

Assignment 6

2022-11-20

```
library(lpSolveAPI)
```

```
## Warning: package 'lpSolveAPI' was built under R version 4.2.1
```

AP shipping service worker scheduling

```
# create an lp object with 0 constraints and 7 decision variables
lprec <- make.lp(0, 7)

# Making an objective function. The default problem type is a minimization problem.
set.objfn(lprec, c(775,800,800,800,800,775,750))

# Adding 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", "Wednesday", "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)

# Examine the linear program object to ensure that it is 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
```

```
## Wednesday      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")
```

In the table below, we've estimated how many people will be needed each day for a week.

```
Workersrequired_Daywise<-matrix(c("Sunday","Monday","Tuesday","Wednesday","Thursday","Friday","Saturday",
colnames(Workersrequired_Daywise)<-c("Days_in_a_week","Number_of_Required_workers")

as.table(Workersrequired_Daywise)
```

```
##   Days_in_a_week Number_of_Required_workers
## A Sunday          18
## B Monday           27
## C Tuesday          22
## D Wednesday        26
## E Thursday         25
## F Friday           21
## G Saturday         19
```

```
Daysoff_and_Wages<-matrix(c(1,2,3,4,5,6,7,"Sunday and monday","Monday and Tuesday","Tuesday and wednesday",
colnames(Daysoff_and_Wages)<-c("Shifts","Days_offs","Wages")
as.table(Daysoff_and_Wages)
```

```
##   Shifts Days_offs      Wages
## A 1      Sunday and monday $775
## B 2      Monday and Tuesday $800
## C 3      Tuesday and wednesday $800
## D 4      wednesday and Thursday $800
## E 5      Thursday and friday $800
## F 6      Friday and Saturday $775
## G 7      Saturday and Sunday $750
```

```
# 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 Constraints  
get.constraints(lprec)
```

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

#The overall cost to the company to ensure that total pay expenses are kept to a minimum and there are enough workers available for work each day is \$ 25675 #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