

Assignment 6

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```
library(lpSolveAPI)
```

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

```
## Model name:
##           x1    x2    x3    x4    x5    x6    x7
## 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
```

```
Workers <- matrix(c("Sunday", "Monday", "Tuesday", "Wednesday", "Thursday", "Friday", "Saturday", 18, 27, 22, 26, 25, 21, 19),
                  nrow=7, ncol=14, byrow=TRUE)
colnames(Workers) <- c("Day", "Workers")
as.table(Workers)
```

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

Package handlers at AP are guaranteed a five-day work week with two consecutive days off. The base wage for the handlers is \$750 per week. Workers working on Saturday or Sunday receive an additional \$25 per day.

```
Days_off_and_wages <- matrix(c(1,2,3,4,5,6,7,
                                "Sunday and Monday", "Monday and Tuesday", "Tuesday and Wednesday", "Wednesday and Thursday", "Thursday and Friday", "Friday and Saturday", "Saturday and Sunday"),
                              nrow = 7, ncol = 3, byrow = TRUE)

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
```

```
solve(AP)
```

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

```
#Objective function (Total cost)
```

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

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

The company will incur a total cost of \$25,675 after maintaining total labor expenses as low as possible and making sure there are enough personnel on hand every day.

```
#Variables (No of workers available each day)
```

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

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

Findings:

No.of workers in shift1 = 2 No.of workers in shift2 = 4 No.of workers in shift3 = 5 No.of workers in shift4 = 0 No.of workers in shift5 = 8 No.of workers in shift6 = 1 No.of workers in shift7 = 13 respectively.

According to the objective function and restrictions, these workers are available to work every day:

Workers on Sunday: $x_2 + x_3 + x_4 + x_5 + x_6 \geq 18$; Workers on Monday: $x_3 + x_4 + x_5 + x_6 + x_7 \geq 27$; Workers on Tuesday: $x_4 + x_5 + x_6 + x_7 + x_1 \geq 22$; Workers on Wednesday: $x_5 + x_6 + x_7 + x_1 + x_2 \geq 26$; Workers on Thursday: $x_6 + x_7 + x_1 + x_2 + x_3 \geq 25$; Workers on Friday: $x_7 + x_1 + x_2 + x_3 + x_4 \geq 21$; Workers on Saturday: $x_1 + x_2 + x_3 + x_4 + x_5 \geq 19$;