1-2SensitivityAnalysis

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```
#1-1-2
#warnings('off')#Omit the warnings from Ryacas
#Preload
library(Deriv)
library(Ryacas)
```

```
##
## Attaching package: 'Ryacas'
```

```
## The following object is masked from 'package:stats':
##
##     integrate
```

```
## The following objects are masked from 'package:base':
##
##     %*%, diag, diag<-, lower.tri, upper.tri
```

```
casOut<-function(y) return(parse(text=y[["text"]]))
#-------------------------------------------------------------------------
#1) WITH RESPECT TO r
#ASSUMPTIONS

library(Ryacas)
w<-expression(200+5*t1)
yac_assign(w,"w")
p<-expression(0.65-r*t1)##FACTOR r IS SET AS A VARIABLE IN THIS CASE
yac_assign(p,"p")
C<-expression(0.45*t1)
yac_assign(C,"C")
R<-expression(p*w)
yac_assign(R,"R")
P<-expression(R-C)


yac_assign(P,"P")
P = yac("P",rettype = "expr")
P
```

```
## expression((0.65 - r * t1) * (5 * t1 + 200) - 0.45 * t1)
```

```
dPdt = yac(paste0("D(","t1",")", as.character(P)),rettype = "expr")
d2Pdt2 = yac(paste0("D(","t1",")", as.character(dPdt)),rettype = "expr")
sln = yac(paste0("Solve(",dPdt,",t1)"),rettype = "str")
sln
```

```
## [1] "{t1== -(3.25-200*r-0.45)/((-5)*r-5*r)}"
```

```
t1_opt = parse(text = gsub("}"," ",gsub("{t1=="," ",sln,fixed = TRUE),fixed = TRUE))
t1_opt = yac_expr(t1_opt)
t1_opt #solution for optimal value for t w.r.t. r
```

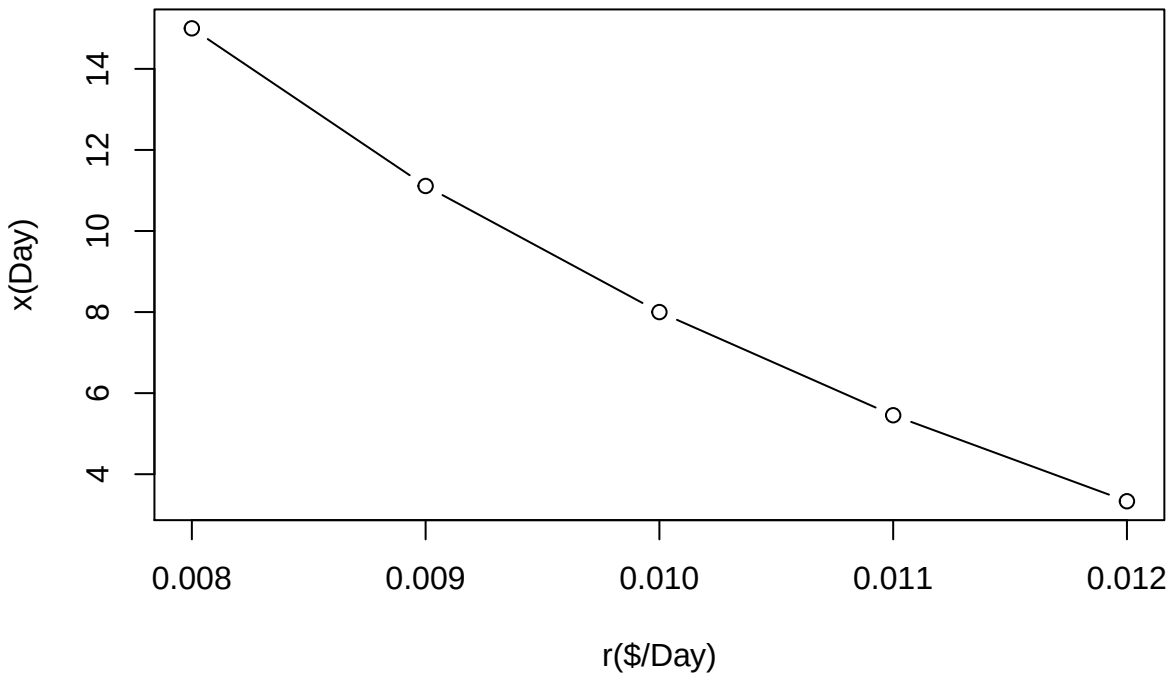
```
## expression(-(3.25 - 200 * r - 0.45)/(-5 * r - 5 * r))
```

```
P_opt = gsub("t1",as.character(t1_opt),as.character(P),fixed = TRUE)
P_opt = parse(text = P_opt)
P_opt
```

```
## expression((0.65 - r * -(3.25 - 200 * r - 0.45)/(-5 * r - 5 *
##     r)) * (5 * -(3.25 - 200 * r - 0.45)/(-5 * r - 5 * r) + 200) -
##     0.45 * -(3.25 - 200 * r - 0.45)/(-5 * r - 5 * r))
```

Above repeats 1-1 but with a variable r instead of constants, get symbolic expression sln_expr

```
r=(8:12)*0.001
x=eval({r<-(8:12)*0.001;t1_opt})
plot(r,x,type="b",xlab="r($/Day)",ylab="x(Day)")#PLOT1
```




```
dxdr<- yac(paste("D(","r",")", as.character(t1_opt)),rettype = "expr")
dxdr
```

```
## expression((-2000 * r - 10 * (3.25 - 200 * r - 0.45))/(10 * r)^2)
```

```
yac_assign(dxdr,"dxdr")
S = expression(dxdr*r/x)
S = yac_assign(S,"S")
S = yac("Simplify(S)",rettype = "expr")
S
```

```
## expression(-28/(100 * r * x))
```

2) WITH RESPECT TO G

```
#LOAD ASSUMPTIONS

detach("package:Ryacas", unload = TRUE)
#clear symbolic vars

require(Ryacas)
```

```
## Loading required package: Ryacas
```

```
##
## Attaching package: 'Ryacas'
```

```
## The following object is masked from 'package:stats':
##
##     integrate
```

```
## The following objects are masked from 'package:base':
##
##     %*%, diag, diag<-, lower.tri, upper.tri
```

```
w<-expression(200+g*t1)
yac_assign(w,"w")#FACTOR g IS SET AS A VARIABLE IN THIS CASE
p<-expression(0.65-0.01*t1)
yac_assign(p,"p")
C<-expression(0.45*t1)
yac_assign(C,"C")
R<-expression(p*w)
yac_assign(R,"R")
P<-expression(R-C)
yac_assign(P,"P")
P = yac("P",rettype = "expr")
P
```

```
## expression((0.65 - 0.01 * t1) * (g * t1 + 200) - 0.45 * t1)
```

```
dPdt = yac(paste0("D(","t1",")", as.character(P)),rettype = "expr")
d2Pdt2 = yac(paste0("D(","t1",")", as.character(dPdt)),rettype = "expr")
sln = yac(paste0("Solve(",dPdt,",t1)"),rettype = "str")
sln
```

```
## [1] "{t1== -(0.65*g-2.45)/((-0.01)*g-0.01*g)}"
```

```
t1_opt = parse(text = gsub("}"," ",gsub("{t1==","  ",sln,fixed = TRUE),fixed = TRUE))
t1_opt = yac_expr(t1_opt)
t1_opt #solution for optimal value for t w.r.t. g
```

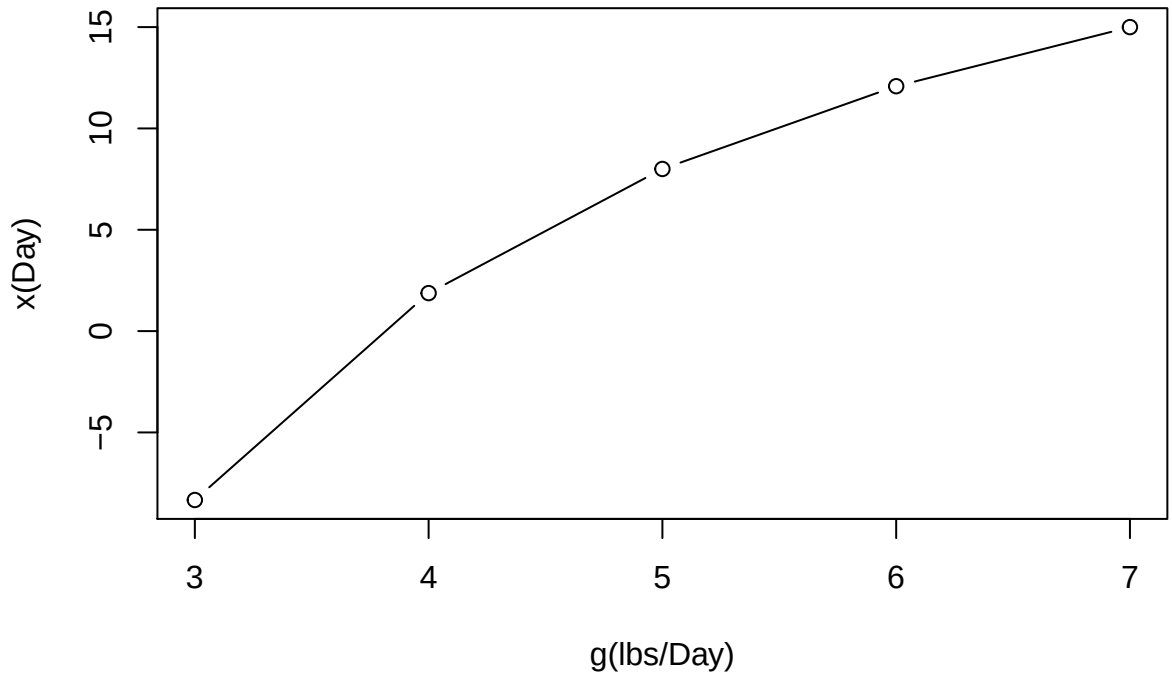
```
## expression(-(0.65 * g - 2.45)/(-0.01 * g - 0.01 * g))
```

```
P_opt = gsub("t1",as.character(t1_opt),as.character(P),fixed = TRUE)
P_opt = parse(text = P_opt)
P_opt
```

```
## expression((0.65 - 0.01 * -(0.65 * g - 2.45)/(-0.01 * g - 0.01 *
##     g)) * (g * -(0.65 * g - 2.45)/(-0.01 * g - 0.01 * g) + 200) -
##     0.45 * -(0.65 * g - 2.45)/(-0.01 * g - 0.01 * g))
```

```
#Above repeats 1-1 but with a variable r instead of constants, get symbolic expression sln_expr

g=3:7
x=eval({g<-3:7;t1_opt})
plot(g,x,type="b",xlab="g(lbs/Day)",ylab="x(Day)")#PLOT1
```




```
dxdg<- yac(paste("D(","g",")", as.character(t1_opt)),rettype = "expr")
yac_assign(dxdr,"dxdg")
S = expression(dxdr*g/x)
S = yac_assign(S,"S")
S = yac("Simplify(S)",rettype = "expr")
S
```

```
## expression((-28 * g)/(100 * r^2 * x))
```