

Integer Programming

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Loading Packages

```
library(lpSolveAPI)
```

Loading IP Equation

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

```
## 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
```

Here x1,x2, x3, x4, x5, x6, x7 are the number of workers assigned to shifts

Given Table

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

```
## 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
```

```
# Day offs for workers
```

```
Day_offs <- 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",
"$775","$800","$800","$800","$800","$775","$750"),ncol=3,byrow=F)
colnames(Day_offs) <- c("Shift", "Days Off", "Wage")
as.table(Day_offs)
```

```
## 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
```

Solving lp

```
set.seed(1234)
solve(ip)
```

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

```
get.objective(ip)
```

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

```
s<-get.variables(ip)
s
```

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

From the above we can observe that,

The total cost is the objective function value, which is **\$25675**.

Also **x1=2, x2=4, x3=5, x4=0, x5=8, x6=1, x7=13**

Also number of workers available on each day are,

Sunday: $x_2 + x_3 + x_4 + x_5 + x_6 = 18$ workers

Monday: $x_3 + x_4 + x_5 + x_6 + x_7 = 27$ workers

Tuesday: $x_1 + x_4 + x_5 + x_6 + x_7 = 24$ workers

Wednesday: $x_1 + x_2 + x_5 + x_6 + x_7 = 28$ workers

Thursday: $x_1 + x_2 + x_3 + x_6 + x_7 = 25$ workers

Friday: $x_1 + x_2 + x_3 + x_4 + x_7 = 24$ workers

Saturday: $x_1 + x_2 + x_3 + x_4 + x_5 = 5+1+5+0+8 = 19$ workers