Assignment 3

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R Markdown

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When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

.libPaths("C:\Users\Ananth\OneDrive\Desktop\MSBA Kent\Fall 2021\Quantittative management modelling\Module 4")

This notebook contains the code for the examples in Chapter 5. Specifically, for postoptimality analysis.

```
library(lpSolveAPI)
```

```
## Warning: package 'lpSolveAPI' was built under R version 4.0.3
```

---

getwd()

```
x <- read.lp("Assignment3.lp") # create an lp object x
print(x)                          # display x
```

```
## Model name:
##   a linear program with 9 decision variables and 11 constraints
```

1. Solve the problem using lpsolve, or any other equivalent library in R.

```
solve(x) # solving the given lp equation ,'0' optimal solution exists
```

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

```
get.objective(x)  # get objective value of x which is profit =  696000 $
```

```
## [1] 696000
```

```r
get.variables(x)  # get values of decision variables of x which is 9 decision variables
```

```
## [1] 516.6667 177.7778   0.0000   0.0000 666.6667 166.6667   0.0000   0.0000
## [9] 416.6667
```

```r
get.constraints(x)  # get constraint LHS  values
```

```
##  [1]  6.944444e+02  8.333333e+02  4.166667e+02  1.300000e+04  1.200000e+04
##  [6]  5.000000e+03  5.166667e+02  8.444444e+02  5.833333e+02 -2.037268e-10
## [11]  0.000000e+00
```

2. Identify the shadow prices, dual solution, and reduced costs

```r
get.sensitivity.rhs(x)  # get shadow prices of the constraints the shadow prices are 12.00 , 20.00 and 
```

```
## $duals
##  [1]    0.00    0.00    0.00   12.00   20.00   60.00    0.00    0.00    0.00
## [10]   -0.08    0.56    0.00    0.00  -24.00  -40.00    0.00    0.00 -360.00
## [19] -120.00    0.00
##
## $dualsfrom
##  [1] -1.000000e+30 -1.000000e+30 -1.000000e+30  1.122222e+04  1.150000e+04
##  [6]  4.800000e+03 -1.000000e+30 -1.000000e+30 -1.000000e+30 -2.500000e+04
## [11] -1.250000e+04 -1.000000e+30 -1.000000e+30 -2.222222e+02 -1.000000e+02
## [16] -1.000000e+30 -1.000000e+30 -2.000000e+01 -4.444444e+01 -1.000000e+30
##
## $dualstill
##  [1] 1.000000e+30 1.000000e+30 1.000000e+30 1.388889e+04 1.250000e+04
##  [6] 5.181818e+03 1.000000e+30 1.000000e+30 1.000000e+30 2.500000e+04
## [11] 1.250000e+04 1.000000e+30 1.000000e+30 1.111111e+02 1.000000e+02
## [16] 1.000000e+30 1.000000e+30 2.500000e+01 6.666667e+01 1.000000e+30
```

```r
get.sensitivity.obj(x)  # get reduced cost The reduced costs are expressed here from $objfrom and $objt
```

```
## $objfrom
## [1]  3.60e+02  3.45e+02 -1.00e+30 -1.00e+30  3.45e+02  2.52e+02 -1.00e+30
## [8] -1.00e+30  2.04e+02
##
## $objtill
## [1] 4.60e+02 4.20e+02 3.24e+02 4.60e+02 4.20e+02 3.24e+02 7.80e+02 4.80e+02
## [9] 1.00e+30
```

```r
get.sensitivity.rhs(x)$duals[1] # the zero shadow price indicates that the profit will not be changed a
```

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

Further, identify the sensitivity of the above prices and costs. That is, specify the range of shadow prices and reduced cost within which the optimal solution will not change.

```r
get.sensitivity.rhs(x)  # get shadow prices of the constraints the shadow prices are 12.00 , 20.00 and 
```

```
## $duals
##  [1]    0.00    0.00    0.00   12.00   20.00   60.00    0.00    0.00    0.00
## [10]   -0.08    0.56    0.00    0.00  -24.00  -40.00    0.00    0.00 -360.00
## [19] -120.00    0.00
##
## $dualsfrom
##  [1] -1.000000e+30 -1.000000e+30 -1.000000e+30  1.122222e+04  1.150000e+04
##  [6]  4.800000e+03 -1.000000e+30 -1.000000e+30 -1.000000e+30 -2.500000e+04
## [11] -1.250000e+04 -1.000000e+30 -1.000000e+30 -2.222222e+02 -1.000000e+02
## [16] -1.000000e+30 -1.000000e+30 -2.000000e+01 -4.444444e+01 -1.000000e+30
##
## $dualstill
##  [1] 1.000000e+30 1.000000e+30 1.000000e+30 1.388889e+04 1.250000e+04
##  [6] 5.181818e+03 1.000000e+30 1.000000e+30 1.000000e+30 2.500000e+04
## [11] 1.250000e+04 1.000000e+30 1.000000e+30 1.111111e+02 1.000000e+02
## [16] 1.000000e+30 1.000000e+30 2.500000e+01 6.666667e+01 1.000000e+30
```

```r
get.sensitivity.obj(x)  # get reduced cost The reduced costs are expressed here from $objfrom and $objt
```

```
## $objfrom
## [1]  3.60e+02  3.45e+02 -1.00e+30 -1.00e+30  3.45e+02  2.52e+02 -1.00e+30
## [8] -1.00e+30  2.04e+02
##
## $objtill
## [1] 4.60e+02 4.20e+02 3.24e+02 4.60e+02 4.20e+02 3.24e+02 7.80e+02 4.80e+02
## [9] 1.00e+30
```

```r
get.sensitivity.rhs(x)$duals[1] # the zero shadow price indicates that the profit will not be changed a
```

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

```r
# the range of the shadow price and reduced cost is from negative 1 to  positive 1
```

```r
rm(list=ls())

dual <-read.lp ("dual1.lp")
dual
```

```
## Model name:
##   a linear program with 11 decision variables and 9 constraints
```

```r
solve(dual) # '0' optimal solution exists
```

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

```r
get.objective(dual)#  The objective value for the dual is 698000.4 while the objective in primal is 696
```

```
## [1] 698000.4
```

```r
get.variables(dual)        #  values of decision variables for dual functions which are 11
```

```
## [1]  0.0  0.0  0.0 12.0 24.0 49.0  0.0  0.0 12.0  0.0  0.4
```

```r
get.constraints(dual) #  9 constraints of the dual function.
```

```
## [1] 420 360 336 480 360 300 680 435 300
```

```r
get.sensitivity.rhs(dual)#  shadow price of the dual are close to the variables in primal. Since there
```

```
## $duals
##  [1]   516.66000   177.78667     0.00000     0.00000   533.33333   333.33333
##  [7]     0.00000     0.00000   416.66667    55.55333    33.33333    33.33333
## [13]     0.00000     0.00000     0.00000   383.34000   488.88000     0.00000
## [19] 24999.00000     0.00000
##
## $dualsfrom
##  [1]  3.600e+02  3.375e+02 -1.000e+30 -1.000e+30  3.150e+02  2.880e+02
##  [7] -1.000e+30 -1.000e+30  2.400e+02 -1.000e+30 -3.000e+02 -1.000e+30
## [13] -1.000e+30 -1.000e+30 -1.000e+30 -6.000e+01 -1.500e+01 -1.000e+30
## [19] -8.000e-02 -1.000e+30
##
## $dualstill
##  [1] 4.800000e+02 4.200000e+02 1.000000e+30 1.000000e+30 3.750000e+02
##  [6] 3.600000e+02 1.000000e+30 1.000000e+30 1.000000e+30 1.800000e+02
## [11] 6.000000e+01 3.000000e+02 1.000000e+30 1.000000e+30 1.000000e+30
## [16] 6.000000e+01 4.500000e+01 1.000000e+30 1.333333e-01 1.000000e+30
```

```r
get.sensitivity.obj(dual)  # the vales of the sensitive
```

```
## $objfrom
##  [1]    694.4467    866.6667    416.6667  10555.6000  11500.0200   4679.9840
##  [7]    516.6600    711.1200    583.3400 -24998.0000 -20000.0000
##
## $objtill
##  [1] 1.000000e+30 1.000000e+30 1.000000e+30 1.388893e+04 1.250000e+04
##  [6] 5.181811e+03 1.000000e+30 1.000000e+30 9.166667e+02 1.000000e+30
## [11] 1.250050e+04
```

[1] 516.6667 177.7778 0.0000 0.0000 666.6667 166.6667 0.0000 0.0000 416.6667

516.6667 177.7778 0.0000 0.0000 666.6667 166.6667 0.0000 0.0000 416.6667 get.variables(dual) # values of decision variables