



UNIVERSITY OF ENGINEERING AND TECHNOLOGY TAXILA
Department of Industrial Engineering

SOLUTION QUIZ # 1

Course Name: Operations Research
Semester: 5th (Session 2011 Fall)

Course Code: IE-313
Course Instructor: ENGR. ZAHID RASHID

Name:
Roll #:

Time Allowed: 30 min
Marks: 10

Answer these questions:

Q#1: Linear Programming Model Formulation

ABC advertising agency wishes to reach two types of audiences; Customers with annual income of more than Rs. 20,000 (i.e.: Target Audience–A) and Customers with annual income of less than Rs. 20,000 ((i.e.: Target Audience–B). The total advertising budget is Rs. 2,00,000. One T.V. advertising costs Rs. 50,000 and one radio advertising costs Rs. 20,000. For contract reasons, at least 3 advertisements have to be on T.V. and the number of radio advertisements must be limited to 5. Surveys indicate that a single T.V. advertisement reaches 4,50,000 customers in Target Audience–A and 50,000 in the Target Audience–B. One radio advertisement reaches 20,000 in Target Audience–A and 80,000 in the Target Audience–B. Formulate the given problem in such a way that the media–mix to maximize the total audience reach.

SOLUTION:

Decision Variables:

Let X_1 and X_2 be the number of advertisements on T.V. and Radio, respectively.

Objective Function:

T.V.: Number of customers with annual income more than Rs. 20,000 is 4,50,000 while the number of customers with annual income less than Rs. 20,000 is 50,000. So,

$$\text{Total T.V. Audience} = 4,50,000 + 50,000 = 5,00,000.$$

Radio: Number of customers with annual income more than Rs. 20,000 is 20,000 while the number of customers with annual income less than Rs. 20,000 is 80,000. So,

$$\text{Total Radio Audience} = 20,000 + 80,000 = 1,00,000.$$

$$\text{MAXIMIZE: } Z = 5,00,000X_1 + 1,00,000X_2 \quad \text{TOTAL AUDIENCE REACH}$$

CONSTRAINTS: →

$$50,000X_1 + 20,000X_2 \leq 2,00,000 \quad (\text{Total available amount constraint})$$

$$X_1 \geq 3 \quad (\text{Minimum T.V. advertisement constraint})$$

$$X_2 \leq 5 \quad (\text{Maximum Radio advertisement constraint})$$

$$X_1, X_2 \geq 0 \quad (\text{Non–Negativity constraint})$$

Q#2: Solve the following problems using the graphical method

Minimize $f(x_1, x_2) = 5x_1 + 10x_2$
subject to:

$$\begin{aligned} 10x_1 + 5x_2 &\geq 50 \\ 5x_1 - 5x_2 &\leq -20 \\ x_1, x_2 &\geq 0 \end{aligned}$$

Summary of Optimal Solution:

Objective Value = 70.00
 $x_1 = 2.00$
 $x_2 = 6.00$

