1 INTRODUCTION

Most of management problems are challenging and difficult to solve using traditional problem-solving techniques. The application of mathematical models and computing technologies recently to such problems has greatly assisted managers in tackling most of these problems which are non-trivial in the past. Mathematical models are used to describe and emulate the behavior or responses of networks, and estimate states and parameters of networks for some specific operating and loading conditions.

2 OBJECTIVES

The water management problem discussed in this exercise describes a network of water resources, irrigation channels and water consumption places with random demands scenarios. The problem can be modeled as a linear program of the form

$$\begin{array}{ll} \text{minimize} & z = c^T x \\ \text{subject to} & Ax = b \\ & \ell \leq x \leq u \end{array}$$

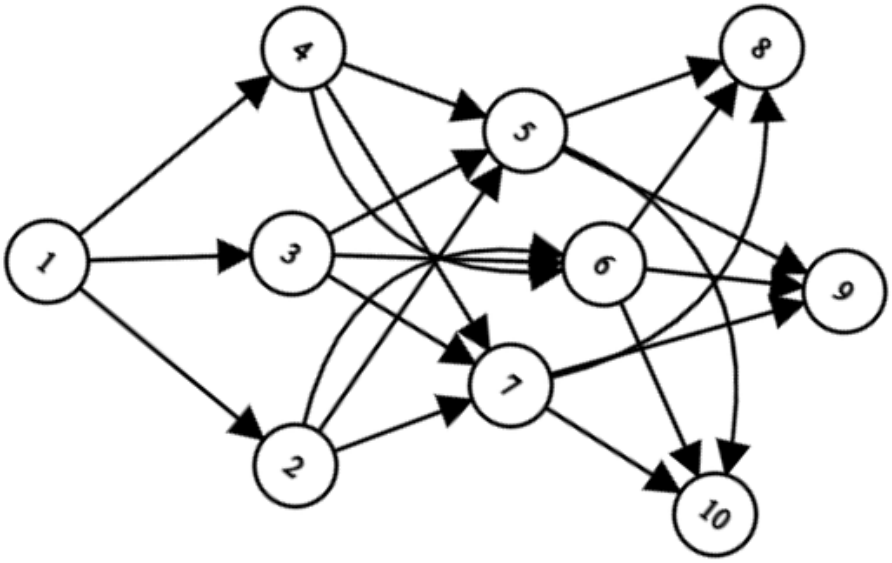
where ℓ and u are vectors of lower and upper bounds on x, c is the cost vector for each edge(delivery channel), and b is the vector of capacities and demands.

A representation of the irrigation channel can be described in the node-edge incidence matrix A below:

```
table a(i,j) incidence node edge matrix
    12  13  14  25  26  27  35  36  37  45  46  47  58  59  510  68  69  610  78  79  710
1   1   1   1
2  -1           1   1   1
3      -1                   1   1   1
4          -1                           1   1   1
5              -1          -1          -1           1    1    1
6                  -1          -1          -1                    1   1    1
7                      -1          -1          -1                          1   1   1
8                                          -1           -1           -1
9                                              -1           -1           -1
10                                                 -1           -1           -1;
```

Take into consideration two water sources at node 1 and node 2, with demands at consumption nodes 8, 9 and 10. Transportation costs are set for each edge (e.g. cost of repairing pipes, salaries of workers etc.).

GRAPH



Task: Write programs in GAMS on the following approach:

1. Wait and See
2. Here and Now

In two consumption scenarios in the following cases:

1. Deterministic approach
2. WS
3. EV
4. MM
5. Recourse reformulation