MSDS 460 Decision Analytics

Assignment 02

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Problem:

The marketing group of A.J. Pitt Company is considering the options available for its next advertising campaign program. After a great deal of work, the group has identified a selected number of options with the characteristics shown in the accompanying table.

	TV	Trade Magazine	Newspaper	Radio	Popular Magazine	Promotional Campaign	Total Resource Avalaible
Customers Reached	1,000,000	200,000	300,000	400,000	450,000	450,000	-
Cost ($)	500,000	150,000	300,000	250,000	100,000	100,000	1,800,000
Designers Needed (man-hours)	700	250	200	300	400	400	1,500
Salesmen Needed (man-hours)	200	100	100	100	1,000	1,000	1,200

The objective of the advertising program is to maximize the number of customers reached, subject to the limitation of resources (money, designers, and salesmen) given in the table.

In addition, the following constraints must be met:

(i) If the promotional campaign is undertaken, it needs either a radio or a popular magazine campaign effort to support it.

(ii) The firm cannot advertise in both the trade and popular magazine.

Formulate an integer programming model that will assist the company to select an appropriate advertising campaign strategy.

Solution:

Decision Variables:

Let,

X_i = be a binary variable.

Where,

X_i = 1, if i-th option is undertaken. The options are 1-TV, 2-Trade magazine, 3-Newspaper, 4-Radio, 5-Popular magazine, 6-Promotional campaign.

Objective Function:

Max Z = $1{,}000{,}000x_1 + 200{,}000x_2 + 300{,}000x_3 + 400{,}000x_4 + 450{,}000x_5 + 450{,}000x_6$

s.t,

Cost:

$500{,}000x_1 + 150{,}000x_2 + 300{,}000x_3 + 250{,}000x_4 + 250{,}000x_5 + 100{,}000x_6 <= 1{,}800{,}000$

Designers (man-hours):

$700x_1 + 250x_2 + 200x_3 + 300x_4 + 300x_5 + 400x_6 <= 1{,}500$

Salesmen (man-hours):

$200x_1 + 100x_2 + 100x_3 + 100x_4 + 100x_5 + 1000x_6 <= 1{,}200$

Promotional campaign conditional:

$X_6 – X_4 – X_5 <= 0$

Trade or Popular magazine:

$X_2 + x_5 <= 1$

All binary constraints:

$X_i = 0, 1$