TOPSIS…
for supplier selection problem.

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Let's consider…

- Luna wants to go on a vacation.
- She has 3 options

Hogwarts

Hogsmeade

Azkaban

How to decide..???

Let us consider…

- Each option can be evaluated against certain criteria.
- Criteria for **vacation destinations** can be:
  - **Entertainment**
  - **Facilities**
  - **Accommodation cost**
  - **Travel cost**

Similarly…

- Selecting a *source of information* (library, internet, etc…) involves various criteria such as:
  - Reliability of information
  - Time to gather information
  - Cost of acquiring information

- These are examples of MULTI-CRITERIA problems and requires MCDM approach.

MCDM

Multiple Criteria Decision Making

- *Selection of the best, from a set of alternatives, each of which is evaluated against multiple criteria.*

Some problem solving techniques are :

- SAW (Simple Additive Weighting)
- TOPSIS (Technique for Order Preference by Similarity to the Ideal Solution)
- ELECTRE (Elimination et Choice Translating Reality)
- AHP (The Analytical Hierarchy Process)
- SMART (The Simple Multi Attribute Rating Technique)
- ANP (Analytic network process)

Important terms…

- *Alternatives* – These are the options which are to be evaluated for selection of the best.

  Example: (for vacation problem)Hogwarts, Hogsmeade, Azkaban

- *Criteria or Attributes* – These will impact the selection of alternatives.

  Example: (for vacation problem) entertainment, facilities, travel cost, accommodation cost

  - Completeness: It is important to ensure that all of the important criteria are included.
  - Redundancy: In principle, criteria that have been judged relatively unimportant or to be duplicates should be removed at a very early stage.
  - Operationality: It is important that each alternative can be judged against each criterion.

Important terms…

- *Weights* – These estimates relative importance of criteria.
  - Each attribute is given certain points on 0-10 or 0-100 rating scale by a team of ***experts*** or ***decision makers.***
  - **Example:**

criteria		*weight*	*rating scale*
Entertainment	-	4	**10** very good **-1** none
Facilities	-	2	**10** very good **-1** none
Travel cost	-	6	**10** low-**1** very high
Accomodation	-	8	**10** low-**1** very high

Important terms…

- *Decision makers* – These are experts who are assigned with the task of weighting each attribute.
  - There can be 'n' number of decision makers.
  - **Example:**

criteria — *rating scale*

- Entertainment - **10** very good **-1** none
- Facilities - **10** very good **-1** none
- Travel cost - **10** low-**1** very high
- Accomodation - **10** low-**1** very high

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	4	2	6	$= \frac{4+2+6}{3} = 4$
Facilities	2	3	1	$= \frac{2+3+1}{3} = 2$

Important terms…

- *Decision matrix* – A table that is used to objectively make decision about making selection from a range of options.
  - Decision maker rates each attribute of each alternative
  - **Example: for alternate 1 (hogwarts)**

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	10	8	9	$= \frac{10+8+9}{3} = 9$
Facilities	7	8	6	$= \frac{7+8+6}{3} = 7$
Travel cost	5	6	7	$= \frac{5+6+7}{3} = 6$
Acc. Cost	9	5	7	$= \frac{9+5+7}{3} = 7$

Similarly…

- **for alternate 2 (hogsmeade)**

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	9	6	9	$= \frac{9+6+9}{3}$ **= 8**
Facilities	8	9	4	$= \frac{8+9+4}{3}$ $= \frac{7+10+10}{3}$ **= 7**
Travel cost	7	10	10	$= \frac{5+7+6}{3}$ **= 9**
Acc. Cost	5	7	6	= **= 6**

- **for alternate 3 (azkaban)**

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	9	4	8	$= \frac{9+4+8}{3}$ **= 7**
Facilities	7	9	8	$= \frac{7+9+8}{3}$ $= \frac{6+5+7}{3}$ **= 8**
Travel cost	6	5	7	$= \frac{7+6+5}{3}$ **= 6**
Acc. Cost	7	6	5	= **= 6**

Decision matrix…

Criteria	Hogwarts	hogsmeade	Azkaban
entertainment	9	8	7
Facilities	7	7	8
Travel cost	6	9	6
Acc. Cost	7	6	6

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	10	8	9	= $\frac{10+8+9}{3}$ = 9
Facilities	7	8	6	= $\frac{7+8+6}{3}$ = 7
Travel cost	5	6	7	= $\frac{5+6+7}{3}$ = 6
Acc. Cost	9	5	7	= $\frac{9+5+7}{3}$ = 7

Hogwarts (Table 1)

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	9	6	9	= $\frac{9+6+9}{3}$ = 8
Facilities	8	9	4	= $\frac{8+9+4}{3}$ = 7
Travel cost	7	10	10	= $\frac{7+10+10}{3}$ = 9
Acc. Cost	5	7	6	= $\frac{5+7+6}{3}$ = 6

Hogsmeade (Table 2)

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	9	4	8	= $\frac{9+4+8}{3}$ = 7
Facilities	7	9	8	= $\frac{7+9+8}{3}$ = 8
Travel cost	6	5	7	= $\frac{6+5+7}{3}$ = 6
Acc. Cost	7	6	5	= $\frac{7+6+5}{3}$ = 6

Azkaban (Table 3)

TOPSIS

Technique for Order Preference by Similarity to Ideal Solution

In this method two artificial alternatives are hypothesized:

- Ideal alternative: One which has the best attributes values (*i.e. max. benefit attributes and min. cost attributes*)
- Negative ideal alternative: One which has the worst attribute values. (*i.e. min. benefit attributes and max. cost attributes*)

TOPSIS selects the alternative that is the closest to the ideal solution and farthest from negative ideal solution.

Steps involved in TOPSIS…

- Step 1 – standardize the decision matrix.
  - This step transforms various attribute dimensions into non-dimensional attributes, which allows comparisons across criteria.
  - For standardizing, each column of decision matrix, is divided by root of sum of square of respective

Criteria	Hogwarts	Hogsmeade	Azkaban	
entertainment	9	8	7 =	$\sqrt{(9^2 + 8^2 + 7^2}$ ⟹ 13.93
				$\sqrt{(7^2 + 7^2 + 8^2}$
Facilities	7	7	8 =	$\sqrt{(6^2 + 9^2 + 6^2}$ =12.73
Travel cost	6	9	6 =	$\sqrt{(7^2 + 6^2 + 6^2}$ =12.37
Acc. Cost	7	6	6 =	= 11.00

DECISION MATRIX

Steps involved in TOPSIS…

- Step 1 – standardize the decision matrix.
  - This step transforms various attribute dimensions into non-dimensional attributes, which allows comparisons across criteria.
  - For standardizing, each column of decision matrix, is divided by root of sum of square of respective

Criteria	Hogwarts	Hogsmeade	Azkaban	
entertainment	9	8	7 =	$\sqrt{(9^2+8^2+7^2}$ = 13.93
Facilities	7	7	8 =	$\sqrt{(7^2+7^2+8^2}$ =12.73
Travel cost	6	9	6 =	$\sqrt{(6^2+9^2+6^2}$ =12.37
Acc. Cost	7	6	6 =	$\sqrt{(7^2+6^2+6^2}$ = 11.00

Steps involved in TOPSIS…

- Step 1 – standardize the decision matrix.
  - This step transforms various attribute dimensions into non-dimensional attributes, which allows comparisons across criteria.
  - For standardizing, each column of decision matrix, is divided by root of sum of square of respective

Criteria	Hogwarts	Hogsmeade	Azkaban	
entertainment	9	8	7 = $\sqrt{(9^2+8^2+7^2}$ / $\sqrt{(7^2+7^2+8^2}$	= 13.93
Facilities	7	7	8 = $\sqrt{(6^2+9^2+6^2}$	=12.73
Travel cost	6	9	6 = $\sqrt{(7^2+6^2+6^2}$	=12.37
Acc. Cost	7	6	6 =	= 11.00

Standardized decision matrix….

Criteria	Hogwarts	Hogsmeade	Azkaban	
entertainment	9	8	7 =	= 13.93
Facilities	7	7	8 =	=12.73
Travel cost	6	9	6 =	=12.37
Acc. Cost	7	6	6 =	= 11.00

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	9 / 13.93		
Facilities			
Travel cost			

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	0.65		
Facilities			
Travel cost			

Standardized decision matrix….

Criteria	Hogwarts	Hogsmeade	Azkaban	
entertainment	9	8	7 =	= 13.93
Facilities	7	7	8 =	=12.73
Travel cost	6	9	6 =	=12.37
Acc. Cost	7	6	6 =	= 11.00

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	9 / 13.93	8 / 13.93	
Facilities			
Travel cost			

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	0.65	0.57	
Facilities			
Travel cost			

Standardized decision matrix….

Criteria	Hogwarts	Hogsmeade	Azkaban	
entertainment	9	8	7 =	= 13.93
Facilities	7	7	8 =	=12.73
Travel cost	6	9	6 =	=12.37
Acc. Cost	7	6	6 =	= 11.00

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	9 / 13.93	8 / 13.93	7 / 13.93
Facilities			
Travel cost			

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	0.65	0.57	0.50
Facilities			
Travel cost			

Standardized decision matrix….

Similarly….

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	0.65	0.57	0.50
Facilities	0.55	0.55	0.63
Travel cost	0.49	0.73	0.49
Acc. Cost	0.64	0.55	0.55

Steps involved in TOPSIS…

- Step 2 - Construct **weighted** standardized decision matrix by **multiplying** attributes **weight** to each **rating.**

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	4	2	6	= 4
Facilities	2	3	1	= 2
Travel cost	6	4	8	= 6
Accomodation	8	9	7	= 8

Attributes weights

Criteria	Hogwarts	Hogsmeade	Azkaban
X	0.65	0.57	0.50
Facilities	0.55	0.55	0.63
Travel cost	0.49	0.73	0.49
Acc. Cost	0.64	0.55	0.55

Standardized decision matrix

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	2.6		
Facilities			
Travel cost			

Weighted Standardized decision matrix

Steps involved in TOPSIS…

- Step 2 - Construct **weighted** standardized decision matrix by **multiplying** attributes **weight** to each **rating.**

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	4	2	6	= 4
Facilities	2	3	1	= 2
Travel cost	6	4	8	= 6
Accomodation	8	9	7	= 8

Attributes weights

X

Criteria	Hogwarts	Hogsmeade	Azkaban
		0.57	0.50
Facilities	0.55	0.55	0.63
Travel cost	0.49	0.73	0.49
Acc. Cost	0.64	0.55	0.55

Standardized decision matrix

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	2.6	2.28	
Facilities			
Travel cost			

Weighted Standardized decision matrix

Steps involved in TOPSIS…

- Step 2 - construct weighted standardized decision matrix by multiplying attributes weight to each rating.

Criteria	Decision makers			Attributes weights
	Harry	Ron	Hermoine	
entertainment	4	2	6	= = 4
Facilities	2	3	1	= = 2
Travel cost	6	4	8	= 6
Accomodation	8	9	7	= 8

Attributes weights

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	**0.65**	**0.57**	**0.50**
Facilities	**0.55**	**0.55**	**0.63**
Travel cost	**0.49**	**0.73**	**0.49**
Acc. Cost	**0.64**	**0.55**	**0.55**

X

Standardized decision matrix

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	**2.6**	**2.28**	
Facilities	**1.1**		
Travel cost			

Weighted Standardized decision matrix

Steps involved in TOPSIS…

- Step 2 - construct weighted standardized decision matrix by multiplying attributes weight to each rating.

Similarly….

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	**2.6**	**2.28**	**2**
Facilities	**1.1**	**1.1**	**1.26**
Travel cost	**2.94**	**4.38**	**2.94**
Acc. Cost	**5.12**	**4.4**	**4.4**

Weighted Standardized decision matrix

Steps involved in TOPSIS…

- Step 3 – Determine ***ideal solution*** and ***negative ideal solution***.

A set of maximum values for each criteria is **Ideal solution**.

Criteria	Hogwarts	Hogsmead	Azkaban
Entertainment	2.6	2.28	2
Facilities	1.1	1.1	1.26
Travel cost	2.94	4.38	2.94
Acc. Cost	**5.12**	**4.4**	**4.4**

Max. → **2.6**

Max. → **1.26**

Max. → **4.38**

Max. → **5.12**

Ideal solution = {2.6, 1.26, 4.38, 5.12}

Steps involved in TOPSIS…

- Step 3 – Determine ***ideal solution*** and ***negative ideal solution***.

A set of minimum values for each criteria is **Negative Ideal solution**.

Criteria	Hogwarts	Hogsmeade	Azkaban	
		e	Min.	2.0
Entertainment	2.6	Min. 2.28		1.1
Facilities	Min. 1.1	1.1	1.26	2.94
Travel cost	2.94	4.38	2.94	4.4
Acc. Cost	**5.12**	**4.4**	**4.4**	

Negative Ideal solution = {2.6, 1.26, 2.94, 4.4}

Steps involved in TOPSIS…

- Step 4 – Determine separation from ***ideal solution.*** S_i^*

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	$(2.6-2.6)^2$	$(2.28-2.6)^2$	$(2.0-2.6)^2$
Facilities	$(1.1-1.26)^2$	$(1.1-1.26)^2$	$(1.26-1.26)^2$
Travel cost	$(2.94-2.94)^2$	$(4.38-2.94)^2$	$(2.94-2.94)^2$
Acc. Cost	$(5.12-4.4)^2$	$(4.4-4.4)^2$	$(4.4-4.4)^2$

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	0.0	0.10	0.36
Facilities	0.02	0.02	0.0
Travel cost	0.0	2.07	0.0
Acc. Cost	0.51	0.0	0.0

$S_i^* =$ | $(0.+0.02+0+0.51)^{1/2}$ = 0.74 | $(.1+.02+2.07+0)^{1/2}$ = 1.48 | = 0.6

$(0.36+.0+0+0)^{1/2}$

Steps involved in TOPSIS…

- Step 5 – Determine separation from ***negative ideal solution***

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	$(2.6-2.0)^2$	$(2.28-2.0)^2$	$(2.0-2.0)^2$
Facilities	$(1.1-1.1)^2$	$(1.1-1.1)^2$	$(1.26-1.1)^2$
Travel cost	$(2.94-4.38)^2$	$(4.38-4.38)^2$	$(2.94-4.38)^2$
Acc. Cost	$(5.12-5.12)^2$	$(4.4-5.12)^2$	$(4.4-5.12)^2$

Criteria	Hogwarts	Hogsmeade	Azkaban
Entertainment	0.36	0.07	0.0
Facilities	0.0	0.0	0.02
Travel cost	2.07	0.0	2.07
Acc. Cost	0.0	0.51	0.51

S_i' = $(0.36+0+2+0)^{1/2}$ / $(0+.02+2+.51)^{1/2}$ = 1.56

$(.07+0+0+.51)^{1/2}$ = 0.773

= 1.618

Steps involved in TOPSIS…

- Step 6 – Determine relative closeness to ***ideal solution.***

Criteria	Hogwarts	Hogsmeade	Azkaban
S_i^*	0.74	1.48	0.6
S_i'	1.56	0.773	1.618
$S_i^*+S_i'$	2.3	2.253	2.218
$S_i'/(S_i^*+S_i')$	1.56/2.3	0.77/2.25	1.62/2.21
	0.68	**0.343**	Max. **0.729**

BEST

TOPSIS for supplier selection problem.

- Consider 3 suppliers…
  - S_1
  - S_2
  - S_3
- 3 suppliers are evaluated against 4 attributes
  - Special factor (Q_1) — COST ATTRIBUTE
  - On time delivery (Q_2) — BENEFIT ATTRIBUTES
  - Performance history (Q_3) — BENEFIT ATTRIBUTES
  - Technical capability (Q_4) — BENEFIT ATTRIBUTES

TOPSIS for supplier selection problem.

- There are 4 decision makers…
  - D_1
  - D_2
  - D_3
  - D_4

…to express their preferences and ratings to select the best supplier.

TOPSIS for supplier selection problem.

- Step 1 – finding **ATTRIBUTE WEIGHTS**.

rating given to each attribute by each decision maker is shown in table

Attributes	D_1	D_2	D_3	D_4	W	Normalized W
Q_1	H(.375)	M(.275)	ML(.225)	VL(.125)	.25	.25/.91 = 0.275
Q_2	VH(.425)	VL(.125)	VVL(.05)	ML(.225)	.21	.21/.91 = 0.230
Q_3	L(.175)	VL(.125)	VVL(.05)	MH(.325)	.17	.17/.91 = 0.187
Q_4	VH(.425)	L(.175)	M(.275)	ML(.225)	.28	.28/.91 = 0.308
Total					0.9	1.00

AVERAGE

AVERAGE

AVERAGE

AVERAGE

scale of attribute weights

	ATTRIBUTE SCALE								
	VVL	VL	L	ML	M	MH	H	VH	VVH
WEIGHTS	.05	.125	.175	.225	.275	.325	.375	.425	.475

TOPSIS for supplier selection problem.

- Step 1 – finding **ATTRIBUTE WEIGHTS**.

rating given to each attribute by each decision maker is shown in table

Attributes	D_1	D_2	D_3	D_4	W	Normalized W
Q_1	H(.375)	M(.275)	ML(.225)	VL(.125)	.25	.25/.91 = 0.275
Q_2	VH(.425)	VL(.125)	VVL(.05)	ML(.225)	.21	.21/.91 = 0.230
Q_3	L(.175)	VL(.125)	VVL(.05)	MH(.325)	.17	.17/.91 = 0.187
Q_4	VH(.425)	L(.175)	M(.275)	ML(.225)	.28	.28/.91 = 0.308
Total					0.9	1.00

scale of attribute weights

	ATTRIBUTE SCALE								
	VVL	VL	L	ML	M	MH	H	VH	VVH
WEIGHTS	.05	.125	.175	.225	.275	.325	.375	.425	.475

TOPSIS for supplier selection problem.

- Step 2 – finding **ATTRIBUTE RATINGS**.

Rating given to each supplier by each decision maker for attribute

Suppliers	D_1	D_2	D_3	D_4	G_1
AVERAGE S_1	.03	.03	.03	.03	.03
AVERAGE S_2	.05	.05	.05	.05	.05
AVERAGE S_3	.01	.01	.01	.01	.01

Rating given to each supplier by each decision maker for attribute

Suppliers	D_1	D_2	D_3	D_4	G_2
AVERAGE S_1	.95	.95	.95	.95	.95
AVERAGE S_2	.98	.98	.98	.98	.98
AVERAGE S_3	.85	.85	.85	.85	.85

TOPSIS for supplier selection problem.

- Step 2 – finding **ATTRIBUTE RATINGS**.

rating given to each supplier by each decision maker for attribute

Suppliers	D_1	D_2	D_3	D_4	G_3
S_1	G(9)	P(1)	MP(3)	MP(3)	4
S_2	MP(3)	MP&F(4)	MP&F(4)	MP&F(4)	3.75
S_3	F(5)	F(5)	MP&F(4)	F(5)	4.75

AVERAGE

rating given to each supplier by each decision maker for attribute

Suppliers	D_1	D_2	D_3	D_4	G_3
S_1	G(9)	MP(3)	P(1)	MP(3)	4
S_2	MP(3)	MP&F(4)	F(5)	F(5)	4.25
S_3	G(9)	G(9)	MP&G(6)	MP&G(6)	8.5

AVERAGE

scale of attribute ratings

	ATTRIBUTE SCALE				
	P	MP	F	MG	G
RATINGS	1	3	5	7	9

TOPSIS for supplier selection problem.

- Step 3 – construct **DECISION TABLE**.

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03	.95	4	4
S_2	.05	.98	3.75	4.25
S_3	.01	.85	4.75	8.5

Q_1

Suppliers	D_1	D_2	D_3	D_4	G_1
S_1	.03	.03	.03	.03	.03
S_2	.05	.05	.05	.05	.05
S_3	.01	.01	.01	.01	.01

Q_3

Suppliers	D_1	D_2	D_3	D_4	G_3
S_1	G(9)	P(1)	MP(3)	MP(3)	4
S_2	MP(3)	MP&F(4)	MP&F(4)	MP&F(4)	3.75
S_3	F(5)	F(5)	MP&F(4)	F(5)	4.75

Q_2

Suppliers	D_1	D_2	D_3	D_4	G_2
S_1	.95	.95	.95	.95	.95
S_2	.98	.98	.98	.98	.98
S_3	.85	.85	.85	.85	.85

Q_4

Suppliers	D_1	D_2	D_3	D_4	G_3
S_1	G(9)	MP(3)	P(1)	MP(3)	4
S_2	MP(3)	MP&F(4)	F(5)	F(5)	4.25
S_3	G(9)	G(9)	MP&G(6)	MP&G(6)	8.5

TOPSIS for supplier selection problem.

- Step 4 – **STANDARDIZE** DECISION TABLE

DECISION TABLE

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03	.95	4	4
S_2	.05	.98	3.75	4.25
S_3	.01	.85	4.75	8.5
	$\sqrt{(.03^2+.05^2+.01^2)}$	$\sqrt{(.95^2+.98^2+.85^2)}$	$\sqrt{(4^2+3.75^2+4.75^2)}$	$\sqrt{(4^2+4.25^2+8.5^2)}$
	= 0.059	= 1.608	= 7.254	= 10.31

TOPSIS for supplier selection problem.

- Step 4 – **STANDARDIZE** DECISION TABLE

DECISION TABLE

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03	.95	4	4
S_2	.05	.98	3.75	4.25
S_3	.01	.85	4.75	8.5
	$\sqrt{(.03^2+.05^2+.01^2)}$	$\sqrt{(.95^2+.98^2+.85^2)}$	$\sqrt{(4^2+3.75^2+4.75^2)}$	$\sqrt{(4^2+4.25^2+8.5^2)}$

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03/.059 = .508			
S_2				
S_3				

STANDARD DECISION TABLE

TOPSIS for supplier selection problem.

- Step 4 – **STANDARDIZE** DECISION TABLE

DECISION TABLE

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03	.95	4	4
S_2	.05	.98	3.75	4.25
S_3	.01	.85	4.75	8.5
	$\sqrt{(.03^2+.05^2+.01^2)}$	$\sqrt{(.95^2+.98^2+.85^2)}$	$\sqrt{(4^2+3.75^2+4.75^2)}$	$\sqrt{(4^2+4.25^2+8.5^2)}$

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03/.059 = .508			
S_2	.05/.059 = .845			
S_3				

STANDARD DECISION TABLE

TOPSIS for supplier selection problem.

- Step 4 – **STANDARDIZE** DECISION TABLE

DECISION TABLE

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03	.95	4	4
S_2	.05	.98	3.75	4.25
S_3	.01	.85	4.75	8.5
	$\sqrt{(.03^2+.05^2+.01^2)}$	$\sqrt{(.95^2+.98^2+.85^2)}$	$\sqrt{(4^2+3.75^2+4.75^2)}$	$\sqrt{(4^2+4.25^2+8.5^2)}$

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03/.059 = .508	.95/1.608= .591		
S_2	.05/.059 = .845			
S_3				

STANDARD DECISION TABLE

TOPSIS for supplier selection problem.

- Step 4 – **STANDARDIZE** DECISION TABLE

DECISION TABLE

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03	.95	4	4
S_2	.05	.98	3.75	4.25
S_3	.01	.85	4.75	8.5
	$\sqrt{(.03^2+.05^2+.01^2)}$	$\sqrt{(.95^2+.98^2+.85^2)}$	$\sqrt{(4^2+3.75^2+4.75^2)}$	$\sqrt{(4^2+4.25^2+8.5^2)}$

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03/.059 = .508	.95/1.608= .591		
S_2	.05/.059 = .845	.98/1.608= .609		
S_3				

STANDARD DECISION TABLE

TOPSIS for supplier selection problem.

- Step 4 – **STANDARDIZE** DECISION TABLE

DECISION TABLE

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03	.95	4	4
S_2	.05	.98	3.75	4.25
S_3	.01	.85	4.75	8.5
	$\sqrt{(.03^2+.05^2+.01^2)}$	$\sqrt{(.95^2+.98^2+.85^2)}$	$\sqrt{(4^2+3.75^2+4.75^2)}$	$\sqrt{(4^2+4.25^2+8.5^2)}$

STANDARD DECISION TABLE

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.03/.059 = .508	.95/1.608= .591	4/7.254= .551	4/10.31= .388
S_2	.05/.059 = .845	.98/1.608= .609	3.75/7.254= .517	4.25/10.31= .412

TOPSIS for supplier selection problem.

- Step 4 – **STANDARD** DECISION TABLE.

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508	.591	.551	.388
S_2	.845	.609	.517	.412
S_3	.169	.529	.655	.824

TOPSIS for supplier selection problem.

- Step 5 – **WEIGHTED** STANDARD DECISION TABLE.

Multiplying **attribute weights** as obtained in **step-1**, with respective attribute values in **standard decision matrix.**

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508X.275			
S_2				
S_3				

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508	.591	.551	.388
S_2	.845	.609	.517	.412
S_3	.169	.529	.655	.824

Standard decision table as obtained from Step-4

	ATTRIBUTES			
	Q_1	Q_2	Q_3	Q_4
WEIGHTS	0.275	0.230	0.187	0.308

attribute weights as obtained from Step-1

TOPSIS for supplier selection problem.

- Step 5 – **WEIGHTED** STANDARD DECISION TABLE.

Multiplying **attribute weights** as obtained in **step-1**, with respective attribute values in **standard decision matrix.**

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508X.275			
S_2	.845X.275			
S_3				

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508	.591	.551	.388
S_2	.845	.609	.517	.412
S_3	.169	.529	.655	.824

Standard decision table as obtained from Step-4

	ATTRIBUTES			
	Q_1	Q_2	Q_3	Q_4
WEIGHTS	0.275	0.230	0.187	0.308

attribute weights as obtained from Step-1

TOPSIS for supplier selection problem.

- Step 5 – **WEIGHTED** STANDARD DECISION TABLE.

Multiplying **attribute weights** as obtained in **step-1**, with respective attribute values in **standard decision matrix.**

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508X.275	.591X.230		
S_2	.845X.275			
S_3				

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508	.591	.551	.388
S_2	.845	.609	.517	.412
S_3	.169	.529	.655	.824

Standard decision table as obtained from Step-4

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	Q_1	Q_2	Q_3	Q_4
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attribute weights as obtained from Step-1

TOPSIS for supplier selection problem.

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Multiplying **attribute weights** as obtained in **step-1**, with respective attribute values in **standard decision matrix.**

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508X.275	.591X.230	.551X.187	
S_2	.845X.275			
S_3				

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508	.591	.551	.388
S_2	.845	.609	.517	.412
S_3	.169	.529	.655	.824

Standard decision table as obtained from Step-4

	ATTRIBUTES			
	Q_1	Q_2	Q_3	Q_4
WEIGHTS	0.275	0.230	0.187	0.308

attribute weights as obtained from Step-1

TOPSIS for supplier selection problem.

- Step 5 – **WEIGHTED** STANDARD DECISION TABLE.

Multiplying **attribute weights** as obtained in **step-1**, with respective attribute values in **standard decision matrix.**

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508X.275	.591X.230	.551X.187	.388X.308
S_2	.845X.275	.609X.230	.517X.187	.412X.308
S_3	.169X.275	.529X.230	.655X.187	.824X.308

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	.508	.591	.551	.388
S_2	.845	.609	.517	.412
S_3	.169	.529	.655	.824

Standard decision table as obtained from Step-4

	ATTRIBUTES			
	Q_1	Q_2	Q_3	Q_4
WEIGHTS	0.275	0.230	0.187	0.308

attribute weights as obtained from Step-1

TOPSIS for supplier selection problem.

- Step 5 – **WEIGHTED** STANDARD DECISION TABLE.

	Attributes			
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	0.14	0.135	0.103	0.119
S_2	0.232	0.14	0.097	0.126
S_3	0.046	0.121	0.122	0.253

TOPSIS for supplier selection problem.

- Step 6 – Construct the **IDEAL SOLUTION** & **NEGATIVE IDEAL SOLUTION**.
  - **IDEAL SOLTION**
    - **Minimum value** of **Cost Attributes** are Ideal.
    - **Maximum value** of **Benefit Attributes** are Ideal.

	Cost attribute	Benefit attributes		
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	0.14	0.135	0.103	0.119
S_2	0.232	(Max) 0.14	0.097	0.126
S_3	(min.) 0.046	0.121	(Max) 0.122	(Max) 0.253

Ideal solution = {0.046, 0.14, 0.122, 0.253}

TOPSIS for supplier selection problem.

- Step 6 – Construct the **IDEAL SOLUTION** & **NEGATIVE IDEAL SOLUTION**.

• NEGATIVE IDEAL SOLTION

- **Maximum value** of **Cost Attributes** are Negative Ideal.
- **Minimum value** of **Benefit Attributes** are Negative Ideal.

	Cost attribute	Benefit attributes		
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	0.14	0.135	0.103	(min.) 0.119
S_2	(max.) 0.232	0.14	(min.) 0.097	0.126
S_3	0.046	(min.) 0.121	0.122	0.253

Negative Ideal solution = {0.232, 0.121, 0.097 0.119}

TOPSIS for supplier selection problem.

- Step 7 – Construct the **SEPARATION** from Ideal solution & negative ideal solution.
  - **SEPARATION** from **Ideal** solution S_i^*

Ideal solution = {0.046, 0.14, 0.122, 0.253}

	Cost attribute	Benefit attributes		
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	**(.194 - .046)² = 0.009**	**(0.135 - 0.14)² = 0.000**	**(0.103 - 0.122)² = 0.0004**	**(0.119 - 0.253)² = 0.018**
S_2	0.232	0.14	0.097	0.126
S_3	0.046	0.121	0.122	0.253

$S_1^* = (0.009+0.00+0.0004+0.018)^{1/2} = 0.166$

TOPSIS for supplier selection problem.

- Step 7 – Construct the **SEPARATION** from Ideal solution & negative ideal solution.
  - **SEPARATION** from **Ideal** solution S_i^*

Ideal solution = {0.046, 0.14, 0.122, 0.253}

	Cost attribute	Benefit attributes		
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	**(0.14 - .046)² = 0.009**	**(0.135 - 0.14)² = 0.000**	**(0.103 - 0.122)² = 0.0004**	**(0.119 - 0.253)² = 0.018**
S_2	**(0.232 - .046)² = 0.035**	**(0.14 - 0.14)² = 0.000**	**(0.097 - 0.122)² = 0.0006**	**(0.126 - 0.253)² = 0.016**
S_3	0.046	0.121	0.122	0.253

$S_1^* = (0.009+0.00+0.0004+0.018)^{1/2} = 0.166$

$S_2^* = (0.035+0.00+0.0006\_0.016)^{1/2} = 0.227$

TOPSIS for supplier selection problem.

- Step 7 – Construct the **SEPARATION** from Ideal solution & negative ideal solution.
  - **SEPARATION** from **Ideal** solution S_i^*

Ideal solution = {0.046, 0.14, 0.122, 0.253}

	Cost attribute	Benefit attributes		
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	**(0.14 - .046)² = 0.009**	**(0.135 - 0.14)² = 0.000**	**(0.103 - 0.122)² = 0.0004**	**(0.119 - 0.253)² = 0.018**
S_2	**(0.232 - .046)² = 0.035**	**(0.14 - 0.14)² = 0.000**	**(0.097 - 0.122)² = 0.0006**	**(0.126 - 0.253)² = 0.016**
S_3	**(0.046 - .046)² = 0.000**	**(0.121 - 0.14)² = 0.0004**	**(0.122 - 0.122)² = 0.000**	**(0.253 - 0.253)² = 0.000**

$S_1^* = (0.009+0.00+0.0004+0.018)^{1/2} = 0.166$

$S_2^* = (0.035+0.00+0.0006+0.016)^{1/2} = 0.227$

$S_3^* = (0.00+0.0004+0.00+0.0000)^{1/2} = 0.02$

TOPSIS for supplier selection problem.

- Step 7 – Construct the **SEPARATION** from Ideal solution & negative ideal solution.
  - **SEPARATION** from **Negative** ideal solution ***S$_i$'***

Negative Ideal solution = {0.232, 0.121, 0.097 0.119}

	Cost attribute	Benefit attributes		
Suppliers	Q_1	Q_2	Q_3	Q_4
S_1	$(0.14 - .232)^2$ = **0.008**	$(0.135 - .121)^2$ **= 0.0002**	$(0.103 - .097)^2$ = **0.0000**	$(0.119 - .119)^2$ **= 0.000**
S_2	$(0.232 - .232)^2$ **= 0.000**	$(0.14 - .121)^2$ = **0.0004**	$(0.097 - .097)^2$ = **0.0000**	$(0.126 - .119)^2$ **= 0.0001**
S_3	$(0.046 - .232)^2$ **= 0.035**	$(0.121 - .121)^2$ **= 0.000**	$(0.122 - .097)^2$ = **0.0006**	$(0.253 - .119)^2$ **= 0.0179**

S_1' = $(0.008+0.0002+0.000+0.000)^{1/2} = 0.09$

S_2' = $(0.00+0.0004+0.000+0.0001)^{1/2} = 0.022$

S_3' = $(0.035+0.00+0.0006+0.0179)^{1/2} = 0.231$

TOPSIS for supplier selection problem.

- Step 8 – Calculate the **RELATIVE CLOSENESS** to Ideal solution.
  - **CLOSENESS** to ideal solution $C_i^* = S_i' /(S_i^* + S_i')$

Criteria	S_1	S_2	S_3
S_i^*	0.166	0.227	0.02
S_i'	0.09	0.022	0.231
$S_i^* + S_i'$	0.256	0.249	0.251
$S_i' /(S_i^* + S_i')$	0.09/0.256	0.022/0.249	0.231/0.251
	0.351	**0.088**	**0.920**

$C_1^* = 0.351$
$C_2^* = 0.088$
$C_3^* = 0.920$

$$C_3^* > C_1^* > C_2^*$$

TOPSIS for supplier selection problem.

- Step 8 – **RANK THE ORDER** of suppliers based on **STEP 8**
  - $C_3^* > C_1^* > C_2^*$

$$Supplier_3 > Supplier_1 > Supplier_2$$

THANK YOU