QMM - Module 11

SAMIKSHA VENUGOPAL

11/20/2022

```
library(lpSolveAPI)
```

```
## Warning: package 'lpSolveAPI' was built under R version 4.1.2
```

```
library(lpSolve)
```

```
## Warning: package 'lpSolve' was built under R version 4.1.2
```

```
f.obj <- c(775,800,800,800,800,775,750)
f.con <- matrix(c(0,1,1,1,1,1,0,0,0,1,1,1,1,1,1,0,0,1,1,1,1,1,1,0,0,1,1,1,1,1,1,0,0,1,1,1,1,1,1,0,0,1,1
f.dir <- c(">=",">=",">=",">=",">=",">=",">=",">=",">=",">=",">=",">=",">=",">=")
f.rhs <- c(18,27,22,26,25,21,19,1,1,1,1,1,1,1)
model <- lp('min',f.obj,f.con,f.dir,f.rhs,int.vec = 1:15)
model
```

```
## Success: the objective function is 25675
```

```
model$solution
```

```
## [1]  2  4  6  1  6  1 13
```

Conclusion

We can conclude that minimum cost is 25675

```
### ALternative method
```

```
### ALternative method
```

Objective Function

775x1 + 800x2 + 800x3 + 800x4 + 800x5 + 775x6 + 750x7 = MINIMIZE

Shift 1 Shift 2 Shift 3 Shift 4 Shift 5 Shift 6 Shift 7

Constraints

(refer)

```r
predict <- make.lp(0, 7)

set.objfn(predict, c(775, 800, 800, 800, 800, 775, 750))

lp.control(predict)
```

```
## $anti.degen
## [1] "none"
##
## $basis.crash
## [1] "none"
##
## $bb.depthlimit
## [1] -50
##
## $bb.floorfirst
## [1] "automatic"
##
## $bb.rule
## [1] "pseudononint" "greedy"       "dynamic"      "rcostfixing"
##
## $break.at.first
## [1] FALSE
##
## $break.at.value
## [1] -1e+30
##
## $epsilon
##       epsb       epsd      epsel     epsint epsperturb   epspivot
##      1e-10      1e-09      1e-12      1e-07      1e-05      2e-07
##
## $improve
## [1] "dualfeas" "thetagap"
##
## $infinite
## [1] 1e+30
##
## $maxpivot
## [1] 250
##
## $mip.gap
## absolute relative
##    1e-11    1e-11
##
## $negrange
## [1] -1e+06
##
## $obj.in.basis
## [1] TRUE
##
## $pivoting
## [1] "devex"    "adaptive"
##
```

```
## $presolve
## [1] "none"
##
## $scalelimit
## [1] 5
##
## $scaling
## [1] "geometric"   "equilibrate" "integers"
##
## $sense
## [1] "minimize"
##
## $simplextype
## [1] "dual"   "primal"
##
## $timeout
## [1] 0
##
## $verbose
## [1] "neutral"
```

```
add.constraint(predict, c(0,1,1,1,1,1,0), ">=", 18)
add.constraint(predict, c(0,0,1,1,1,1,1), ">=", 27)
add.constraint(predict, c(1,0,0,1,1,1,1), ">=", 22)
add.constraint(predict, c(1,1,0,0,1,1,1), ">=", 26)
add.constraint(predict, c(1,1,1,0,0,1,1), ">=", 25)
add.constraint(predict, c(1,1,1,1,0,0,1), ">=", 21)
add.constraint(predict, c(1,1,1,1,1,0,0), ">=", 19)



solve(predict)
```

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

```
get.objective(predict)
```

```
## [1] 25175
```

```
get.variables(predict)
```

```
## [1]  1.3333333  4.0000000  6.3333333  0.0000000  7.3333333  0.3333333 13.0000000
```

```
    ### ALternative method

Working_days = matrix(c("Sunday","Monday","Tuesday","Wednesday","Thursay","Friday","Saturday",18,27,22,2
colnames(Working_days) =c("Daysoftheweek","Workers")
as.table(Working_days)
```

```
##   Daysoftheweek Workers
## A Sunday        18
```

```
## B Monday        27
## C Tuesday       22
## D Wednesday     26
## E Thursay       25
## F Friday        21
## G Saturday      19
```

interpreration

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

```r
consider =  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,
colnames(consider) =c("Shift_1", "Shift_2", "Shift_3", "Shift_4", "Shift_5", "Shift_6", "Shift_7")
row.names(consider) = c('Sunday', 'Monday', 'Tuesday','Wednesday','Thursday','Friday','Saturday')
consider
```

```
##           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
```

```r
## no of employees available on daily basic
rowSums(consider)
```

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

Conclusion

Firstly we see that the workers are avaliable on the monday, tuesday , wednessday, thursday, friday , saturday and sunday. we have 7 shifts therefore Shift arrangement that reduce the wage cost.