20181019j applications of contrained optimization

cheungngo

19 October 2018

library(Ryacas)  
library(mosaic)  
library(manipulate)

### Utility functions

u(x,y) == x^(1/3) \* y^(1/2)  
income M = 40  
price x = 2, price y = 5  
i.e. constraint g(x) == 2*x + 5*y - 40 = 0

x = Sym('x')  
y = Sym('y')  
lambda = Sym('lambda')  
L = x^(1/3) \* y^(1/2) - lambda\*(2\*x + 5\*y - 40)  
dLx = deriv(L,x); dLx

## expression(0.3333333333 \* (x^-0.6666666666 \* y^0.5) - 2 \* lambda)

dLy = deriv(L,y); dLy

## expression(x^0.333333333333333 \* (0.5 \* y^-0.5) - 5 \* lambda)

dLlambda = deriv(L,lambda); dLlambda

## expression(40 - (2 \* x + 5 \* y))

Solve(dLx==0,lambda)

## expression(list(lambda == 0.3333333333 \* (x^-0.6666666666 \* y^0.5)/2))

Solve(dLy==0,lambda)

## expression(list(lambda == x^0.333333333333333 \* (0.5 \* y^-0.5)/5))

Solve(0.3333333333 \* (x^-0.6666666666 \* y^0.5)/2 == x^0.333333333333333 \* (0.5 \* y^-0.5)/5,x)

## expression(list())

Although the computer could not compute,  
The equality could easily be expressed into:

##### 1/6 \* y == 1/10 \* x ==> y == 3\*x / 5

Solve(List(y == 3\*x / 5, dLlambda == 0),  
 List(x,y))

## expression(list(list(x == 8, y == 24/5)))

# Finding Lambda  
Eval(1/3 \* (x^(-2/3) \* y^0.5)/2, list(x=8,y=24/5))

## [1] 0.09128709

#### Note that the application of constrained optimization also includes capital costs / output, and raw material costs / output