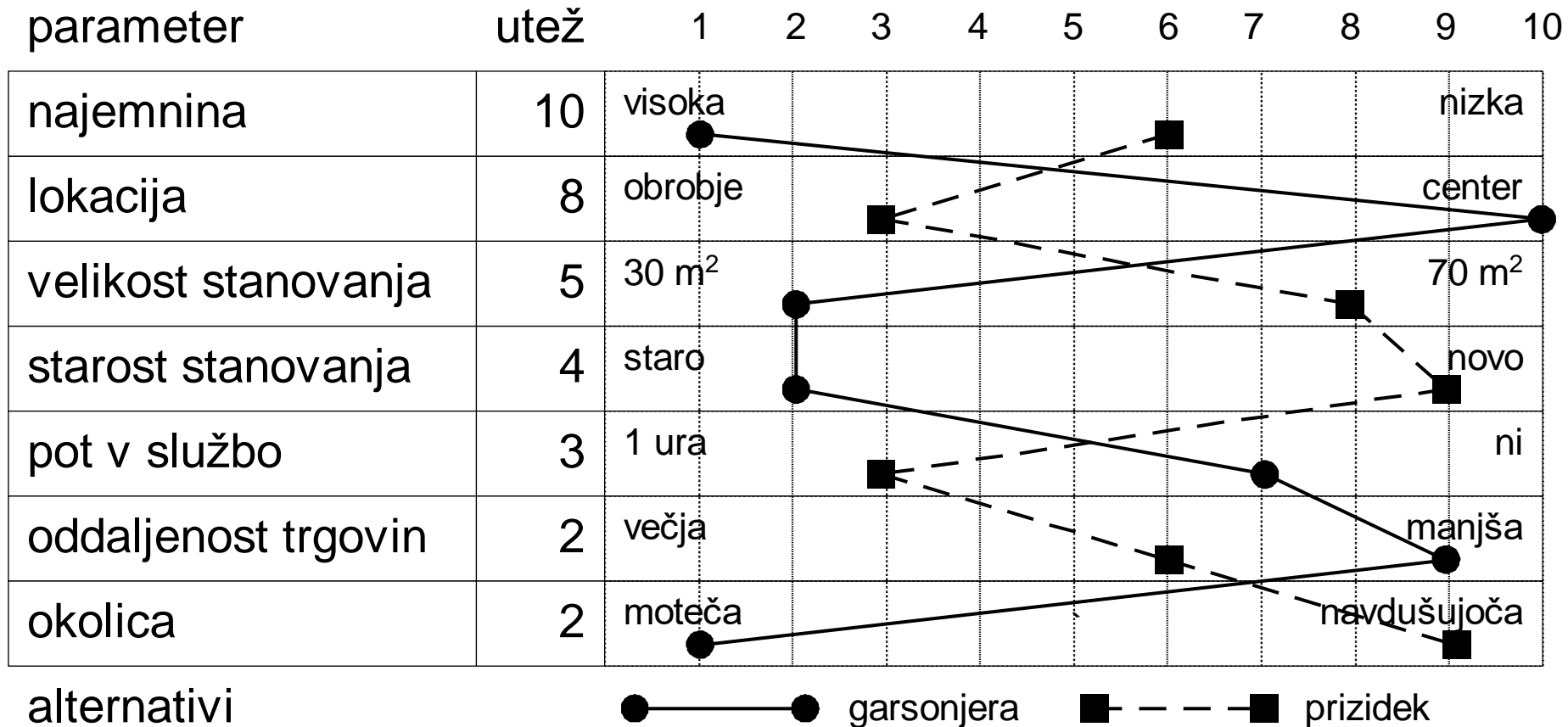


# Domača naloga 5

Kam (ali na kakšno delovno mesto) po končanem študiju?

- a. Zamislite si 2 do 5 alternativ (organizacije ali delovna mesta). Alternative so lahko anonimne (imena A, B, ...)
- b. Opišite/ovrednotite alternative z metodama:
  - prednosti in slabosti
  - PMI
- c. Definirajte 5 do 8 kriterijev v skladu z vašimi željami in pričakovanji ter jih razvrstite po pomembnosti
- d. Zasnujte diagram po metodi ABACON in vrišite profile alternativ

# Metoda Kepner-Tregoe



# Metoda Kepner-Tregoe

parameter <i>i</i>	utež $w_i$	<i>garsonjera</i>		<i>prizidek</i>	
		točke $t_i$	utež×točke $w_i t_i$	točke $t_i$	utež×točke $w_i t_i$
<i>najemnina</i>	10	1	10	6	60
<i>lokacija</i>	8	10	80	3	24
<i>velikost stanovanja</i>	5	2	10	8	40
<i>starost stanovanja</i>	4	2	8	9	36
<i>pot v službo</i>	3	7	21	3	9
<i>oddaljenost trgovin</i>	2	9	18	6	12
<i>okolica</i>	2	1	2	9	18
<b>skupaj</b>			<b>149</b>		<b>199</b>

# Komponente večkriterijskih modelov

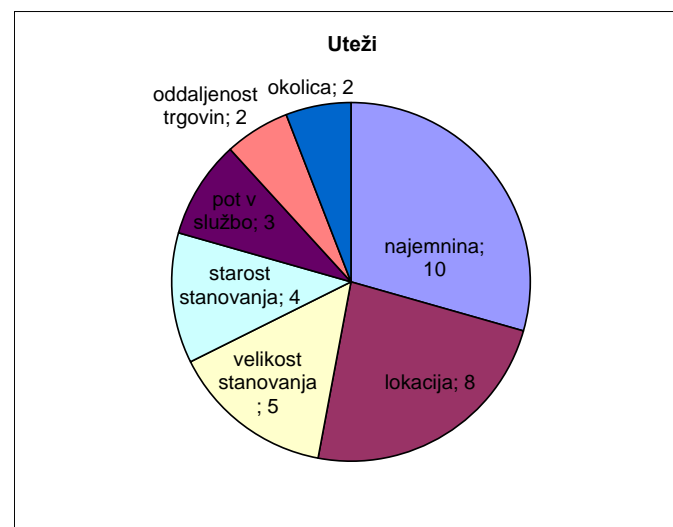
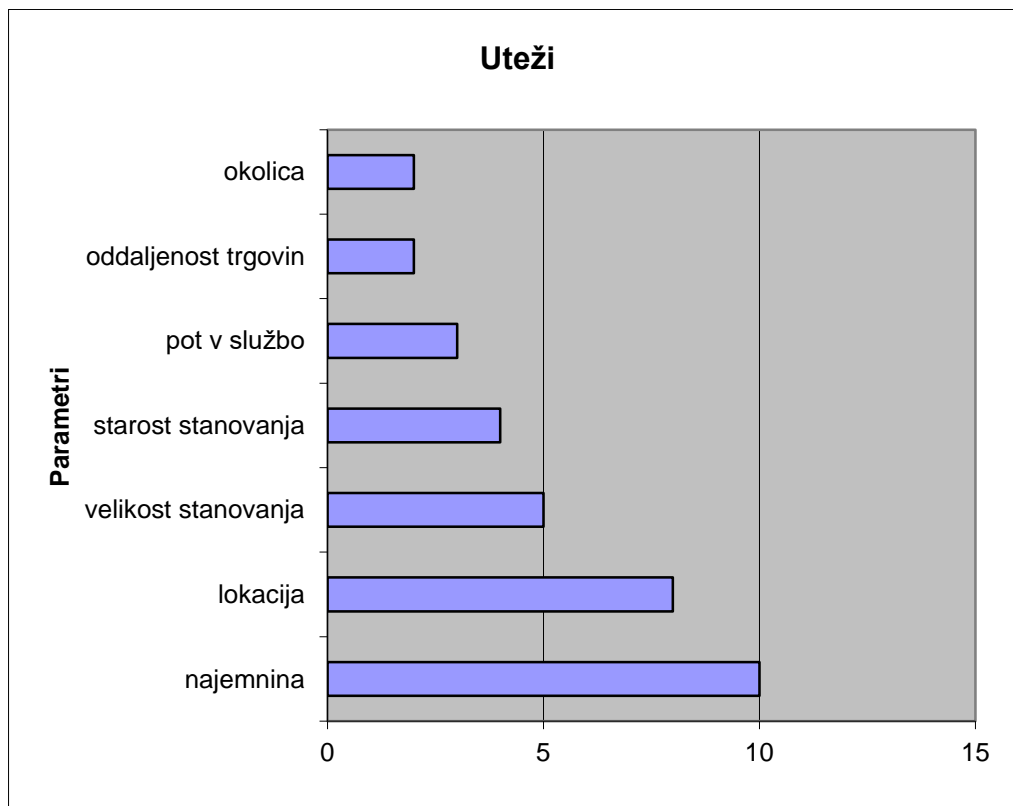
1. **Parameter (lastnost, opisna spremenljivka, lahko tudi cilj):** Lastnost, ki jo opazujemo pri alternativah. Ima ime («cena») in definicijo («nabavna cena avtomobila z davkom»).
2. **Merska lestvica:** Vsakemu parametru določimo mersko lestvico, to je zalogo vrednosti, s katero ocenjujemo oziroma merimo alternative pri tem parametru.
3. **Atribut (merilo):** Parameter, ki ima določeno mersko lestvico.
4. **Kriterij:** Vrednostno opredeljen atribut: kaj je dobro in kaj slabo, kaj je nezaželeno in kaj zaželeno? Kje so meje?
5. **Funkcije združevanja:** Predpis, ki pove, kako združimo (agregiramo) *delne ocene* alternativ, ki nastopajo pri posameznih parametrih, v *končno oceno* alternativ.

# Uteži

atribut	uteži		
	metoda K-T	največ 100	vsota 100
<i>najemnina</i>	10	100	29,4
<i>lokacija</i>	8	80	23,5
<i>velikost stanovanja</i>	5	50	14,7
<i>starost stanovanja</i>	4	40	11,8
<i>pot v službo</i>	3	30	8,8
<i>oddaljenost trgovin</i>	2	20	5,9
<i>okolica</i>	2	20	5,9
<b>vsota</b>	<b>34</b>	<b>340</b>	<b>100</b>

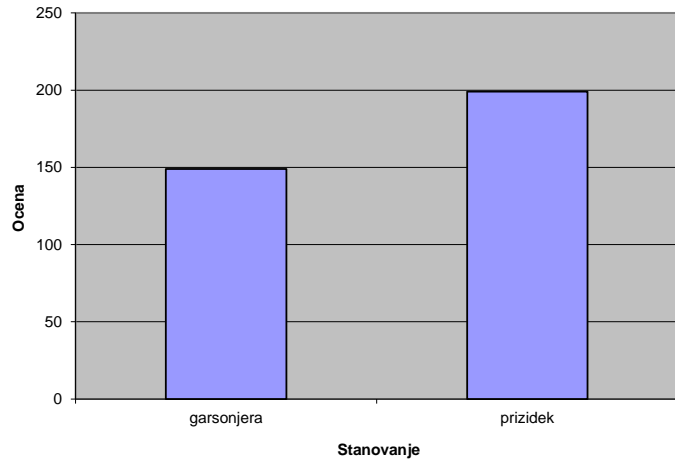


# Grafični prikazi: Uteži

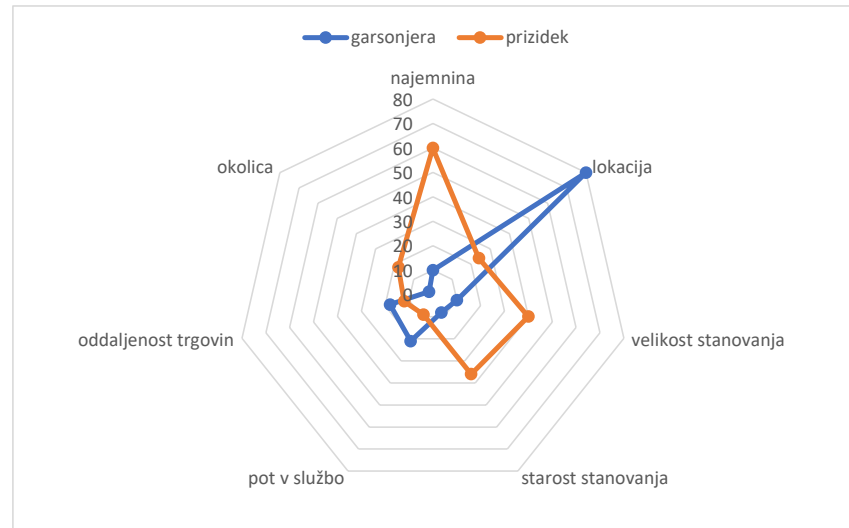
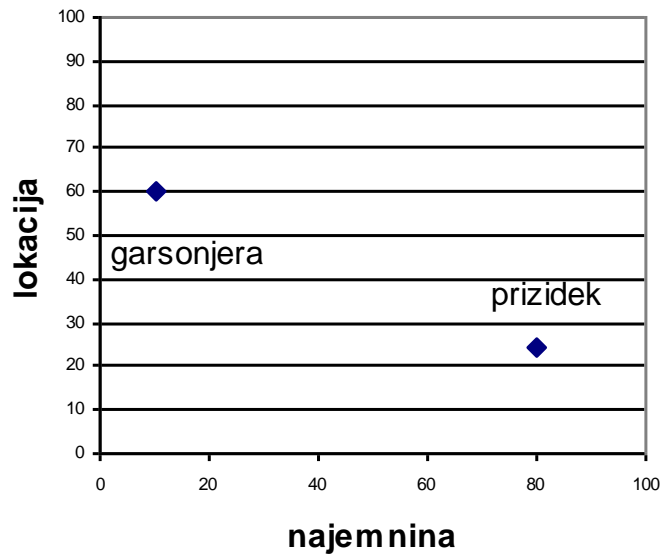
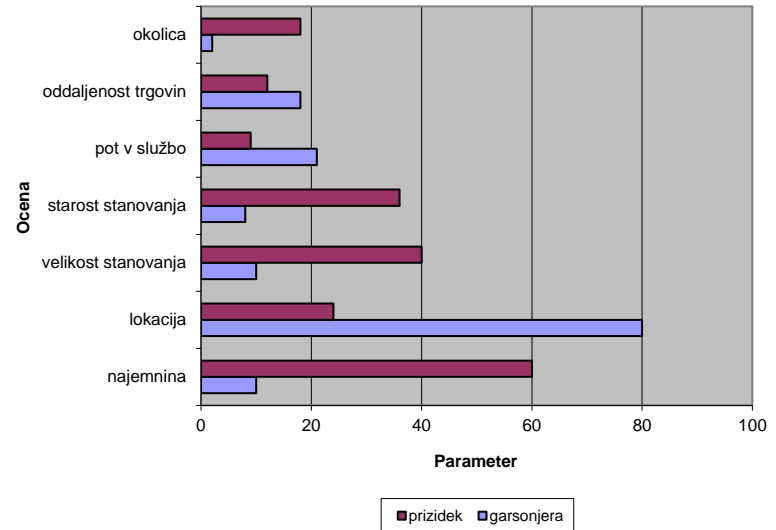


# Grafični prikazi: Vrednotenje

Ocena stanovanj



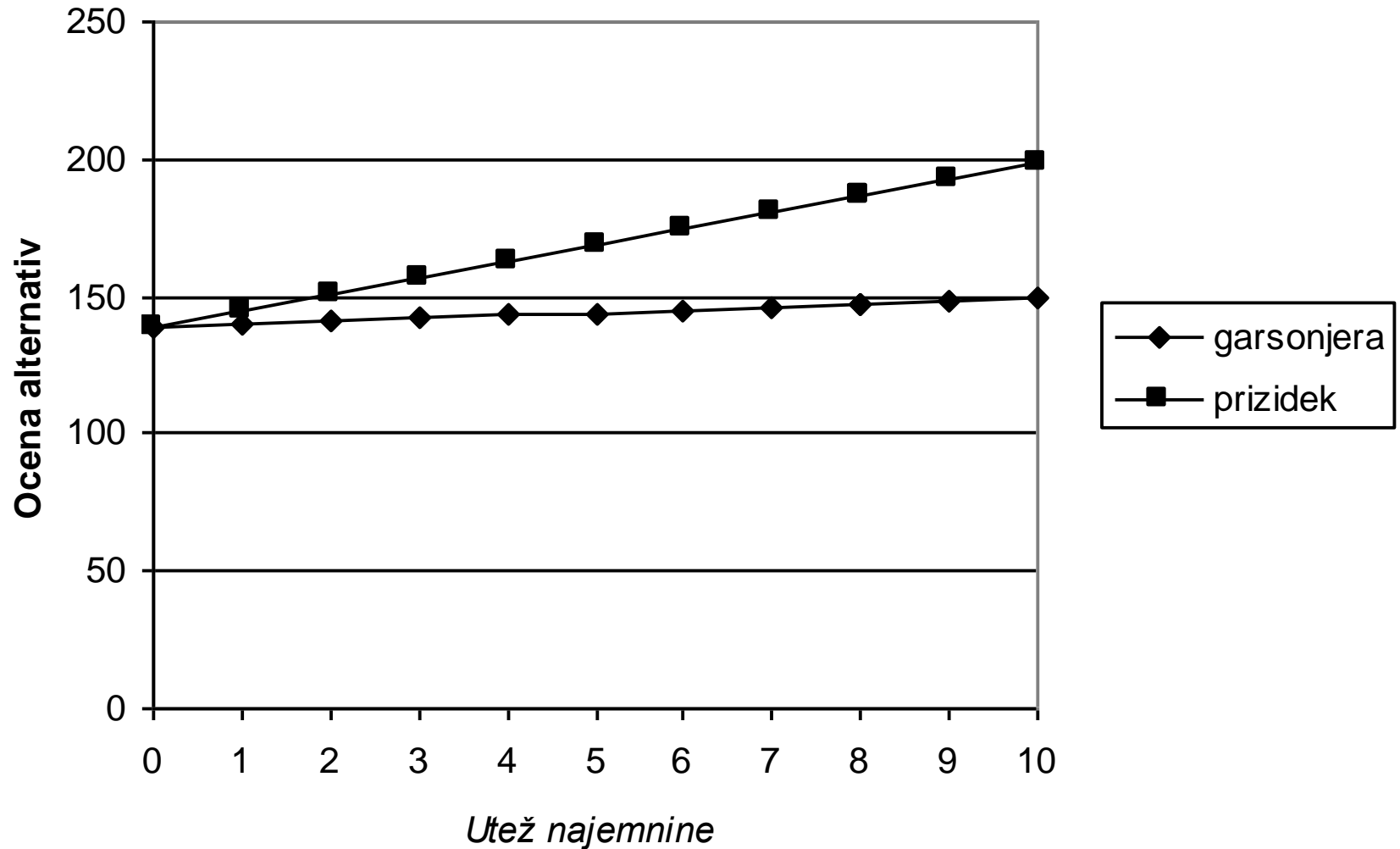
Ocene po parametrih



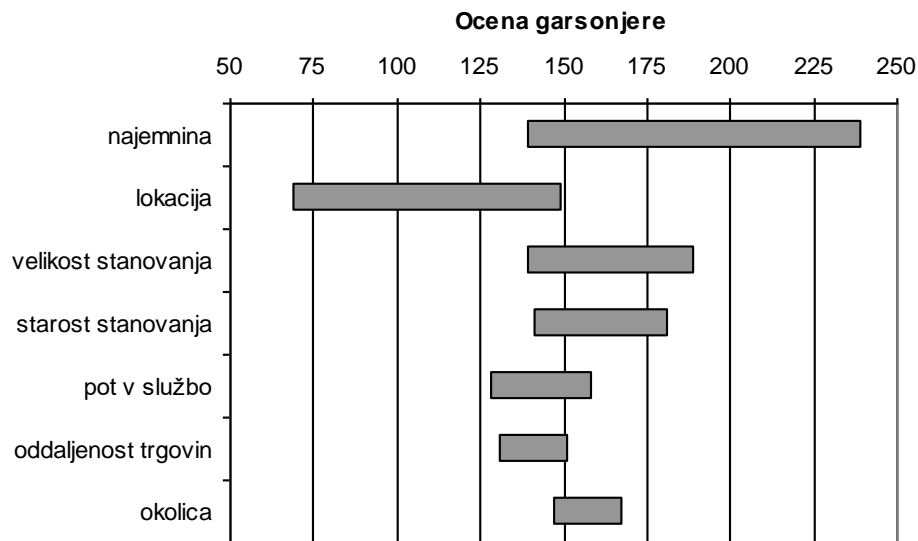
# Analize: Analiza "kaj-če"

parameter	utež	garsonjera pred spremembo		garsonjera po spremembi	
		točke	utež×točke	točke	utež×točke
<i>najemnina</i>	10	1	10	<b>4</b>	<b>40</b>
<i>lokacija</i>	8	10	80	10	80
<i>velikost stanovanja</i>	5	2	10	2	10
<i>starost stanovanja</i>	4	2	8	2	8
<i>pot v službo</i>	3	7	21	7	21
<i>oddaljenost trgovin</i>	2	9	18	9	18
<i>okolica</i>	2	1	2	1	2
<b>skupaj</b>			<b>149</b>		<b>179</b>

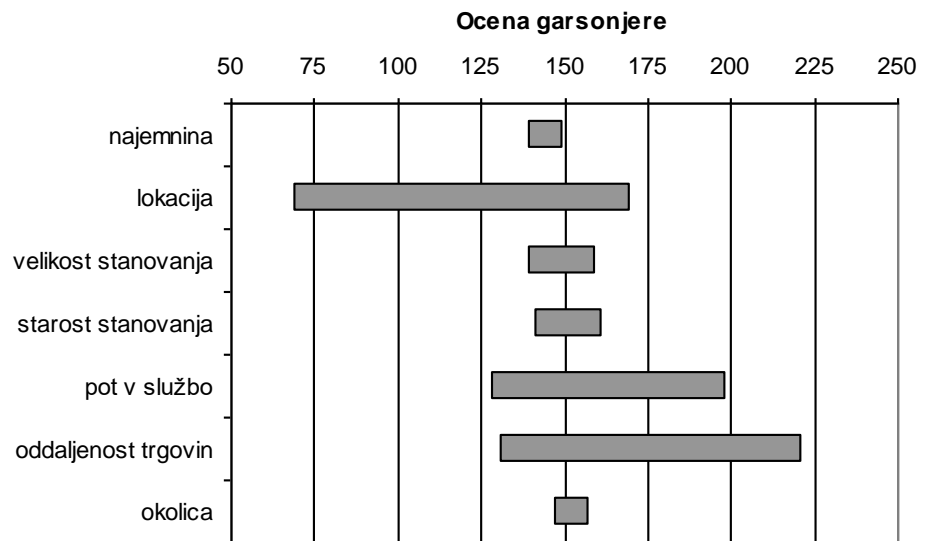
# Analize: Analiza občutljivosti



# Grafični prikazi: Diagram "tornado"



*vrednosti parametrov od 0 do 10*



*uteži od 0 do 10*



# Domača naloga 6

Nadaljujte vaš primer iz Domače naloge 5:

- a. Ovrednotite alternative po metodi Kepner-Tregoe
- b. Analizirajte občutljivost glede na en izbran kriterij.
- c. V računalniški preglednici narišite grafikone:
  - uteži
  - končnih rezultatov vrednotenja alternativ
  - delnih rezultatov vrednotenja alternative po kriterijih
  - krožni (radarski) grafikon [neobvezno]
  - diagram tornado [neobvezno]
- d. Primerjajte metode iz domačih nalog 5 in 6 ter ocenite skladnost reštev, ki ste jih dobili z različnimi metodami

# Modeliranje: Zakaj?

- Sistematičen, strukturiran pristop
  - upošteva razpoložljive podatke in negotovost
- Razvoj modela:
  - zahteva pazljivo preučitev in razgradnjo problema
  - omogoča in spodbuja komunikacijo med odločevalci
- Vrednotenje variant:
  - izbira ene variante
  - rangiranje variant
- Analize:
  - analize tipa "kaj-če"
  - analize občutljivosti
  - razlage
    - potek vrednotenja ("kako?")
    - selektivne razlage prednosti in slabosti ("zakaj?")
- Kvalitetnejše odločitve:
  - bolje razumljene, utemeljene, razložene, preverjene, dokumentirane

# Vprašanja

Posamezna metoda večkriterijskega modeliranja:

- kaj omogoča?
- kaj zahteva (katere podatke je treba zbrati in definirati)?
- ocenite prednosti in slabosti te metode

Primerjava dveh metod večkriterijskega modeliranja  
[npr. Kepner-Tregoe : ABACON]

- v čem se metodi bistveno razlikujeta?
- katera omogoča več od druge in zakaj?
- kakšna je “cena” za to?

Primerjava metod večkriterijskega modeliranja z:

- odločitvenimi drevesi
- diagrami vpliva

# Naloga

Janez je absolvent *Fakultete za odločanje*. Razmišlja o tem, kam v službo po končanem študiju. Ima ponudbe štirih organizacij:

- Analitika d.o.o.
- Bankirska banka d.d.
- Center za planiranje
- Dinamične odločitve d.o.o.

O službi še ni dosti razmišljal, ve pa, da ga zanimajo lokacija delovnega mesta, višina plače, varnost in možnost napredovanja. Na fakulteti so ga zelo zanimali predmeti v zvezi z ekonomiko in zakonodajo, medtem ko matematike in računalništva ne mara.

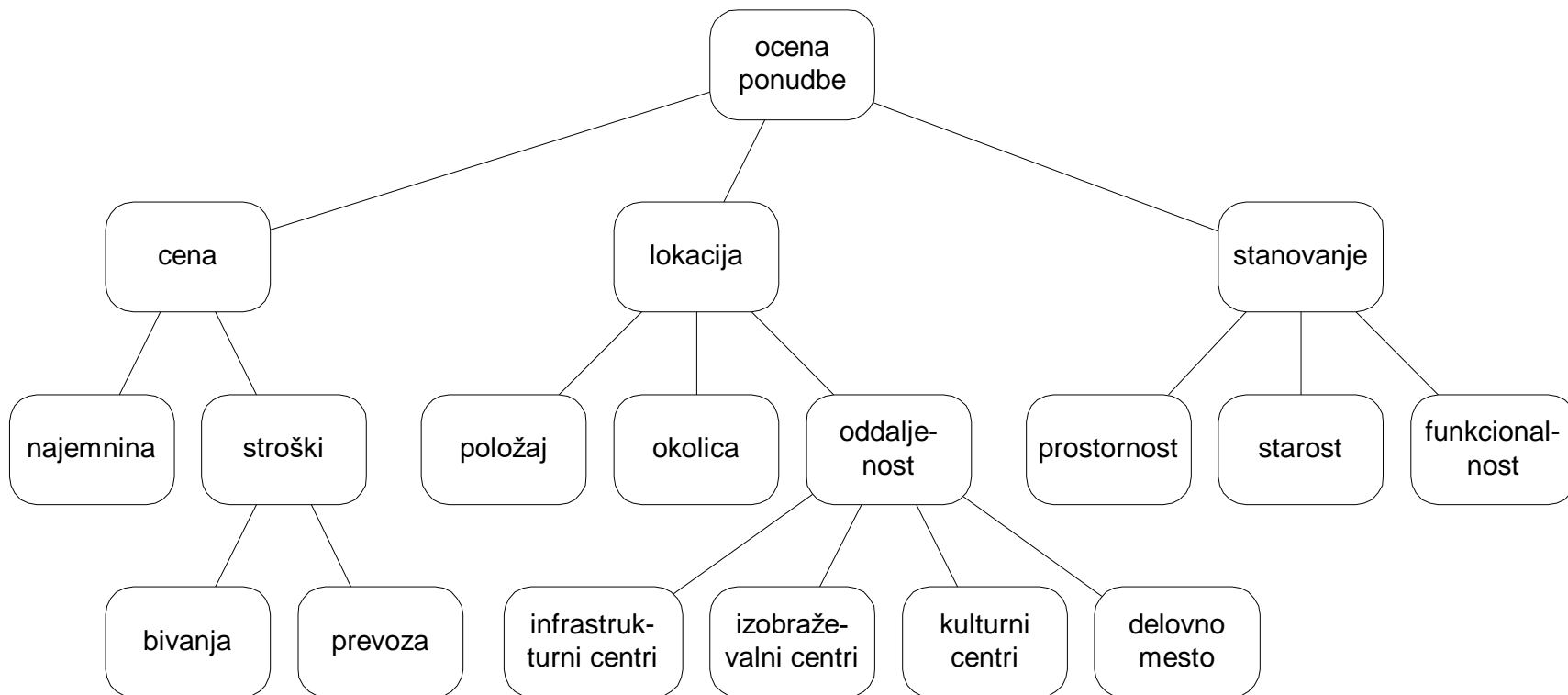
# 10. Hierarhični večkriterijski modeli



# Hierarhični večkriterijski modeli

*Razgradnja odločitvenega problema na podprobleme:*

Drevo kriterijev



# Kriteriji hierarhičnih modelov

**Nadredni:** odvisni od podrednih

**Podredni:** vplivajo na nadredne

**Osnovni:** “listi” modela, nimajo podrednih kriterijev

**Izpeljani:** imajo podredne kriterije

**Vhodni:** osnovni

**Izhodni:** izpeljani, še posebej pa:

**koren(i)** drevesa ali hierarhije

# Naloga

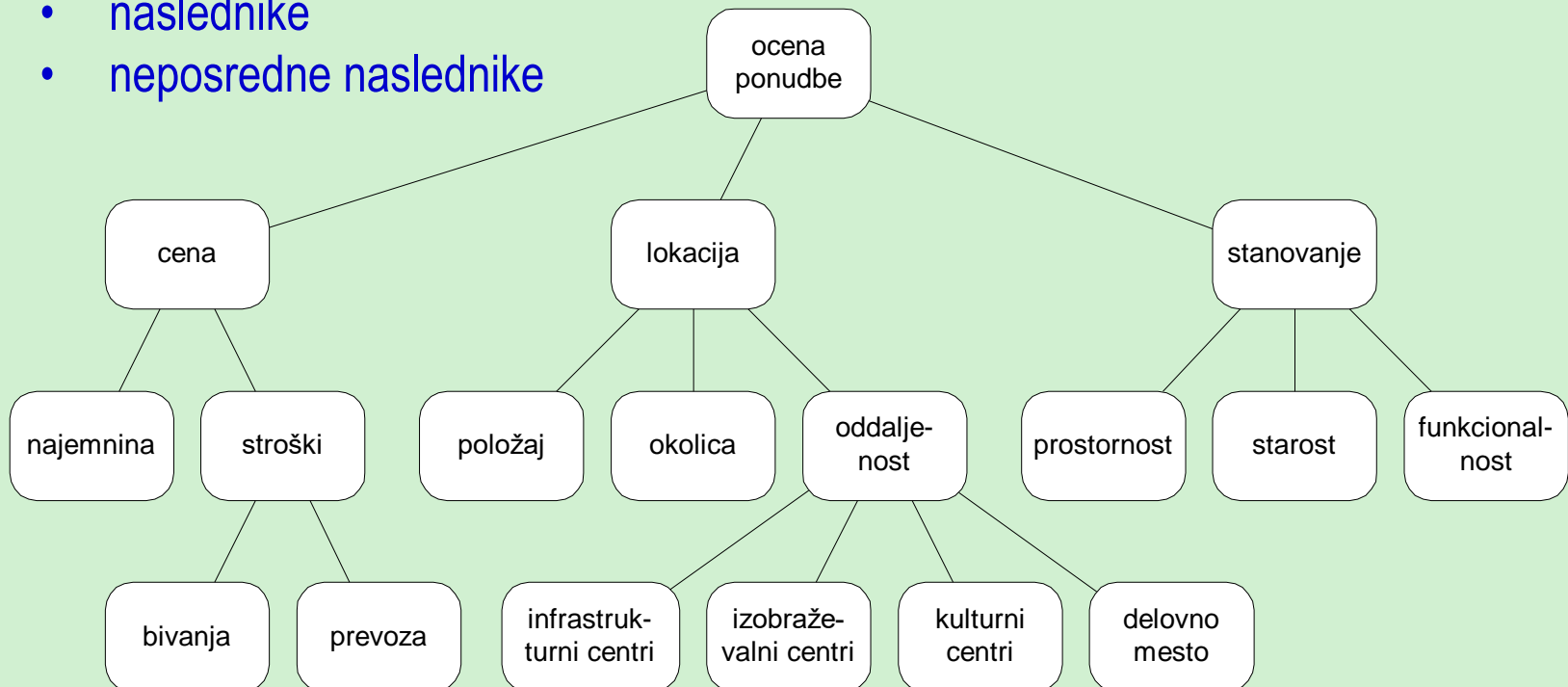
Na sliki za vsak atribut označite:

- kateremu atributu je podredni in kateremu nadredni
- ali je osnovni ali izpeljani
- ali je vhodni ali izhodni

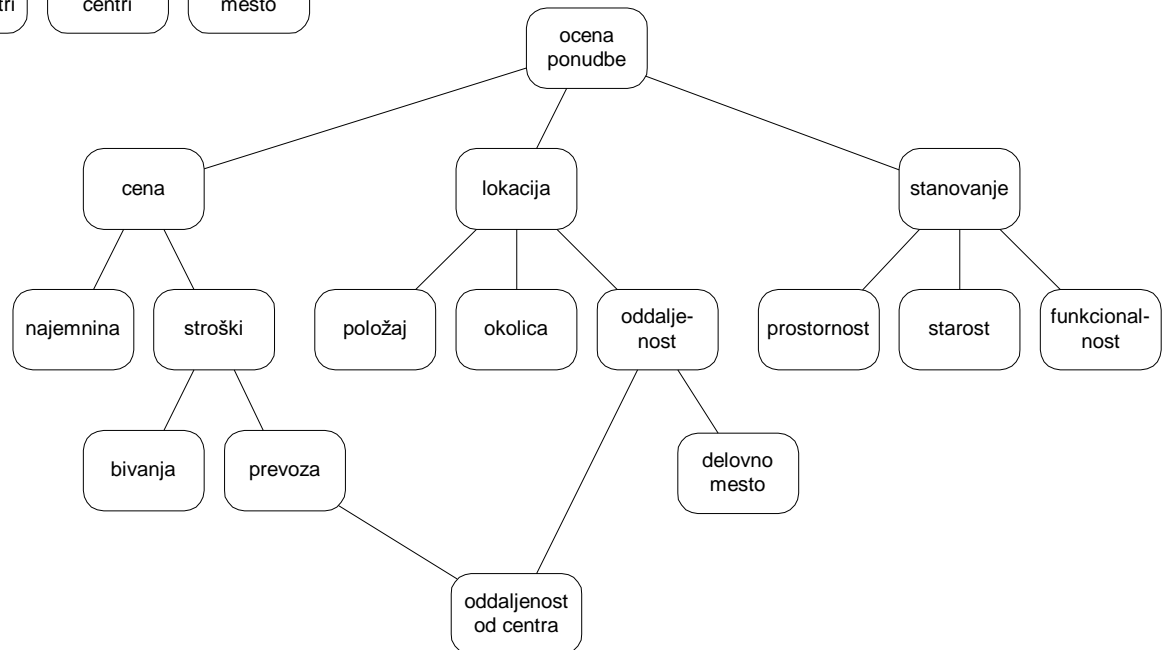
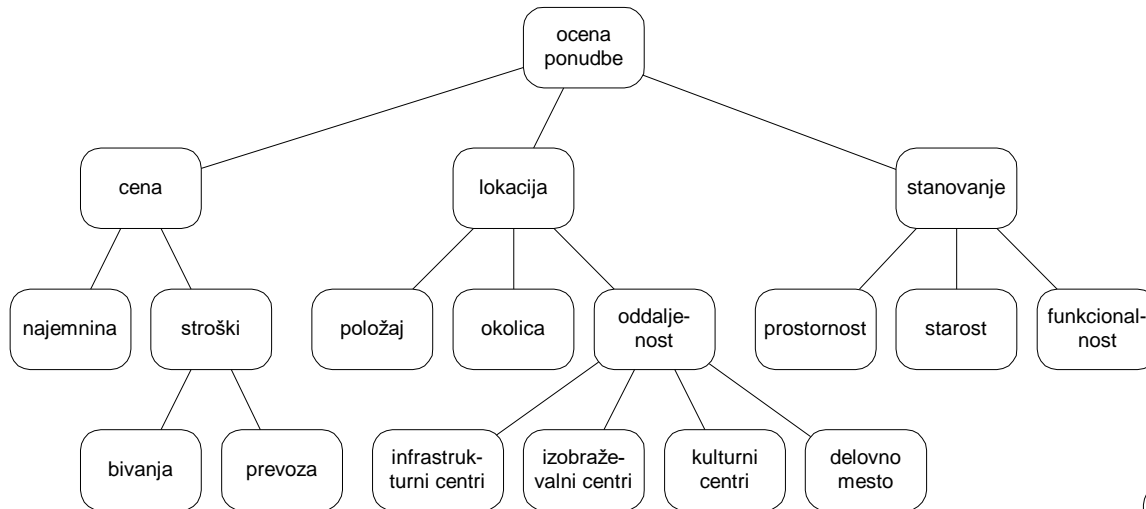
Kateri atribut je koren drevesa?

Za atribut *cena* naštejte:

- naslednike
- neposredne naslednike



# Drevo : hierarhija



# Interpretacija hierarhičnih modelov

1. *Delitev* oziroma *razgradnja* odločitvenega problema na manjše in v splošnem lažje obvladljive podprobleme [“deli in vladaj”]
2. Predstavitev *ciljev* naše odločitve
3. *Vpliv* oziroma *odvisnost* med kriteriji: podredni kriteriji vplivajo na nadredne, in ti so odvisni od podrednih



# Razvoj hierarhičnih modelov

1. **Od zgoraj navzdol:** Začnemo s končno oceno alternativ, ki jo po načelu »deli in vladaj« postopno delimo na podredne kriterije na vse nižjih nivojih strukture. Delitev končamo, ko pridemo do dovolj preprostih in merljivih oziroma operativnih osnovnih kriterijev.
2. **Od spodaj navzgor:** Začnemo s seznamom osnovnih kriterijev. Te po načelu vsebinske povezanosti in medsebojne odvisnosti postopoma povezujemo v nadredne kriterije na vse višjih nivojih strukture. Postopek nadaljujemo tako dolgo, dokler ne pridemo do enega samega izhodnega kriterija, ki ponazarja končno oceno alternativ.
3. **Iz sredine navzven.** Praktična kombinacija obeh pristopov.

# Lastnosti kriterijev

## Osnovni kriteriji

- *Polnost*: upoštevati vse bistvene lastnosti (in ne spregledati res pomembnih)
- *Neredundantnost*: izločiti nepotrebne, nevplivne kriterije
- *Medsebojna neodvisnost (ortogonalnost)*: kriteriji naj bi bili med seboj čim bolj neodvisni; vsak pomemben odločitveni dejavnik naj bi bil zastopan samo z enim kriterijem
- *Operativnost*: uporabnost v praksi: vsak kriterij naj bi se dalo jasno definirati, razložiti, izmeriti ali izraziti z neko zahtevano stopnjo točnosti ali zanesljivosti ter opredeliti njegov vpliv na končno oceno

## Poddrevesa modela

- Logična struktura
- Medsebojna povezanost in vsebinska odvisnost
- Nekateri metode (DEX) omejujejo število neposrednih naslednikov

# Domača naloga 7

Razvijte drevo kriterijev za nakup novega družinskega avtomobila.

Okvirna navodila:

- Sami določite kriterije, ki se vam zdijo pomembni
- Najprej oblikujte (neurejen) seznam kriterijev, te potem postopoma povezuje v drevo
- Struktura naj bo večnivojska in naj odraža medsebojno povezanost in vsebinsko odvisnost kriterijev
- Kriterijev naj bo okrog 10-15, razvrščenih v 3-5 ravni
- Označite, kateri kriteriji so vhodni in kateri izhodni

# 11. Metode MAUT oz. MAVT

Multi-Attribute Utility Theory

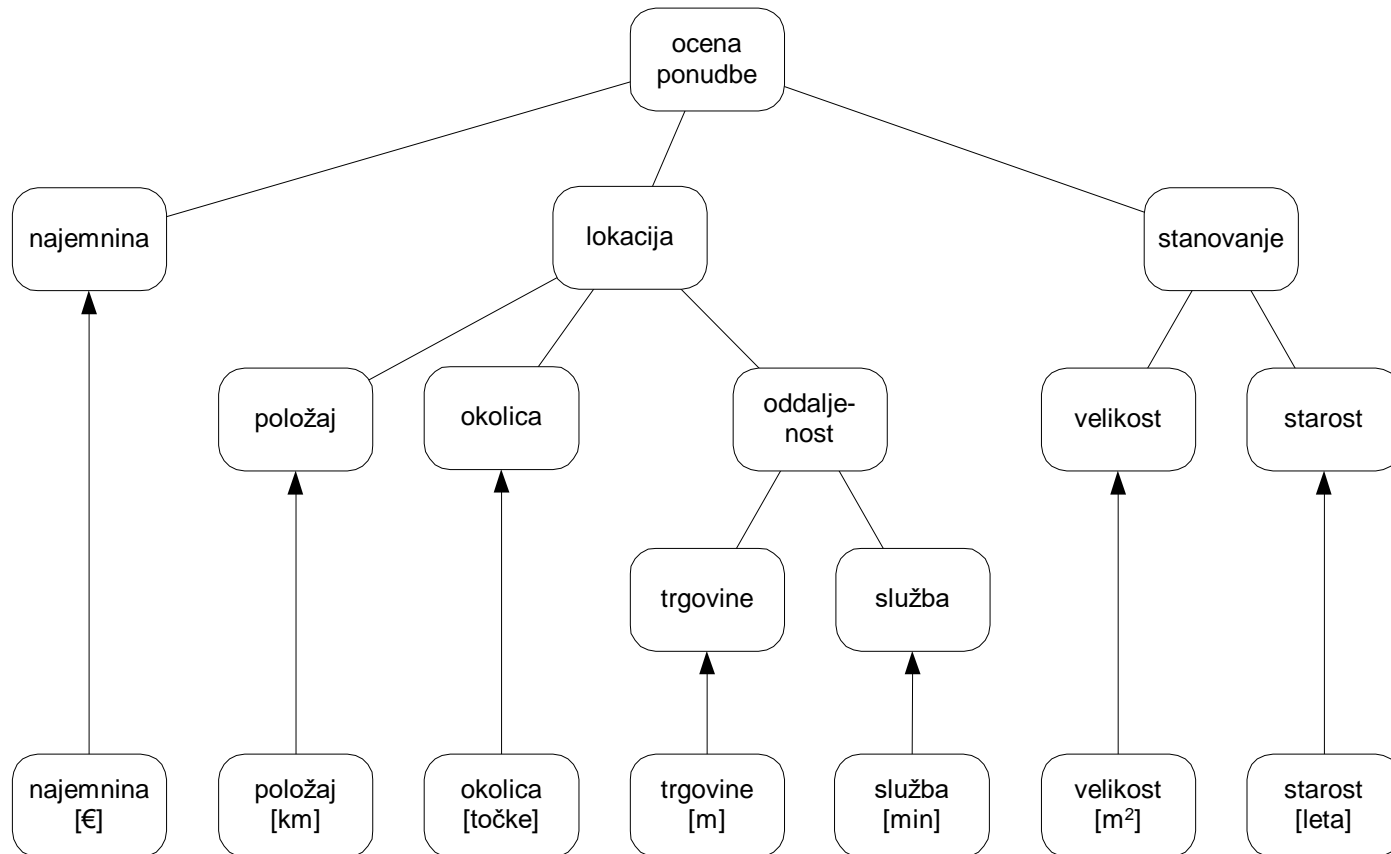
Multi-Attribute Value Theory

# Metode MAUT

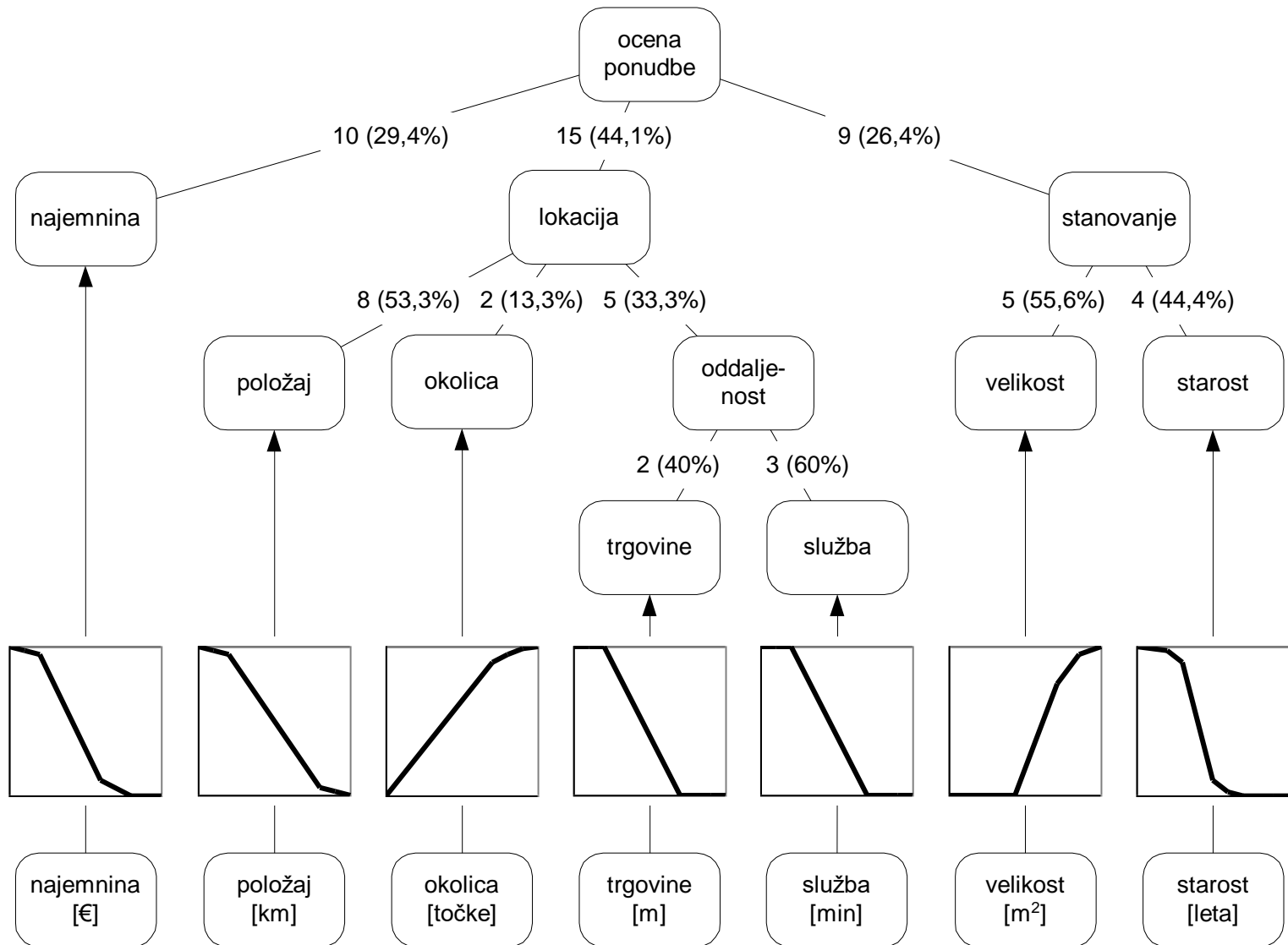
Kvantitativni modeli: vse spremenljivke so numerične

Dvostopenjsko vrednotenje

1. Osnovne vrednostne funkcije: preslikava “naravne” vrednosti v preferenco
2. Funkcije združevanja: večparametrsko združevanje preferenc



# Metode MAUT



# Domača naloga 8

Narišite mejne vrednostne funkcije za kriterije:

- starost avtomobila [merjene v letih]
- cena avtomobila [€]
- poraba avtomobila [l/100km]
- starost kandidata za prodajalca v trgovini [leta]
- starost kandidata za predsednika ZDA [leta]



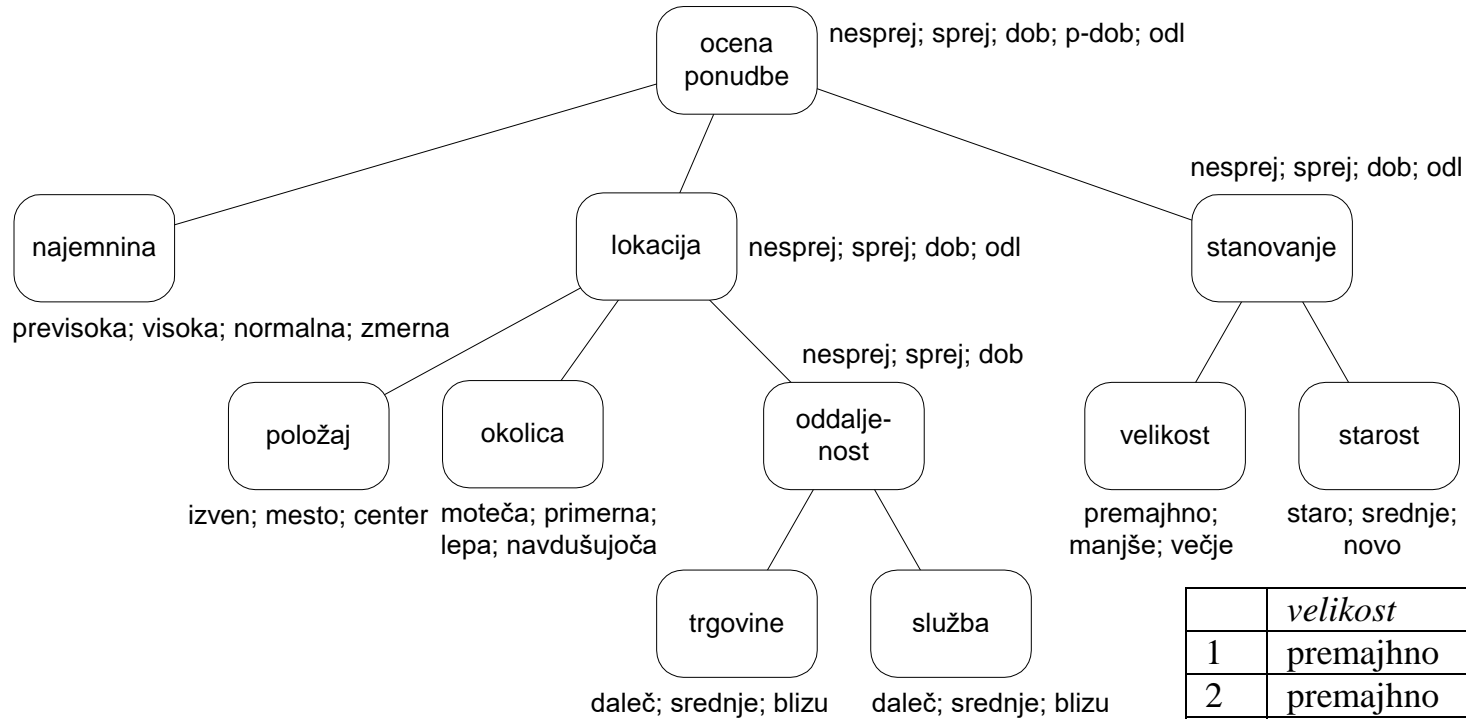
# Metode MAUT

parameter	<i>garsonjera</i>		<i>prizidek</i>	
	vrednost	koristnost	vrednost	koristnost
<i>najemnina</i>	previsoka	0,10	normalna	0,60
<i>položaj</i>	0 km	1,00	8 km	0,12
<i>okolica</i>	1	0,13	9	0,99
<i>trgovine</i>	100 m	0,80	300 m	0,30
<i>služba</i>	10 min	0,70	45 min	0,30
<i>velikost</i>	35 m <sup>2</sup>	0,20	55 m <sup>2</sup>	0,85
<i>starost</i>	20 let	0,15	2 leti	0,90

parameter	koristnost	
	<i>garsonjera</i>	<i>prizidek</i>
<b><i>ocena ponudbe</i></b>	<b>0,43</b>	<b>0,54</b>
<i>najemnina</i>	0,10	0,60
<b><i>lokacija</i></b>	<b>0,80</b>	<b>0,30</b>
<i>položaj</i>	1,00	0,12
<i>okolica</i>	0,13	0,99
<b><i>oddaljenost</i></b>	<b>0,74</b>	<b>0,30</b>
<i>trgovine</i>	0,80	0,30
<i>služba</i>	0,70	0,30
<b><i>stanovanje</i></b>	<b>0,18</b>	<b>0,87</b>
<i>velikost</i>	0,20	0,85
<i>starost</i>	0,15	0,90



# Kvalitativne metode: DEX



	<i>velikost</i>	<i>starost</i>	<i>stanovanje</i>
1	premajhno	staro	nesprej
2	premajhno	srednje	nesprej
3	premajhno	novo	nesprej
4	manjše	staro	sprej
5	manjše	srednje	dob
6	manjše	novo	dob
7	večje	staro	dob
8	večje	srednje	odl
9	večje	novo	odl

# Orodja za večkriterijsko modeliranje

1. “svinčnik in papir”
2. preglednice (MS Excel)
3. namenska programska oprema

# Programska oprema

MS Excel oz. LibreOffice Calc

The screenshot shows a spreadsheet window with the following data:

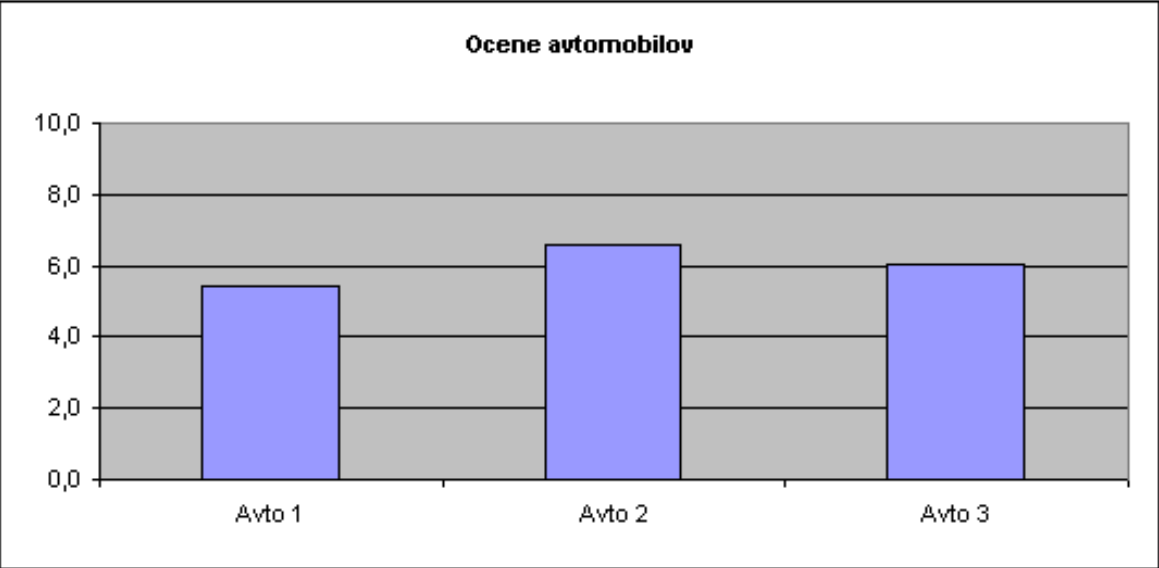
	A	B	C	D	E	F
1	<b>Vrednotenje stanovanj</b>					
2						
3	<b>Metoda Kepner-Tregoe</b>					
4						
5				<i>garsonjera</i>	<i>prizidek</i>	
6	<b>parameter</b>	<b>utež</b>	<b>točke</b>	<b>utež*točke</b>	<b>točke</b>	<b>utež*točke</b>
7	<i>najemnina</i>	10	1	10	6	60
8	<i>lokacija</i>	8	10	80	3	24
9	<i>velikost stanovanja</i>	5	2	10	8	40
10	<i>starost stanovanja</i>	4	2	8	9	36
11	<i>pot v službo</i>	3	7	21	3	9
12	<i>oddaljenost trgovin</i>	2	9	18	6	12
13	<i>okolica</i>	2	1	2	9	18
14	<b>skupaj</b>			<b>149</b>		<b>199</b>

Formula bar: F7 = \$B7\*E7

Status bar: Average: 24,85714286 Count: 14 Sum: 348

# Programska oprema

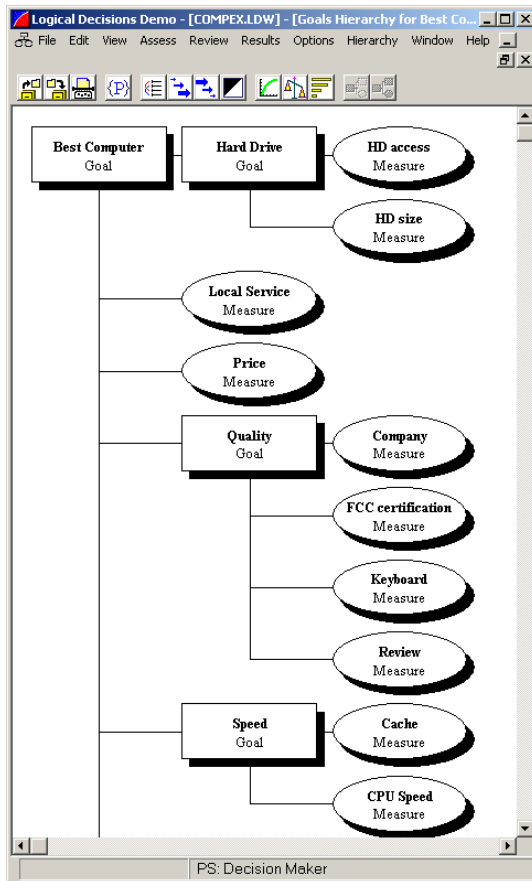
MS Excel oz. LibreOffice Calc

	A	B	C	D	E	F	G
1	<b>Model vrednotenja avtomobilov</b>						
2							
3	<b>Parameter</b>	<b>Uteži</b>		<b>Avto 1</b>	<b>Avto 2</b>	<b>Avto 3</b>	
4	Cena	40%		7,0	6,0	5,5	
5	Cena nabave		75%	8	6	5	
6	Cena vzdrževanja		25%	4	6	7	
7	Tehnične lastnosti	60%		4,4	7,0	6,4	
8	Varnost		70%	5	7	7	
9	Udobnost		30%	3	7	5	
10	<b>KONČNA OCENA</b>			<b>5,4</b>	<b>6,6</b>	<b>6,0</b>	
11							
12	<b>Ocene avtomobilov</b>						
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							

# Programi za večkriterijske modele

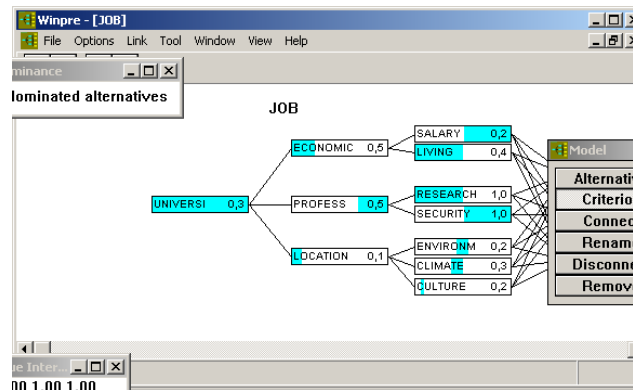
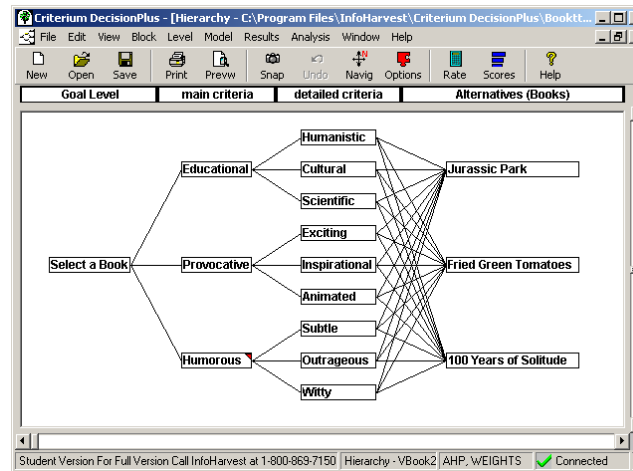
## Logical Decisions

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



## Criterion DecisionPlus

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

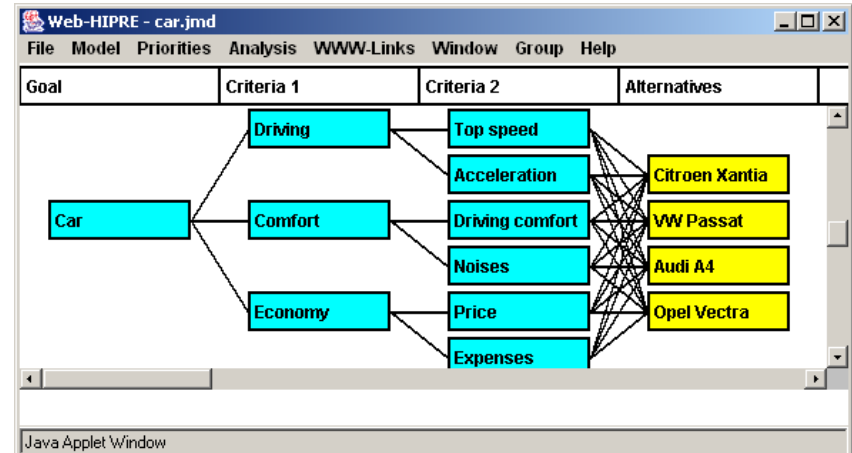


## WinPre

<http://sal.aalto.fi/en/resource/s/downloadables/winpre>

# Programi za večkriterijske modele

Web-HIPRE <http://hipre.aalto.fi/>



**Priorities - Car**

Direct SMART SWING SMARTER AHP Valuefn Group

How many times more important?

More important 9  3.0  9

Economy  Driving

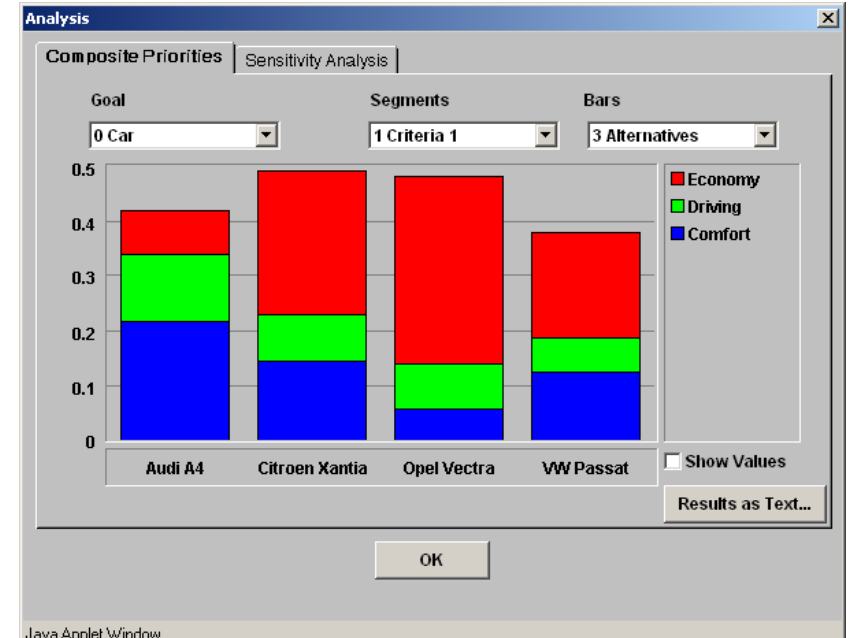
Next Comparison 3 slightly preferred Clear All

	A	B	C
A Economy	1.0	3.0	2.0
B Driving	0.33	1.0	0.5
C Comfort	0.5	2.0	1.0

1 - 9 scale CM: 0.061

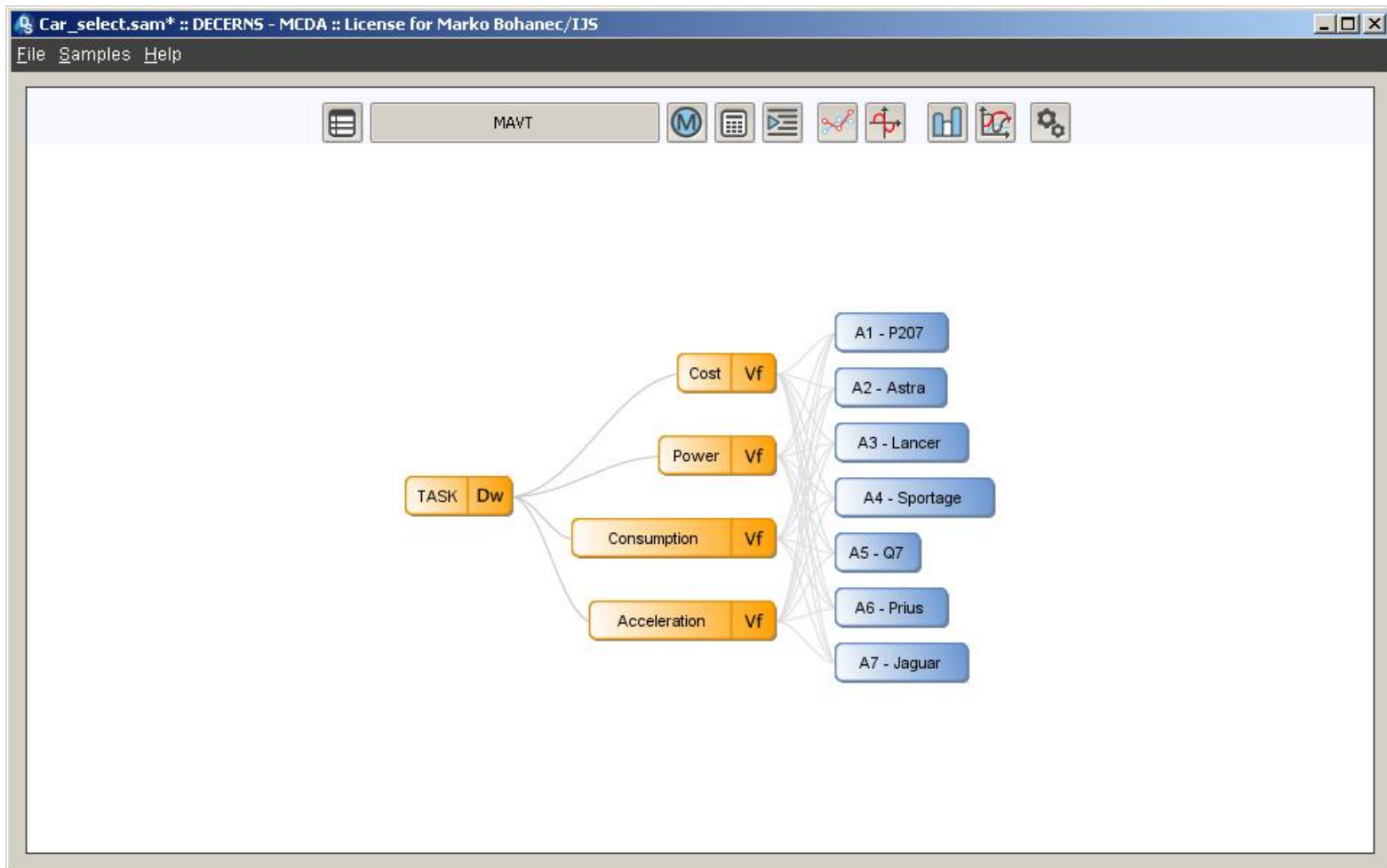
Economy	0.540	<div style="width: 54%;"></div>
Driving	0.163	<div style="width: 16%;"></div>
Comfort	0.297	<div style="width: 29%;"></div>

OK Cancel



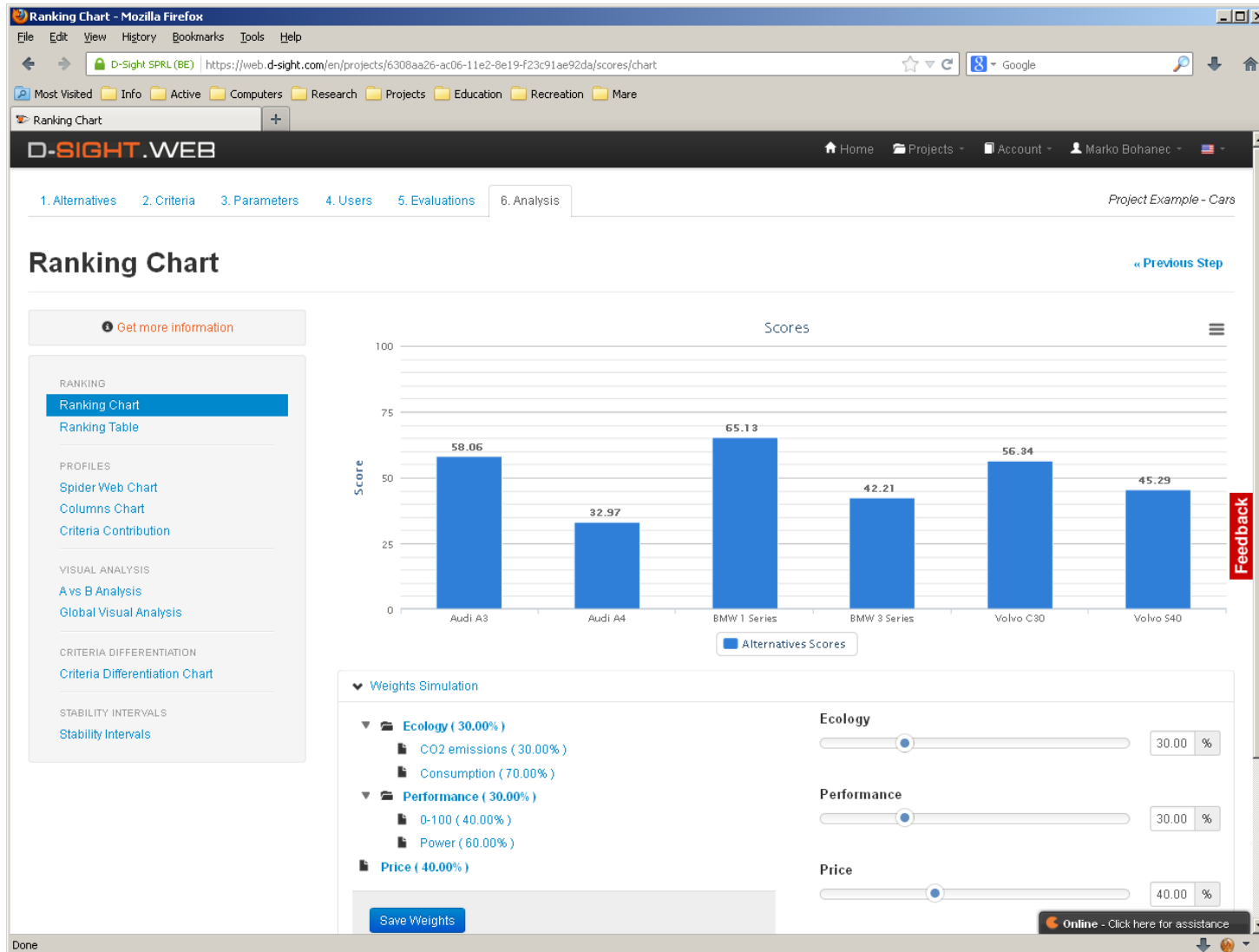
# Programi za večkriterijske modele

DECERNS <http://decerns.com/mcda.html>



# Programi za večkriterijske modele

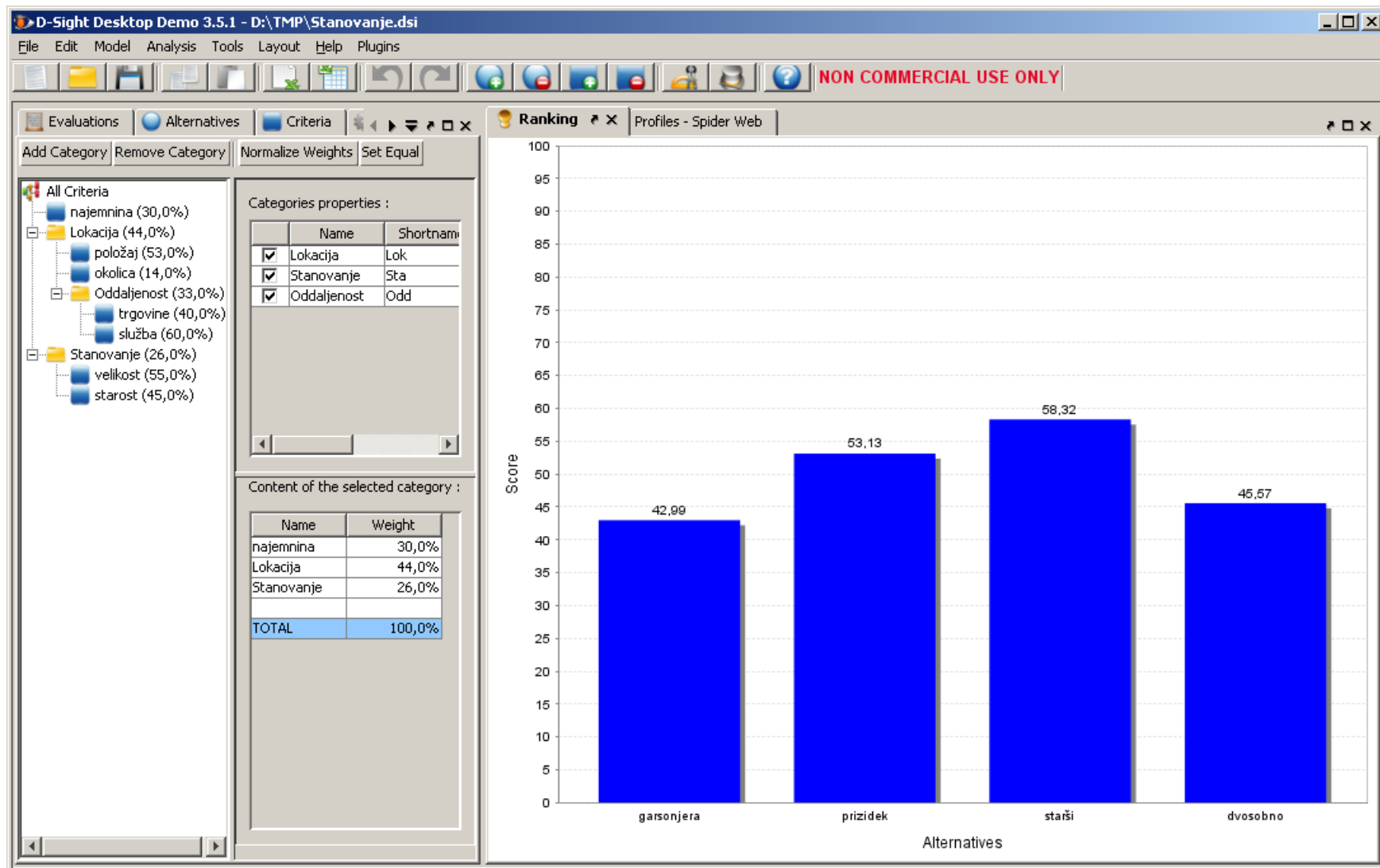
D-SIGHT <http://www.d-sight.com/>





# Programi za večkriterijske modele

D-SIGHT <http://www.d-sight.com/>



# Programi za večkriterijske modele

Entscheidungsnavi <https://enavi.app/en/start#/landingpage>

ENTSCHEIDUNGSNAVI **Guided** Projects Alex (Case study for job and life planning) EN

How could I shape my life from a professional viewpoint over the next three years to achieve the highest possible level regarding my quality of life?

1 | Decision Statement

2 | Fundamental Objectives

- First Brainstorm
- Further Considerations
- Suggestion Lists
- First Objective Hierarchy
- Review
- Result

3 | Alternatives

4 | Consequences Table

5 | Evaluation

Final Review

## 2 Fundamental Objectives

Here you can see the result of the second step. (More Information)  
You can continue to make changes at this point. You may need to adjust the hierarchy a bit later on, to fit your alternatives. The decision process can be iterative at this point.

View: Objective Hierarchy

```
graph LR; Root[Objective hierarchy] --- Obj1[Achieve the highest possible level of personal well-being]; Root --- Obj2[Make my activities mean as much as possible]; Root --- Obj3[Enjoy my passions to the fullest]; Root --- Obj4[Have as many valuable social relationships as possible]; Root --- Obj5[Have a pronounced feeling of competence]; Obj1 --- Sub1_1[mental]; Obj1 --- Sub1_2[physical]; Sub1_1 --- Sub1_1_1[less stress]; Sub1_1 --- Sub1_1_2[more possibility to plan vacations]; Sub1_1 --- Sub1_1_3[possibility of working in home office]; Sub1_1 --- Sub1_1_4[lower task pressure]; Sub1_1 --- Sub1_1_5[no mobile phone accessibility at the weekend]; Sub1_2 --- Sub1_2_1[health]; Sub1_2 --- Sub1_2_2[improve fitness]; Sub1_2 --- Sub1_2_3[healthier nutrition]; Sub1_2 --- Sub1_2_4[good cafeteria]; Obj2 --- Sub2_1[do something socially useful]; Obj2 --- Sub2_2[do more for the environment]; Obj3 --- Sub3_1[bouldering]; Obj3 --- Sub3_2[get to know new things]; Obj3 --- Sub3_3[cinema and concerts]; Sub3_1 --- Sub3_1_1[more time to boulder]; Sub3_1 --- Sub3_1_2[health]; Sub3_1 --- Sub3_1_3[boulder coach]; Sub3_2 --- Sub3_2_1[completely new fields of activity]; Sub3_2 --- Sub3_2_2[variety]; Sub3_2 --- Sub3_2_3[discover other cultures]; Obj4 --- Sub4_1[in the workplace]; Obj4 --- Sub4_2[partner]; Obj4 --- Sub4_3[maintain friendships]; Sub4_1 --- Sub4_1_1[nicer boss]; Sub4_1 --- Sub4_1_2[get compliments from the boss]; Sub4_1 --- Sub4_1_3[good relationship to colleagues]; Sub4_2 --- Sub4_2_1[more time for the partner]; Obj5 --- Sub5_1[feel recognition]; Obj5 --- Sub5_2[freedom to shape]; Obj5 --- Sub5_3[more responsibility in the job]; Obj5 --- Sub5_4[expand skills]; Sub5_2 --- Sub5_2_1[independently design and optimize production facilities]; Sub5_4 --- Sub5_4_1[learn another language]; Sub5_4 --- Sub5_4_2[soft skills]; Sub5_4 --- Sub5_4_3[learn negotiation techniques];
```

# Programi za večkriterijske modele

DEXiWin <https://dex.ijs.si/dexisuite/dexiwin.html>

The screenshot displays the DEXiWin software interface for a car model. The main window is titled "DEXiWin - [Car [Car.dxi]]". The interface includes a menu bar (File, Edit, View, Window, Help) and a toolbar with various icons. Below the toolbar, there are tabs for "Model", "Alternatives", "Evaluation", "Report", and "Charts".

The "Model" tab is active, showing a hierarchical tree structure of attributes. The root attribute is "CAR", which is expanded to show its sub-attributes:

- PRICE
  - BUY.PRICE
  - MAINT.PRICE
- TECH.CHAR.
  - #PERS
  - #DOORS
  - LUGGAGE
  - SAFETY

Each attribute has a description and a scale. The scales are color-coded: red for "unacc", green for "acc", blue for "good", and orange for "exc".

Attribute	Description	Scale
CAR	Quality of a car	unacc; acc; good; exc
PRICE	Price of a car	high; medium; low
BUY.PRICE	Buying price	high; medium; low
MAINT.PRICE	Maintenance price	high; medium; low
TECH.CHAR.	Technical characteristics	bad; acc; good; exc
COMFORT	Comfort	small; medium; high
#PERS	Maximum number of passengers	to_2; 3-4; more
#DOORS	Number of doors	2; 3; 4; more
LUGGAGE	Size of the luggage boot	small; medium; big
SAFETY	Car's safety	small; medium; high

On the right side of the interface, there are input fields for "Attribute name" (containing "CAR"), "Attribute description" (containing "Quality of a car"), and "Scale" (containing "unacc; acc; good; exc"). Below these is a "Function" field containing the text "Rules: 12/12 (100,00%), determined: 100,00% [unacc:6, acc:1, good:2, exc:3]".

At the bottom of the window, a status bar displays: "Attributes: 10 (6 basic, 4 aggregate, 0 linked) | Scales: 10 | Functions: 4 | Alternatives: 2".

# Programi za večkriterijske modele

Glejte tudi: <https://kt.ijs.si/MarkoBohanec/dss.html>

- [1000Minds](#) (PAPRIKA): Decision-making and conjoint analysis software
- [Analytica](#): Visual software for creating, analyzing and communicating quantitative decision models
- [BPMSG AHP](#): Multi-criteria decision making using the Analytic Hierarchy Process
- [Criterion DecisionPlus](#): Multi-criteria decision making using AHP and SMART
- [DECERNS MCDA](#): Multi-criteria decision analysis system using MAVT/MAUT/F-MAVT, AHP, TOPSIS, PROMETHEE, FlowSort, ProMAA and FMAA
- [DecideIT](#): Multi-criteria decision analysis and decision tree modelling with imprecise information
- [Decision Deck](#): A software workbench which helps to design, execute and share complex MCDA/M algorithms and experiments
- [DecisionPad](#): Decision support based on the decision matrix and multi-attribute utility theory
- [Definite / BOSDA](#): Decision making software for a finite set of alternatives
- [DEX Software](#): A software suite for qualitative multi-criteria modeling using method DEX
- [DPL](#): Intuitive, graphical decision tree and influence diagram software tool for robust decision and risk analytics
- [D-SIGHT](#): [2023-02-08: Cannot login/register] Visual and interactive tool for multicriteria decision aid problems based on the PROMETHEE and MAUT methods
- [Entscheidungsnavi \("Decision Navigation"\)](#): A free decision support tool for value-focused thinking using MAUT
- [Expert Choice](#): AHP software for collaborative decision making Solution
- [FITradeoff](#): Flexible and Interactive Tradeoff elicitation procedure for multicriteria additive models in MAVT scope
- [GeNIe and SMILE](#): Tools for artificial intelligence modeling and machine learning with Bayesian networks and other types of graphical probabilistic models
- [GMAA](#): Generic Multiattribute Analysis
- [HIPRE](#): Decision support software using AHP and SMART
- [HiView3](#): Hierarchical multi-criteria modeling and decision analysis
- [Hugin Expert](#): Bayesian Network analytics
- [IDS5 Poznań \(JAMM, iMaf, iRank, VisualUTA, ...\)](#). Related: [Marcin Szela's software](#) on DRSA (Dominance-based Rough Set Approach).
- [IRIS](#): Interactive Robustness analysis and parameters' Inference for multicriteria Sorting problems
- [JSMMA](#): Open source implementation of SMAA (Stochastic Multicriteria Acceptability Analysis) methods in Java
- [LAMSADe](#): Software at the University Paris Dauphine: ELECTRE, UTA+, SRF, IRIS, ...
- [Logical Decisions](#): Hierarchical multi-criteria modeling and analysis
- [MAMCA](#): Web software for Multi-Actor Multi-Criteria Analysis
- [Mathematica](#): Technical computing
- [M-MACBETH](#): Multi-criteria problem structuring and evaluations involving both quantitative and qualitative criteria (Measuring Attractiveness by a Categorical Based Evaluation Technique)
- [MATLAB](#): Desktop environment for iterative analysis and design processes
- [MCDA package for R](#): Multicriteria Decision Aiding process with algorithms, preference elicitation and data visualisation functions
- [MCDA-ULeval](#): Software tool for multicriteria decision aiding using methods of the ELECTRE family
- [Netica](#): Software for working with belief networks and influence diagrams
- [odesys // helping you decide](#): A simple web-based multi-criteria tool
- [Precision Tree](#): Probabilistic decision analysis in Excel
- [PriEst](#): Priority Estimation Tool using AHP
- [Prime Decisions](#): Decision analytic tool for interval-valued ratio statements in the specification of preferences
- [pymcdm](#): Python library for multi-criteria decision-making
- [R](#) and [R Studio](#): Free software environment for statistical computing and graphics
- [Rational Will](#): Integrated decision analysis software using decision trees, AHP, Bayesian inference, Markov decision process
- [RightChoice](#): Multi-criteria analysis package
- [SilverDecisions](#): Decision tree software on the web
- [Smart Decisions](#): Multi-criteria modeling and analysis using value trees and weighting
- [Super Decisions](#): Decision support software using AHP and ANP
- [Supertree](#): [2023-02-08: Timed-out access]
- [Transparent Choice](#): AHP Software
- [TreeAge Pro](#): Building decision trees, Markov models and event-based simulations
- [TreePlan](#): Decision tree add-in for Excel
- [Vanguard System](#): Advanced decision analysis, business modeling, forecasting, optimization, Monte Carlo simulations
- [V.I.S.A.](#): Web based multi-criteria decision making software using value trees and weighting
- [VIP](#): Variable Interdependent Parameters analysis
- [Visual PROMETHEE](#): Implementation of the PROMETHEE-GAIA multicriteria decision aid methodology
- [Web-HIPRE](#): A java applet for multiattribute modeling using MAVT, AHP, MAVT, SMART, SWING, SMARTER
- [Winpre](#): Implementation of techniques based on the propagation of imprecise preference statements in hierarchical weighting