Assignment 11 - Integer Programming

## R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.

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:

The purpose of this assignment is to formulate and solve an integer programming problem.

library(lpSolveAPI)

AP shipping service worker scheduling

# make an lp object with 0 constraints and 7 decision variables  
lprec <- make.lp(0, 7)  
  
# Creating objective function. The default is a minimization problem  
set.objfn(lprec, c(775,800,800,800,800,775,750))  
  
# Add the constraints  
add.constraint(lprec, c(0, 1, 1, 1, 1 ,1, 0), ">=", 18)  
add.constraint(lprec, c(0, 0, 1, 1, 1 ,1, 1), ">=", 27)  
add.constraint(lprec, c(1, 0, 0, 1, 1 ,1, 1), ">=", 22)  
add.constraint(lprec, c(1, 1, 0, 0, 1 ,1, 1), ">=", 26)  
add.constraint(lprec, c(1, 1, 1, 0, 0 ,1, 1), ">=", 25)  
add.constraint(lprec, c(1, 1, 1, 1, 0 ,0, 1), ">=", 21)  
add.constraint(lprec, c(1, 1, 1, 1, 1 ,0, 0), ">=", 19)  
  
# Set bounds for variables explicitly.  
set.bounds(lprec, lower = c(0, 0, 0, 0, 0, 0, 0), columns = c(1, 2,3,4,5,6,7))  
  
#Making the decision variables as Integer   
set.type(lprec,1:7,"integer")  
  
# Nameing the decision variables (column) and constraints (rows)  
lp.rownames <- c("Sunday", "Monday", "Tuesday", "Wednesady", "Thursday", "Friday", "Saturday")  
  
#Rows represents the day shift starts   
lp.colnames <- c("Shift1", "Shift2", "Shift3", "Shift4", "Shift5", "Shift6", "Shift7")  
dimnames(lprec) <- list(lp.rownames, lp.colnames)  
  
# view the linear program object to make sure it's correct  
lprec

## Model name:   
## Shift1 Shift2 Shift3 Shift4 Shift5 Shift6 Shift7   
## Minimize 775 800 800 800 800 775 750   
## Sunday 0 1 1 1 1 1 0 >= 18  
## Monday 0 0 1 1 1 1 1 >= 27  
## Tuesday 1 0 0 1 1 1 1 >= 22  
## Wednesady 1 1 0 0 1 1 1 >= 26  
## Thursday 1 1 1 0 0 1 1 >= 25  
## Friday 1 1 1 1 0 0 1 >= 21  
## Saturday 1 1 1 1 1 0 0 >= 19  
## Kind Std Std Std Std Std Std Std   
## Type Int Int Int Int Int Int Int   
## Upper Inf Inf Inf Inf Inf Inf Inf   
## Lower 0 0 0 0 0 0 0

# Writing the model to a file  
write.lp(lprec, filename = "APShipping.lp", type = "lp")

# Solving it as a LP model  
solve(lprec)

## [1] 0

# Objective function value:  
get.objective(lprec)

## [1] 25675

# Total wage cost :25675  
  
# Optimal decision variable values:  
get.variables(lprec)

## [1] 2 4 5 0 8 1 13

# Values of the Contraints   
get.constraints(lprec)

## [1] 18 27 24 28 25 24 19

#Shift 1 No. of workers: 18  
#Shift 2 No. of workers: 27  
#Shift 3 No. of workers: 25  
#Shift 4 No. of workers: 26  
#Shift 5 No. of workers: 27  
#Shift 6 No. of workers: 23  
#Shift 7 No. of workers: 19