myusuf2_Assignment5_Goal_Programming

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The Research and Development Division of the Emax Corporation has developed three new products. A decision now needs to be made on which mix of these products should be produced. Management wants primary consideration given to three factors: total profit, stability in the workforce, and achieving an increase in the company's earnings next year from the $75 million achieved this year.

Emax Corporation

```
getwd()
```

```
## [1] "C:/Users/Mukht/OneDrive/Desktop/Kent State University/College of Business Admin-Bus. Analytics
```

```
setwd("C:\\Users\\Mukht\\OneDrive\\Desktop\\Kent State University\\College of Business Admin-Bus. Analy
```

```
library(lpSolveAPI)
gp <- read.lp("Assignment5QT.lp")
gp
```

```
## 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
```

Solve

```
solve(gp)
```

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

```
get.objective(gp)
```

```
## [1] 250
```

```
get.variables(gp)
```

```
## [1]  0  0 10  0  0  0 25
```

Remarks

Applying the simplex method to this formulation yields an optimal solution of y1m = 0, y2m = 0, x1 = 0, x2 = 0, x3 = 10, y1p = 0, y1m = 0. Note that the solution is given in the order in which the variables appear in the formulation. This implies that y1 = 0 and y2 = 0, so the first goals is fully satisfied. ***

Preemptive Goal Programming - Sequential Approach

Emax Corporation - First Stage

Formulation and Solution

```
gp_fs <- read.lp("Assignment5QT.lp")
gp_fs
```

```
## 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
```

```
solve(gp_fs)
```

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

```
get.objective(gp_fs)
```

```
## [1] 250
```

```
get.variables(gp_fs)
```

```
## [1]  0  0 10  0  0  0 25
```

The solution is Z = 250, with x1=0, x2=0, x3=10
y1P=0, y1m=0, y2m=0, y2P=25 As we have an optimal solution, we can now go to the second stage of optimization ***

Emax Corporation - Second Stage

```
gp_ss <- read.lp("Assignment5QT.lp")
gp_ss
```

```
## 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
```

```
solve(gp_ss)
```

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

```
get.objective(gp_ss)
```

```
## [1] 250
```

```
get.variables(gp_ss)
```

```
## [1]  0  0 10  0  0  0 25
```

The optimal solution is unique, and requires no further goals, so we can stop here. The final solution is Z = 250, with x1=0, x2=0, x3=10, y1P=0, y1m=0, y2m=0, y2P=25 This solution fully achieves both first-priority goals

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This solution is exactly as what we achieved with the two-stage process. First priority goals are met, and the optimal solution falls short of the second-priority goals with respect to long-run profit.

Maximizing Progress towards All Objectives

- Goal programming requires establishing goals for all objectives. What if some objectives were open ended?
- In open-ended objectives, there is no minimum (standard) goal. As such, we want to make progress on all objectives simultaneously.
- Thus, the appropriate objective is to maximize the minimum progress toward all objectives.

Formulation and Solution

```
mx <- read.lp("Assignment5QT.lp")
mx
```

```
## 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
```

```
solve(mx)
```

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

```
get.objective(mx)
```

```
## [1] 250
```

```
get.variables(mx)
```

```
## [1]  0  0 10  0  0  0 25
```

The employment goal is superseded by 25 employees and the final penalty from exceeding the goal is in the amount of 250. ***

We can now establish that the total discounted profit would be 10m multiply by 25m would be 250 million over the life of the new products