Code

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11/28/2024

Optimisation Model (Case Study)

4 members (EXISTING)

```r
library(lpSolve)
```

```
## Warning: package 'lpSolve' was built under R version 4.4.2
```

```r
#4 members (Existing)
# Objective function
objective <- c(1, 1, 1, 1, 1)

# Constraints matrix
constraints <- matrix(c(
  1, 0, 0, 0, 0,   # x1 ≤ 377
  0, 1, 0, 0, 0,   # x2 ≤ 377
  0, 0, 1, 0, 0,   # x3 ≤ 377
  0, 0, 0, 1, 0,   # x4 ≤ 377
  0, 0, 0, 0, 1,   # x5 ≤ 377
  1, 1, 1, 0, 0,   # x1 + x2 + x3 ≤ 1020 ((340/4)*4*3)
  0, 1, 1, 1, 0,   # x2 + x3 + x4 ≤ 1020
  0, 0, 1, 1, 1    # x3 + x4 + x5 ≤ 1020
), nrow = 8, byrow = TRUE)

# Constraint directions
directions <- c("<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=")

# Right-hand side of constraints
rhs <- c(377, 377, 377, 377, 377, 1020, 1020, 1020)

# Solve the linear programming problem
solution <- lp("max", objective, constraints, directions, rhs, compute.sens = TRUE)

# Output the solution
cat("Maximum total orders:", solution$objval, "\n")
```

```
## Maximum total orders: 1774
```

```r
cat("Daily orders:", solution$solution, "\n")
```

```
## Daily orders: 377 377 266 377 377
```

5 members

```
#5 members
rm(list=ls())
library(lpSolve)

# Objective function
objective <- c(1, 1, 1, 1, 1)

# Constraints matrix
constraints <- matrix(c(
  1, 0, 0, 0, 0,   # x1 ≤ 471 (377/4*5)
  0, 1, 0, 0, 0,   # x2 ≤ 471
  0, 0, 1, 0, 0,   # x3 ≤ 471
  0, 0, 0, 1, 0,   # x4 ≤ 471
  0, 0, 0, 0, 1,   # x5 ≤ 471
  1, 1, 1, 0, 0,   # x1 + x2 + x3 ≤ 1275 (340/4*5*3)
  0, 1, 1, 1, 0,   # x2 + x3 + x4 ≤ 1275
  0, 0, 1, 1, 1    # x3 + x4 + x5 ≤ 1275
), nrow = 8, byrow = TRUE)

# Constraint directions
directions <- c("<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=")

# Right-hand side of constraints
rhs <- c(471, 471, 471, 471, 471, 1275, 1275, 1275)

# Solve the linear programming problem
solution <- lp("max", objective, constraints, directions, rhs, compute.sens = TRU
E)

# Output the solution
cat("Maximum total orders:", solution$objval, "\n")
```

```
## Maximum total orders: 2217
```

```
cat("Daily orders:", solution$solution, "\n")
```

```
## Daily orders: 471 471 333 471 471
```

6 members

```
rm(list=ls())
library(lpSolve)

# Objective function
objective <- c(1, 1, 1, 1, 1)

# Constraints matrix
constraints <- matrix(c(
  1, 0, 0, 0, 0,   # x1 ≤ 565 (377/4*6)
  0, 1, 0, 0, 0,   # x2 ≤ 565
  0, 0, 1, 0, 0,   # x3 ≤ 565
  0, 0, 0, 1, 0,   # x4 ≤ 565
  0, 0, 0, 0, 1,   # x5 ≤ 565
  1, 1, 1, 0, 0,   # x1 + x2 + x3 ≤ 1530 (340/4*6*3)
  0, 1, 1, 1, 0,   # x2 + x3 + x4 ≤ 1530
  0, 0, 1, 1, 1    # x3 + x4 + x5 ≤ 1530
), nrow = 8, byrow = TRUE)

# Constraint directions
directions <- c("<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=")

# Right-hand side of constraints
rhs <- c(565, 565, 565, 565, 565, 1530, 1530, 1530)

# Solve the linear programming problem
solution <- lp("max", objective, constraints, directions, rhs, compute.sens = TRU
E)

# Output the solution
cat("Maximum total orders:", solution$objval, "\n")
```

```
## Maximum total orders: 2660
```

```
cat("Daily orders:", solution$solution, "\n")
```

```
## Daily orders: 565 565 400 565 565
```

7 members

```
rm(list=ls())
library(lpSolve)

# Objective function
objective <- c(1, 1, 1, 1, 1)

# Constraints matrix
constraints <- matrix(c(
  1, 0, 0, 0, 0,   # x1 ≤ 659 (377/4*7)
  0, 1, 0, 0, 0,   # x2 ≤ 659
  0, 0, 1, 0, 0,   # x3 ≤ 659
  0, 0, 0, 1, 0,   # x4 ≤ 659
  0, 0, 0, 0, 1,   # x5 ≤ 659
  1, 1, 1, 0, 0,   # x1 + x2 + x3 ≤ 1785 (340/4*7*3)
  0, 1, 1, 1, 0,   # x2 + x3 + x4 ≤ 1785
  0, 0, 1, 1, 1    # x3 + x4 + x5 ≤ 1785
), nrow = 8, byrow = TRUE)

# Constraint directions
directions <- c("<=", "<=", "<=", "<=", "<=", "<=", "<=", "<=")

# Right-hand side of constraints
rhs <- c(659, 659, 659, 659, 659, 1785, 1785, 1785)

# Solve the linear programming problem
solution <- lp("max", objective, constraints, directions, rhs, compute.sens = TRU
E)

# Output the solution
cat("Maximum total orders:", solution$objval, "\n")
```

```
## Maximum total orders: 3103
```

```
cat("Daily orders:", solution$solution, "\n")
```

```
## Daily orders: 659 659 467 659 659
```