IntegerProgram

Madhusudhan Masineni

2022-11-20

Read Integer.lp from working directory

```
library(lpSolveAPI)
integer <- read.lp("IntegerProgram.lp")
integer
```

```
## 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
```

Solving the integer program by solve method and derive objective function

```
solve(integer)
```

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

```
get.objective(integer)
```

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

```
get.variables(integer)
```

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

#Objective result

The total cost is : $25,675

From above First execution of r block or from the constraints, we can conclude that ::

The workers available on Sunday would be = 18 The workers available on Monday would be = 27 The workers available on Tuesday would be = 22 The workers available on Wednesday would be = 26 The workers available on Thursday would be = 25 The workers available on Friday would be = 21 The workers available on Saturday would be = 19

In R we can write

```
workers_days = matrix(c("Sunday","Monday","Tuesday","Wednesday","Thursday","Friday","Saturday",18,27,22
colnames(workers_days) = c("DayOfTheWeek","Workers")
as.table(workers_days)
```

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

Interpretation from 2nd block of r code

x1 = 2 Workers Shift 1 x2 = 4 Workers Shift 2 x3 = 5 Workers Shift 3 x4 = 0 Workers Shift 4 x5 = 8 Workers Shift 5 x6 = 1 Workers Shift 6 x7 = 13 Workers Shift 7

The above equation in lp model

```
tb = matrix(c(0,4,5,0,8,1,0,0,0,5,0,8,1,13,2,0,0,0,8,1,13,2,4,0,0,8,1,13,2,4,5,0,0,1,13,2,3,4,0,0,0,13,
colnames(tb) = c("Shift_1", "Shift_2", "Shift_3", "Shift_4", "Shift_5", "Shift_6", "Shift_7")
row.names(tb) = c('Sunday', 'Monday', 'Tuesday','Wednesday','Thursday','Friday','Saturday')
tb
```

```
##           Shift_1 Shift_2 Shift_3 Shift_4 Shift_5 Shift_6 Shift_7
## Sunday          0       4       5       0       8       1       0
## Monday          0       0       5       0       8       1      13
## Tuesday         2       0       0       0       8       1      13
## Wednesday       2       4       0       0       8       1      13
## Thursday        2       4       5       0       0       1      13
## Friday          2       3       4       0       0       0      13
## Saturday        2       4       5       0       8       0       0
```

No. of employees available on daily basis, we can conclude that the shift arrangement that reduces the overall wage cost.

```
rowSums(tb)
```

```
##    Sunday    Monday   Tuesday Wednesday  Thursday    Friday  Saturday
##        18        27        24        28        25        22        19
```

Feasible solution

We'll need a total of 35 employees. We can quickly confirm the information above by examining shift 7 (employees off Saturday and Sunday). We only have 22 personnel to handle shift seven because 13 people are absent. Employees who work shifts 1, 2, 3, 4, and 5 will also work on Saturday. There would be 21 workers in this. We observe that Saturday requires a minimum of 19, thus 13 people on shift 7 and no one else working on this day are safe. If we apply same reasoning to the other days, we will discover that we have provided the bare minimum of personnel for each day.