AHP
Multi Criteria
Decision Making

Analytic Hierarchy Process

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Analytic Hierarchy Process

► Analytic Hierarchy Process (AHP) is a multicriteria decision-making system.

► AHP was developed by Thomas L. Saaty.

► It is used to solve complex decision-making problems.

► AHP has been applied in variety of decisions and planning projects in many countries.

► AHP is implemented in the software of Expert Choice© .
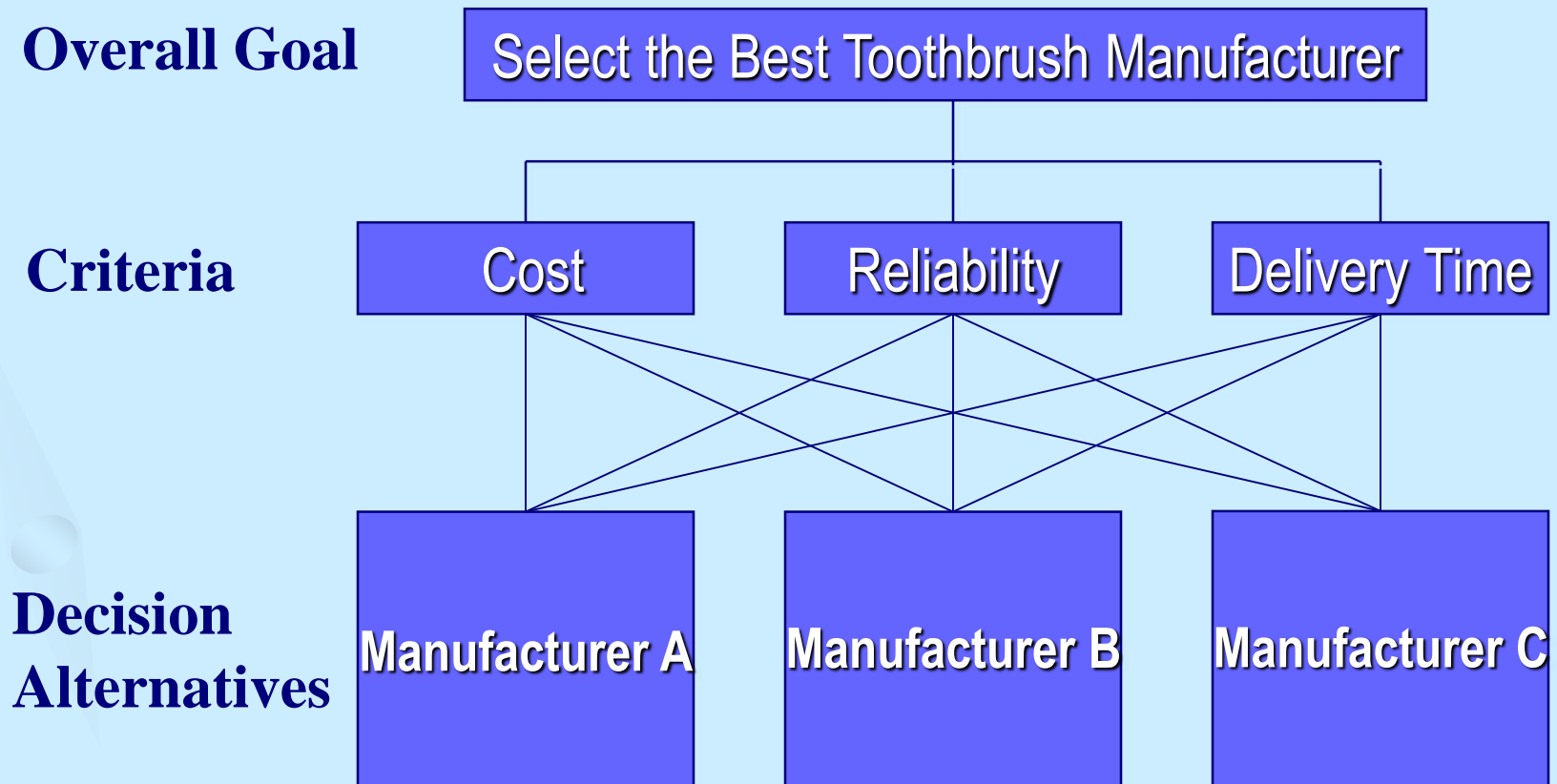
Typical application areas

► Resource allocation

► Hiring, evaluating and promoting employees

► TQM

► Strategic planning

► Relocation decisions

► Vendor selection

INTERESTING CASES OF AHP

► **Xerox Corporation** uses AHP for R&D decisions on portfolio management, technology implementation, and engineering design selection.

► **British Columbia Ferries Corporation** in Canada uses AHP in the selection of products, suppliers and consultants.

► **NASA** used AHP to consider criteria for Safety, Performance, Reliability and Flexibility in recommending a power source for the first lunar outpost.

► **General Motors** use AHP to evaluate design alternatives, perform risk management, and arrive at the best and most cost-effective automobile designs.

► **University Islam Antarabangsa (UIA)** used AHP in benchmarking factors influencing international students' choice towards universities in Malaysia.

Analytic Hierarchy Process

►**Step 1:** Structure a hierarchy. Define the problem, determine the criteria and identify the alternatives.

Overall Goal	Select the Best Toothbrush Manufacturer
Criteria	Cost Reliability Delivery Time
Decision Alternatives	Manufacturer A Manufacturer B Manufacturer C

Analytic Hierarchy Process

► **Step 2:** Make pairwise comparisons. Rate the relative importance between each pair of decision alternatives and criteria.

Analytic Hierarchy Process

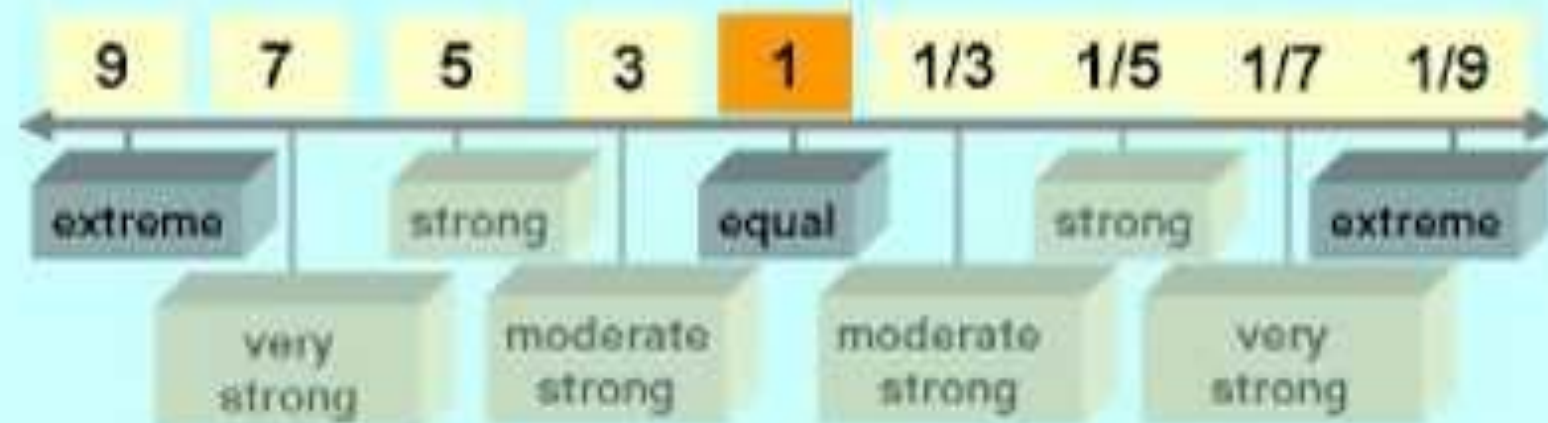► **Step 2 (cont'd):** AHP uses 1-9 scale for the prioritization process.

Numerical ratings	Verbal judgments
1	Equally important (preferred)
3	Moderately more important
5	Strongly more important
7	Very strongly more important
9	Extremely more important

AHP

Compare all elements **pair wise** with respect to the objective

Color | Memory

Scale:

9	7	5	3	1	1/3	1/5	1/7	1/9

extreme | strong | equal | strong | extreme

very strong | moderate strong | moderate strong | very strong

Analytic Hierarchy Process

► **Step 2 (cont'd):** Intermediate numerical ratings of **2, 4, 6**, and **8** can be assigned. If someone could not decide whether one criterion (alternative) is moderately more important than the other one or strongly more important than the other one, **4** (**moderately to strongly more important**) can be assigned.

Analytic Hierarchy Process

► **Step 3:** Synthesize the results to determine the best alternative. Obtain the final results.

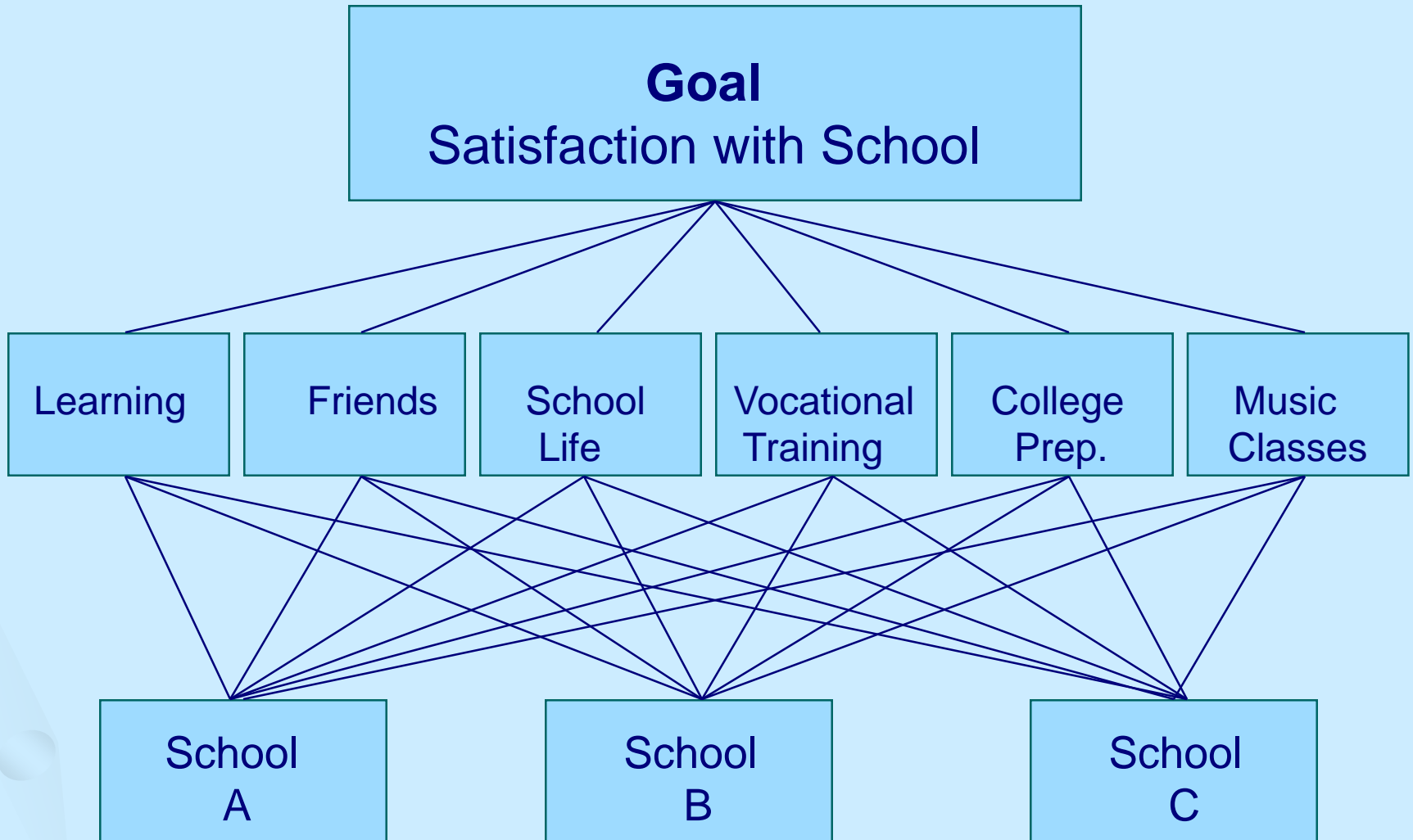► The output of AHP is the set of priorities of the alternatives.

An Example with AHP

Choosing the most satisfied school

► Goal: To select the most satisfied school.

► Criteria: learning, friends, school life, vocational training, college prep. and music classes.

► Alternatives: School A, school B, and school C.

Hierarchy:

School Selection

	L	F	SL	VT	CP	MC	Weights
Learning	1	4	3	1	3	4	.32
Friends	1/4	1	7	3	1/5	1	.14
School Life	1/3	1/7	1	1/5	1/5	1/6	.03
Vocational Trng.	1	1/3	5	1	1	1/3	.13
College Prep.	1/3	5	5	1	1	3	.24
Music Classes	1/4	1	6	3	1/3	1	.14

Comparison of Schools with Respect to the Six Characteristics

	Learning A	B	C	Priorities
A	1	1/3	1/2	.16
B	3	1	3	.59
C	2	1/3	1	.25

	Friends A	B	C	Priorities
A	1	1	1	.33
B	1	1	1	.33
C	1	1	1	.33

	School Life A	B	C	Priorities
A	1	5	1	.45
B	1/5	1	1/5	.09
C	1	5	1	.46

	Vocational Trng. A	B	C	Priorities
A	1	9	7	.77
B	1/9	1	1/5	.05
C	1/7	5	1	.17

	College Prep. A	B	C	Priorities
A	1	1/2	1	.25
B	2	1	2	.50
C	1	1/2	1	.25

	Music Classes A	B	C	Priorities
A	1	6	4	.69
B	1/6	1	1/3	.09
C	1/4	3	1	.22

Composition and Synthesis
Impacts of School on Criteria

	.32 L	.14 F	.03 SL	.13 VT	.24 CP	.14 MC	Composite Impact of Schools
A	.16	.33	.45	.77	.25	.69	.37
B	.59	.33	.09	.05	.50	.09	.38
C	.25	.33	.46	.17	.25	.22	.25

School A: .16*.32+.33*.14+.45*.03+.77*.13+.25*.24+.69*.14= .37

Overall final outcome

► School B is the best school with an overall priority of 0.38, followed by school A.

SAMMARY

► **AHP** is a simple, practical and handy

► The one-to-one qualitative and quantitative comparison is clear and easy to digest by decision maker.

► AHP is being widely used and accepted by various organization, enterprises and country all over the world.

► AHP actively nurture intellectual discussion, debate and research on various field and study.

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THANK YOU

FOR LISTENING TO MY PRESENTATION