Question-1.R

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library(lpSolve)  
  
# Define the objective function coefficients and the constraint matrix  
obj <- c(3, 2)  
const <- matrix(c(3, 1, 2, 3), nrow = 2, byrow = TRUE)  
dir <- c("<=", "<=")  
rhs <- c(30, 40)  
  
# Solve the LP problem  
sol <- lp(direction = "max", objective.in = obj, const.mat = const, const.dir = dir, const.rhs = rhs)  
  
# Print the results  
cat("Optimal solution:\n")

## Optimal solution:

cat("x1 =", sol$solution[1], "\n")

## x1 = 7.142857

cat("x2 =", sol$solution[2], "\n")

## x2 = 8.571429

cat("Maximum value of z =", sol$objval, "\n")

## Maximum value of z = 38.57143

cat("\nSlack variables:\n")

##   
## Slack variables:

for (i in 1:length(dir)) {  
 slack <- rhs[i] - const[i,] %\*% sol$solution  
 if (dir[i] == "<=") {  
 cat("Constraint", i, "is binding with slack =", slack, "\n")  
 } else {  
 cat("Constraint", i, "is nonbinding with slack =", slack, "\n")  
 }  
}

## Constraint 1 is binding with slack = 3.552714e-15   
## Constraint 2 is binding with slack = 0

cat("\nShadow prices:\n")

##   
## Shadow prices:

for (i in 1:length(dir)) {  
 shadow <- sol$pi[i]  
 if (dir[i] == "<=") {  
 cat("Constraint", i, "has a shadow price of", shadow, "and a range of feasibility from",   
 rhs[i] - sol$sensitivity[i], "to", rhs[i] + sol$sensitivity[i], "\n")  
 } else {  
 cat("Constraint", i, "has no shadow price since it's nonbinding\n")  
 }  
}

## Constraint 1 has a shadow price of and a range of feasibility from to   
## Constraint 2 has a shadow price of and a range of feasibility from to

cat("\nRange of optimality for objective function coefficients:\n")

##   
## Range of optimality for objective function coefficients:

cat("The coefficient of x1 can range from", sol$objval/2, "to infinity\n")

## The coefficient of x1 can range from 19.28571 to infinity

cat("The coefficient of x2 can range from", sol$objval/3, "to infinity\n")

## The coefficient of x2 can range from 12.85714 to infinity