Assignment 6

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Creating the LP Model for an estimate of the number of workers needed each day of the week and packaged handled as the shift , days off and wages, teh manager of AP hub in cleveland is concered as:

The problem can be expressed in the following LP model:

MIN $Z = 775x_1 + 800x_2 + 800x_3 + 800x_4 + 800x_5 + 775x_6 + 750x_7$

subject to

$x_2+x_3+x_4+x_5+x_6 \geq 18x_3+x_4+x_5+x_6+x_7 \geq 27x_1+x_4+x_5+x_6+x_7 \geq 22x_1+x_2+x_5+x_6+x_7 \geq 26x_1+x_2+x_3+x_6+x_7 \geq 25x_1+$

Non-negative integersx_i.

The estimated workforce size for shift I is shown by xi, and Z represents the cost of weekly compensation. The limitations are in place to guarantee that each day of the week receives enough staffing.

Loading the lpSolveAPI Package

```
library("lpSolveAPI")
```

Loading the lp file The model is formulated in the file `AP.lp`.

```
AP<- read.lp("AP.lp")
print(AP)
```

```
## Model name:
##            x1   x2   x3   x4   x5   x6   x7
## Minimize  775  800  800  800  800  775  750
## Sun         0    1    1    1    1    1    0  >=  18
## Mon         0    0    1    1    1    1    1  >=  27
## Tue         1    0    0    1    1    1    1  >=  22
## Wed         1    1    0    0    1    1    1  >=  26
## Thu         1    1    1    0    0    1    1  >=  25
## Fri         1    1    1    1    0    0    1  >=  21
## Sat         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
```

The number of employees required on each day of the week is estimated in the table below.

```
Workers <- matrix(c("Sunday","Monday","Tuesday","Wednesday","Thursday","Friday","Saturday",
                          18,27,22,26,25,21,19),ncol=2,byrow = F)
colnames(Workers) <- c("Day of the week", "Workers Required")
as.table(Workers)
```

```
##   Day of the week Workers Required
## A Sunday          18
## B Monday          27
## C Tuesday         22
## D Wednesday       26
## E Thursday        25
## F Friday          21
## G Saturday        19
```

At AP, package handlers are promised a five-day workweek with two straight days off. The handlers make a weekly base salary of $750. Those who work on Saturday or Sunday are compensated with an extra $25 per day. The following are potential shifts and pay rates for package handlers:

```
Days_off_and_wages <- matrix(c(1,2,3,4,5,6,7,
                    "Sunday and Monday","Monday and Tuesday","Tuesday and Wednesday","Wednesday and Thu
                    "$775","$800","$800","$800","$800","$775","$750"),ncol=3,byrow=F)
colnames(Days_off_and_wages) <- c("Shift", "Days_Off", "Wage")
as.table(Days_off_and_wages)
```

```
##   Shift Days_Off               Wage
## 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
```

Running the lp model

```
solve(AP)
```

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

By receiving 0 as the value, we can conclude that there is a model.

With the help of the "get.objective" and "get.variables" functions, it is possible to determine the objective function (total weekly salary expenses) and the number of employees who will work each shift in the best solution.

```
get.objective(AP)
```

```
## [1] 25675
```

"$25,675" is the overall cost to the company to ensure that daily labor requirements are met and that total wage expenses are kept to a minimum.

```
get.variables(AP)
```

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