.'— title: "assignment module 9" author: "sai prasad desineni/811191807" date: "11/6/2022" output: pdf_document: default html_document: default —

Setting default values to get a clean output

```
knitr::opts_chunk$set(message = FALSE)
knitr::opts_chunk$set(warning = FALSE)
```

I'm loading the necessary packages.

```
library(lpSolve)
library(lpSolveAPI)
```

Loading the LP file from the current directory and printing the model.

The amounts over and below the employment level goal, respectively, are defined as y1p and y1m. In order to achieve the desired level of profits the next year, Y2p and Y2M are defined similarly. The production velocities of Products 1, 2, and 3 are denoted by the variables x1, x2, and x3, accordingly. The objective function is also expressed in terms of x1, x2, and x3, as well as y1p, y1m, y2p, and y2m.

```
ema_rd <- read.lp("C:/Users/desineni/Downloads/emax.lp")
print(ema_rd)
```

```
## Model name:
##             X1    X2    X3   Y1P   Y1M   Y2M   Y2P
## Maximize    20    15    25    -6    -6    -3     0
## R1           6     4     5    -1     1     0     0  =  50
## R2           8     7     5     0     0     1    -1  =  75
## Kind       Std   Std   Std   Std   Std   Std   Std
## Type      Real  Real  Real  Real  Real  Real  Real
## Upper      Inf   Inf   Inf   Inf   Inf   Inf   Inf
## Lower        0     0     0     0     0     0     0
```

The impact (per unit of production) of each new product on each of these factors is shown in the table below:

```
ema_table <- matrix(c("Total Profit", "Employment Level", "Earnings Next Year",
                      20,6,8,
                      15,4,7,
                      25,5,5,
                      "Maximize","=50",">=75",
                      "Millions of Dollars", "Hundreds of Employees", "Millions of Dollars"), ncol=6,
                    byrow = F)

colnames(ema_table) <- c("Factor","Product 1", "Product 2", "Product 3", "Goal", "Units")

as.table(ema_table)
```

```
##   Factor             Product 1 Product 2 Product 3 Goal
## A Total Profit       20        15        25        Maximize
## B Employment Level   6         4         5         =50
## C Earnings Next Year 8         7         5         >=75
##   Units
## A Millions of Dollars
## B Hundreds of Employees
## C Millions of Dollars
```

The values of the goals and variables can be obtained by solving the goal programming model.

```
solve(ema_rd)
```

```
## [1] 0
```

```
get.objective(ema_rd)
```

```
## [1] 225
```

```
get.variables(ema_rd)
```

```
## [1]  0  0 15 25  0  0  0
```

Interpretation:

a) The combination units that businesses must use to maximize their objective function are.X1, X2, and X3. Products 1 and 2 cannot be produced in the manner planned according to X1 for Product 1, X2 for Product 2, and X3 for Product 3. H. Since the outcome was "0," 20 units of product 1 and 15 units of product 2 cannot be produced. The X3 has changed, though. H. The company can only create Product 3 at this time. H. 15 units of product 3 to increase profits.

b) The maximum number of employees was set at 5000 with the intention of stabilizing the employment level; however, in this instance, the company had 2500 more employees than allowed (y1p) and was therefore penalized and required to pay an increase in employee's wages.

c) Understanding the revenue growth or decline from current levels over the following several years was the aim of Y2P and Y2M. In this instance, it is denoted by a '0,' signifying that there has been neither a gain in revenue nor a drop in revenue compared to this next level. Year income is given back in the current year. As a result, the revenue for the following year won't change.

4.The value of the objective function provides the profit that the company aims to optimize. This value in this instance is $225 million.