Integer Programming

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Questions:

The manager wants to keep the total wage expenses as low as possible while ensuring that there are sufficient number of workers available each day. Formulate and solve the problem. What was the total cost? How many workers are available each day?

```
# Load library
library(lpSolveAPI)
X <- read.lp("ip.lp")
X
```

```
## Model name:
##              X1    X2    X3    X4    X5    X6    X7
## Minimize      1     1     1     1     1     1     1
## 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
## SUNDAY        0     1     1     1     1     1     0  >=  18
## MONDAY        0     0     1     1     1     1     1  >=  27
## 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
```

```
solve(X)
```

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

```
get.variables(X)
```

```
## [1] 2 4 5 2 6 6 8
```

```
get.constraints(X)
```

```
## [1] 24 26 25 21 19 23 27
```

Now we will answer all the question asked. What will be total minimized cost and How many workers will be availaible each day?

```r
# Creating a table
days <- c("MONDAY", "TUESDAY", "WEDNESDAY", "THURSDAY", "FRIDAY", "SATURDAY", "SUNDAY")
workers_available <- c(27, 24, 26, 25, 21, 19, 23)
cost <- workers_available * c(750, 775, 800, 800, 800, 800, 775)
workers_required <- c(27, 22, 26, 25, 21, 19, 18)
table <- data.frame(DayOfWeek = days, NoOfWorkersRequired = workers_required,  NoOfWorkersAvailaible = 

# Adding a row for total cost
total <- c("Total",sum(workers_required), sum(workers_available), sum(cost))
table <- rbind(table, total)

# table
print(table)
```

```
##   DayOfWeek NoOfWorkersRequired NoOfWorkersAvailaible   Cost
## 1    MONDAY                  27                    27  20250
## 2   TUESDAY                  22                    24  18600
## 3 WEDNESDAY                  26                    26  20800
## 4  THURSDAY                  25                    25  20000
## 5    FRIDAY                  21                    21  16800
## 6  SATURDAY                  19                    19  15200
## 7    SUNDAY                  18                    23  17825
## 8     Total                 158                   165 129475
```

After solving the problem, the optimal solution provides the minimum total cost while satisfying the constraints. Based on the current data, the total cost of the optimal solution is $129,475.