Project 1: Promethee/Electre

Wojciech Bogacz 156034, Krzysztof Skrobała 156039

1

1. Dataset

1.1. Description

As decision makers, we want to plan our vacation in the Mazurian lakes. There are many yachts with several parameters to consider, and we want the best one for the best price. We gathered 16 yachts from zegluj.pl website, and outlined 5 parameters: cost per day, deposit, power of the engine, sail area, width of the boat.

Example yacht data:

Name	PricePerDay	Deposit	EnginePower	SailArea	Width
Antila 24.4	290	1500	6	30	270
Antila 24	220	2000	4	27	270

Here we can say that *Antila 24* is cheaper, but on the cost of the lower engine power and the lower sail area. Unfortunately, there is no solution which is the best on every criterion, so we aim to select boats with sensible trade-offs with the MCDA methods.

1.2. Criterion

1.2.1. Cost per day

This criterion specifies the cost of renting the boat. It has a continuous domain, and hypothetically the owner can provide infinitely large value. Of course, the nature is of the cost type. As a student, we prefer to boat for a limited budget. Therefore, we apply for this criteria the highest weight equals 4.

1.2.2. Deposit

This criterion specifies the cost of deposit. It also has a continuous domain, without an upper boundary. Of course, the nature is of cost type. This criterion is not very important, so we assigned 1 as a weight.

1.2.3. Power of the engine

This criterion specifies the power of the engine in horsepower. It's discrete and gain-type parameter. Having more horsepower, gives me pleasure during the sailing. We assigned 2 as the weight.

1.2.4. Sail area

This criterion specifies the Sail area in cm^2. It is continuous and gain-type parameter. Having a greater area, provides faster boat and as a result more adventure experience. We assigned 2 as the weight.

1.2.5. Width of the boat

This criterion specifies the width of the boat in cm. It is continuous and gain-type parameter. This parameter is not very relevant, however having greater boat, provides greater space for the crew. We assigned 1 as the weight.

2. Our opinions

Best alternative could be either much cheaper, even with some trade-off on the other criterions, or compensate the higher (not too much) price for better qualities.

Our prediction is, that one of the strongest candidates is:

Name	PricePerDay	Deposit	EnginePower	SailArea	Width
Laguna 25	19	1000	6	29	274

Because it is prominantly cheap, with low deposit and quite average quality

2.1. Pairwise comparisons

We believe that:

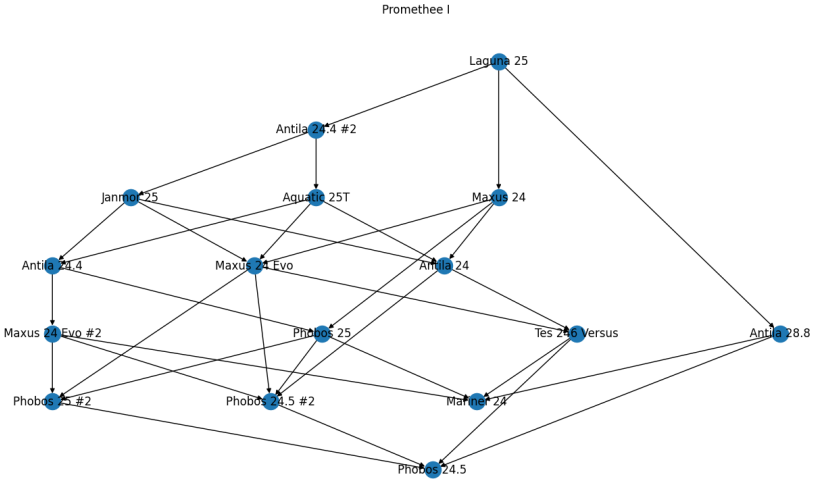
- *Antila 24.4 > Antila 24*
- *Phobos 25 > Phobos 24.5 #2*
- *Aquatic 25T > Antila 24*
- *Phobos 24.5 #2 > Mariner 24*

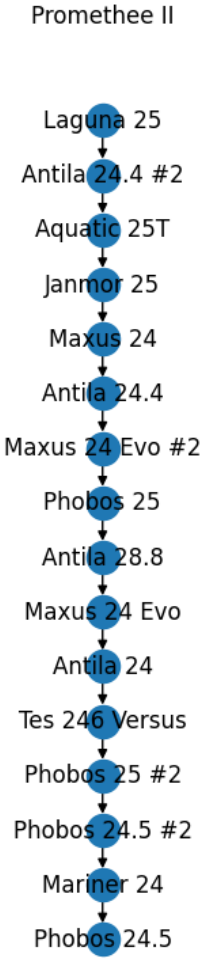
3. Promethee

3.1. Preferential informations

Critertion	Indifference Threshold	Preference Threshold	Weight	Type
PricePerDay	15	40	4	cost
Deposit	100	300	1	cost
EnginePower	0	2	2	gain
SailArea	1	3	2	gain
Width	15	45	1	gain

3.2. Result


Promethee I
Laguna 25
Antila 24.4 #2
Janmor 25
Aquatic 25T
Maxus 24
Antila 24.4
Maxus 24 Evo
Antila 24
Maxus 24 Evo #2
Phobos 25
Tes 246 Versus
Antila 28.8
Phobos 25 #2
Phobos 24.5 #2
Mariner 24
Phobos 24.5


Promethee II
Laguna 25
Antila 24.4 #2
Aquatic 25T
Janmor 25
Maxus 24
Antila 24.4
Maxus 24 Evo #2
Phobos 25
Antila 28.8
Maxus 24 Evo
Antila 24
Tes 246 Versus
Phobos 25 #2
Phobos 24.5 #2
Mariner 24
Phobos 24.5

3.3. Summary

We see that there are many branches in partial ranknig suggesting that the yachts are generally hard to compare. However we can see clearly the winner *Lagune 25* and the loser *Phobos 24.5*. What is interesting, the 2-4 position in the complete ranking is not constituted by *Antila 24.4 #2*, *Maxus 24*, *Antila 28.8* in the breadth-first manner, but by *Antila 24.4*, *Aquatic 25T* and *Janmor 25* which are a part of a one branch. The complete ranking loses some information about the comparability, but it is easier to interpret and it keeps the direct order between pairs which are comparable. In our case, we are interested in a very small subset of the best alternatives, so incomparability which exists generally within the low-ranked alternatives is not a very big problem in this case.

3.4. Comparison to a priori

We see some differences with the a priori pairs, especially in the partial ranking:

- *Antila 24.4* > *Antila 24* - In reality there is *I* relation on the parial ranking but > on the complete one
- *Phobos 25* > *Phobos 24.5 #2* - It holds for both rankings
- *Aquatic 25T* > *Antila 24* - It holds for both rankings
- *Phobos 24.5 #2* > *Mariner 24* - In reality there is *I* relation on the parial ranking and even < on the complete one

4. Electre TRI-B

Here we classify yachts to classes **Bad**, **Average** and **Good** based on given boundary profiles

4.1. Boundary profiles

Alternative	PricePerDay	Deposit	EnginePower	SailArea	Width
b1	350	2500	6	28	250
b2	250	1600	8	31	275

4.2. Indifference threshold

Criterion	PricePerDay	Deposit	EnginePower	SailArea	Width
b1	10	50	0	1	5
b2	10	100	0	0	5

4.3. Preference threshold

Criterion	PricePerDay	Deposit	EnginePower	SailArea	Width
b1	30	200	1	2	15
b2	20	200	1	1	10

4.4. Credibility threshold

Credibility threshold is set to **0.65**

4.5. Veto threshold

Criterion	PricePerDay	Deposit	EnginePower	SailArea	Width
b1	110		5	5	
b2	100		4	5	

4.6. Result

	class
Antila 24.4	average
Maxus 24 Evo	average
Aquatic 25T	average
Mariner 24	average
Laguna 25	good
Phobos 25	good
Antila 24	good
Antila 28.8	good
Phobos 24.5	bad
Antila 24.4 #2	average
Phobos 25 #2	average
Maxus 24 Evo #2	average
Maxus 24	average
Tes 246 Versus	good
Janmor 25	good
Phobos 24.5 #2	bad

	class
Antila 24.4	average
Maxus 24 Evo	average
Aquatic 25T	bad
Mariner 24	bad
Laguna 25	average
Phobos 25	average
Antila 24	bad
Antila 28.8	bad
Phobos 24.5	bad
Antila 24.4 #2	average
Phobos 25 #2	bad
Maxus 24 Evo #2	average
Maxus 24	average
Tes 246 Versus	bad
Janmor 25	average
Phobos 24.5 #2	bad

4.7. Summary

We see that pessimistic assignment did not assign **Good** class to any alternative. On the other hand in the optimistic assignment there is more variaty of class asignments. What is interesting is that many **Bad** alternatives in the pessimistic assignment jumped over to **Good** in the the optimisic, skipping the **Average** class.

5. Comparison

Interesting fact is, that despite the fact that the methods agree on the worst yacht (*Phobos 24.5*), Promethee assigned *Laguna 25* as the best alternative, but Electre Tri-B in the pessimistic assignment assigned it to the **Average** class. Moreover, second and third rank according to Promethe II are assigned the **Average** class, while fourth rank is **Good**.