

Chapter 19

Multiple Objectives

19-1

Prairie View is considering numerous sites for its new convention center. Land acquisition cost has a weight of 40%, construction cost has a weight of 45% and location a weight of 15%. Using the information provided below, which site should be chosen?

<u>Site</u>	<u>Land Cost*</u>	<u>Construction Cost*</u>	<u>Location*</u>
A	1	2	3
B	2.5	3	4
C	2.5	1	2
D	4	4	1

*Rank order: 1 = worst and 4 = best

Solution

$$\text{Site A} = .40(1) + .45(2) + .15(3) = 1.75$$

$$\text{Site B} = .40(2.5) + .45(3) + .15(4) = 2.95$$

$$\text{Site C} = .40(2.5) + .45(1) + .15(2) = 1.75$$

$$\text{Site D} = .40(4) + .45(4) + .15(1) = 3.55$$

Site D maximizes the selection criteria and should be chosen.

19-2

LowTech Inc. is currently studying alternatives to its present computer system. The NPW has a weight 3 times as great as the reliability of the system. Using the information below, which system is preferable? Is any system dominated?

<u>System</u>	<u>NPW</u>	<u>Reliability</u>
SimTech	\$5,000	High
Byte	4,500	Very High
MBI	7,500	Low
Glitch	6,000	Average
Doorway	3,500	Very low

Solution

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<u>System</u>	<u>NPW Rank</u>	<u>Reliability Rank</u>
SimTech	3	4
Byte	2	5
MBI	5	2
Glitch	4	3
Doorway	1	1

SimTech = $.75(3) + .25(4) = 3.25$
 Byte = $.75(2) + .25(5) = 2.75$
 MBI = $.75(5) + .25(2) = 4.25$
 Glitch = $.75(4) + .25(3) = 3.75$
 Doorway = $.75(1) + .25(1) = 1.00$

MBI is the preferred system based on maximizing selection criteria.

Doorway is dominated.

19-3

Lexie C. is trying to decide which university she should attend in the fall. She has decided there are several factors that she needs to consider. The universities she is considering are The University of Columbus, The University of Knoxville, The University of Lexington, and Louisville State University. She has decided to use the following factors and weights in her decision.

<u>Factor</u>	<u>Scholarship Amount</u>	<u>Academic Reputation</u>	<u>Success of Football Team</u>	<u>Party Reputation</u>
Weight	40%	25%	15%	20%

Information for her four universities of choice is summarized below:

	<u>Scholarship Amount</u>	<u>Academic Reputation</u>	<u>Success of Football Team*</u>	<u>Party Reputation</u>
University of Columbus	\$15,000	Excellent	13-0	Above Average
University of Knoxville	6,750	Poor	7-6	Excellent
University of Lexington	10,000	Above Average	3-10	Average
Louisville State	4,575	Average	4-7	Poor

*Record in most recent season.

Help Lexie make her decision.

Solution

	<u>Scholarship Amount</u>	<u>Academic Reputation</u>	<u>Success of Football Team*</u>	<u>Party Reputation*</u>
University of Columbus	4	4	4	3
University of Knoxville	2	1	3	4

University of Lexington	3	3	1	2
Louisville State	1	2	2	1

*Assumes excellent reputation is best.

$$\begin{aligned}
 U \text{ of } C &= .4(4) + .25(4) + .15(4) + .20(3) = 3.80 \\
 U \text{ of } K &= .4(2) + .25(1) + .15(3) + .20(4) = 2.30 \\
 U \text{ of } L &= .4(3) + .25(3) + .15(1) + .20(2) = 2.50 \\
 \text{LSU} &= .4(1) + .25(2) + .15(2) + .20(1) = 1.40
 \end{aligned}$$

Based on Lexie’s decision criteria she should attend the University of Columbus.

19-4

Consolidated Edison Power is evaluating the construction of a new electric generation facility. The two choices are a coal burning plant (CB), a gaseous diffusion (GD) or a light nuclear reactor (LNR) plant. The CB plant will cost \$150 per megawatt to construct, GD plant will cost \$300 per megawatt, and the LNR \$450 per megawatt. Fuel availability and the impact of future air- and water- quality, public opinion, and construction costs are the factors of concern to ConEd in the decision as to which facility to build. The cost is weighted as 60% of the decision with the remaining factors evenly weighted. Determine the preferable plant to build based on these factors.

	<u>Fuel Availability</u>	<u>Air-quality</u>	<u>Water-quality</u>	<u>Public Opinion</u>
Coal Burning	High	Low	High	Very low
Gaseous Diffusion	High	High	High	Medium
Light Reactor	Medium	Medium	Low	Very low

Solution

	<u>Cost</u>	<u>Fuel Availability</u>	<u>Air-quality</u>	<u>Water-quality</u>	<u>Public Opinion</u>
Coal Burning	3	2.5	1	2.5	1.5
Gaseous Diffusion	2	2.5	3	2.5	3
Light Reactor	1	1	2	1	1.5

$$\begin{aligned}
 \text{CB} &= .6(3) + .1(2.5) + .1(1) + .1(2.5) + .1(1.5) = 2.55 \\
 \text{GD} &= .6(2) + .1(2.5) + .1(3) + .1(2.5) + .1(3) = 2.30 \\
 \text{LR} &= .6(1) + .1(1) + .1(2) + .1(1) + .1(1.5) = 1.15
 \end{aligned}$$

The coal burning plant is preferable based on maximizing the decision criteria.

19-5

The local fire department is in the process of choosing new tires for one of its trucks. The tires are rated on cost, expected life, and other issues. The two most important are cost and life. These factors need to be rated on a scale of 1 to 10. The best cost is considered \$225, and 10 years is considered the best life. Develop the ratings for these two factors based on the following:

<u>Tire</u>	<u>Cost</u>	<u>Life</u>
Wingedfoot	\$250	10
HotRock	350	20

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Hooper	300	16
BF Good	325	18
ManyMiles	225	14

Solution

$$\text{Score}(x) = 10(\text{Worst value} - x)/(\text{Worst value} - \text{Best value})$$

Cost

Wingedfoot	Score = $10(350 - 250)/(350 - 225) = 8.00$
HotRock	Score = $10(350 - 350)/(350 - 225) = 0.00$
Hooper	Score = $10(350 - 300)/(350 - 225) = 4.00$
BF Goodmiles	Score = $10(350 - 325)/(350 - 225) = 2.00$
ManyMiles	Score = $10(350 - 225)/(350 - 225) = 10.00$

Life

Wingedfoot	Score = $10(10 - 10)/(10 - 20) = 0.00$
HotRock	Score = $10(10 - 20)/(10 - 20) = 10.00$
Hooper	Score = $10(10 - 16)/(10 - 20) = 6.00$
BF Goodmiles	Score = $10(10 - 18)/(10 - 20) = 8.00$
ManyMiles	Score = $10(10 - 14)/(10 - 20) = 4.00$