Multi attribute Decision Making Methods

Lexicographic Method

Step 1 :- Rank the attributes based on the preference

Rank →	1	4	2	3
	Price	fuel efficiency	Comfort	Looks.
Car1	4	15	G (2)	A (1)
Car2	8	16	G (2)	G (2)
Car3	10	17	F (4)	F (4)
Car4	3.5	18	A (1)	A (1)

Price is the most important attribute.

Step2 :- Compare the alternatives on the most important attribute, highest Rank.

In this example the most important attribute is ~~ranks~~ Price

So the most preferred car is 4.

If few values of ~~that~~ an attribute (highest) tied then

~~Ste~~ **Step3 :-** use the second important attribute for these attributes,

Car1 > Car4

So Car1 is Selected.

Categorizing the attributes

1) Benefit attribute :- More the value more ~~preferred~~ preferred the attribute. Fuel efficiency, Comfort, and looks.

Cost attribute :- Greater the ~~attrib~~ ~~attrib~~ ~~attrib~~ attribute value lesser the preference. Price of the Car.

Median Ranking Method

Attributes	Price	Fuel efficiency	Comfort	Looks	
Car 1	4 (2+)	15 (4)	G (2) 2.5	G (2) 2	10.5
Car 2	8 (3)	16 2.5	G (2) 2.5	G (2) 2	10
Car 3	10 (4)	17 . 1	E (4) 1	G (2) 2	8
Car 4	3.5 (1)	16 2.5	A (1) 4	A (1) 4	11.5

Step 1:- Convert the linguistic ~~value~~ term into numerical value.

A - 1, Good - 2, Very Good - 3, Excellent - 4, Outstanding - 5

Step 2:- Ranking of all the options for different attributes according to preference value.

$m, m+1$

$\frac{m+m+1}{2} = \frac{2m+1}{2}$

for Comfort

for looks $\frac{m+m+1+m+2}{3} = \frac{3m+3}{3}$

Step 3:- Add rankings of all the attributes.

The Car with highest rank will be selected as the best Car. Here in this example the best Car is Car 3.

TOPSIS Method (Multi Criteria Based Decision Making)

Technique for Ordered Preference by Similarity to ideal Solution :-

The best assumption should have shortest distance. (Euclidian Distance).

	Price & Cost	Storage space	Camera	Looks
M1	250$	16GB	12MP	E
M2	200$	16GB	8MP	A
M3	300$	32GB	16MP	G
M4	275$	32GB	8MP	G
M5	225$	16GB	16MP	BA
	564.579	53.06	28	8.3666

Low = 1
BA = 2
~~Good~~
Average 3
Good 4
E - 5

Formula for vector ~~norm~~ normalization

$$\bar{x}_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^{n} x_{i}^{2}}}$$

$$\sqrt{\sum_{i=1}^{m} x_i^2} = \sqrt{250^2 + 200^2 + 300^2 + 275^2 + 225^2}$$

$= 564.579$.

Performance value of each cell

weight	0.25	0.25	0.25	0.25
	Price & Cost	Storage space	Camera	Looks
M1	0.4426	0.3015	0.4286	0.5976
M2	0.3542	0.3015	0.2857	0.3586
M3	0.5314	0.6030	0.5714	0.4781
M4	0.4871	0.6030	0.2857	0.4781
M5	0.3985	0.3015	0.5714	0.2390

The value of each cell is termed as Normalized Performance value

Now the weighted Normalised Decision matrix.

	0.25	0.25	0.25	0.25
	Price & cost	Storage space	Camera	Cooling
M1	0.1107	0.0754	0.1071	0.1494
M2	0.0886	0.0754	0.0714	0.0896
M3	0.1328	0.1508	0.1429	0.1195
M4	0.1218	0.1508	0.0714	0.1195
M5	0.0996	0.0754	0.1429	0.0598
v_j^+	0.0886	0.1508	0.1429	0.1494
v_j^-	0.1328	0.0754	0.0714	0.0598

S_i^+	S_i^-
0.0863	0.0990
0.1198	0.0534
0.0534	0.1198
0.0842	0.0968
0.1176	0.0788

~~Now~~ Next we ~~Calculate~~ Calculate Ideal best & ideal worst value.

Eucledian distance from Ideal best –

$$S_i^+ = \sqrt{(0.1107-0.0866)^2 + (0.0754-0.1508)^2 + (0.1071-0.1429)^2 + (0.1494-0.1494)^2} = 0.0863$$

Eucledian distance from Ideal worst –

$$S_i^- = \sqrt{(0.1107-0.1328)^2 + (0.0754-0.0754)^2 + (0.1071-0.0714)^2 + (0.1494-0.0598)^2} = 0.0990$$

Relative Closeness

	S_i^+	S_i^-	$S_i^+ + S_i^-$	P_i		
M1	0.0863	0.0990	0.1853	0.5342	3	0.2716
M2	0.1196	0.0534	0.1732	0.3083	5	0.69
M3	0.0534	0.1198	0.1732	0.691	1	0.30
M4	0.0842	0.0968	0.181	0.534	2	
M5	0.1176	0.0788	0.1964	0.4012	4	

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-}$$

Mobile 3 is selected as it is having maximum Performance score.