QM Assignment #3

getwd()

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

```
library(lpSolve)
library(lpSolveAPI)
lprec <- read.lp("QM#2Solution.lp")
solve(lprec)
```

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

```
get.objective(lprec)
```

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

```
get.variables(lprec)
```

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

```
get.constraints(lprec)
```

```
##  [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
```

```
X <- "QM#2Solution.lp"
```

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

```
#Get shadow prices
get.sensitivity.rhs(lprec)
```

```
## $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

#Get dual solution
get.dual.solution(lprec)

##  [1]    1.00    0.00    0.00    0.00   12.00   20.00   60.00    0.00
0.00
## [10]    0.00   -0.08    0.56    0.00    0.00  -24.00  -40.00    0.00
0.00
## [19] -360.00 -120.00    0.00

#Get reduced costs
get.sensitivity.obj(lprec)

## $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
```

#3 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.

```
# The range of the shadow prices within the optimal solution that will not
change are the valid ranges of -1.000000e+30 to 5.181818e+03. The shadow
price for constraint one to three is zero. The range of reduced costs is -
1.00e+30 to 4.60e+.02 .
```

#4 Formulate the dual of the above problem and solve it. Does the solution agree with what you observed for the primal problem?

```
library(lpSolveAPI)
library(lpSolve)
lprec <- read.lp("3RSTUDIO.lp")
solve(lprec)

## [1] 0

get.objective(lprec)

## [1] 698000.4

get.variables(lprec)

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

```
get.constraints(lprec)
```

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

```
Y <- "QM#2Solution.lp"
```

#this solution somewhat agrees with what I observed in the orignal primal problem. When I orignially solved the primal problem, I got 696,000. When I solved the duality function, I got 698,000.4. The reason why they are 2,000.2 apart is due to the additional Y10 and Y11 constraints. This is why there is a price difference.