Assignment 3

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

   See Code from Github named: Celijah_3.R

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

   Shadow prices:
   0.00 0.00 0.00 12.00 20.00 60.00 0.00 0.00 0.00 -0.08 0.56

   Dual solution:
   0.00 0.00 0.00 12.00 20.00 60.00 0.00 0.00 0.00 -0.08 0.56

   Reduced cost:
   0 0 -24 -40 0 0 -360 -120 0

3. 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.

```
> cbind(get.sensitivity.rhs(lprec)$duals[1:11],
get.sensitivity.rhs(lprec)$dualsfrom[1:11], get.sensitivity.rhs(lprec)$dualstill[1:11])
      price         lower         upper
 [1,]  0.00 -1.000000e+30 1.000000e+30
 [2,]  0.00 -1.000000e+30 1.000000e+30
 [3,]  0.00 -1.000000e+30 1.000000e+30
 [4,] 12.00  1.122222e+04 1.388889e+04
 [5,] 20.00  1.150000e+04 1.250000e+04
 [6,] 60.00  4.800000e+03 5.181818e+03
 [7,]  0.00 -1.000000e+30 1.000000e+30
 [8,]  0.00 -1.000000e+30 1.000000e+30
 [9,]  0.00 -1.000000e+30 1.000000e+30
[10,] -0.08 -2.500000e+04 2.500000e+04
[11,]  0.56 -1.250000e+04 1.250000e+04

> cbind(get.sensitivity.rhs(lprec)$duals[12:20],
get.sensitivity.rhs(lprec)$dualsfrom[12:20], get.sensitivity.rhs(lprec)$dualstill[12:20])
     cost         lower         upper
 [1,]    0 -1.000000e+30 1.000000e+30
 [2,]    0 -1.000000e+30 1.000000e+30
 [3,]  -24 -2.222222e+02 1.111111e+02
 [4,]  -40 -1.000000e+02 1.000000e+02
 [5,]    0 -1.000000e+30 1.000000e+30
 [6,]    0 -1.000000e+30 1.000000e+30
 [7,] -360 -2.000000e+01 2.500000e+01
```

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[8,] -120 -4.444444e+01 6.666667e+01
[9,]    0 -1.000000e+30 1.000000e+30
```

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

Solution:

The solution of the dual is the same as the shadow price in the primal problem. The optimal objective value is the same as that of the primal problem.