1-1-1 One-Variable Optimization

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This R repository is for demonstration of algorithms involved in the book Mathematical Modeling (4th Edition) written by Prof. Mark. M. Meerschaert

```r
#re-edited Mar 2021


#This R repository is for demonstration of algorithms involved in the book
#Mathematical Modeling (4th Edition) written by Prof. Mark. M. Meerschaert
#coded, edited and tested by Hao Li during Dec. 2018 - Jan. 2019.


#1-1-1
#1 var optimization Symbolic&Numeric calculations and visualization with R

#
#1 Variable Optimization sample question
#-------------------------------------------------------------------------
#AIM: FIND P MAX
#ASSUMPTIONS
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
```

```r
w<-expression(200+5*t1)
yac_assign(w,"w")
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")
```

```r
P<-expression(R-C)
```

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

```
## expression((0.65 - 0.01 * t1) * (5 * t1 + 200) - 0.45 * t1)
```

```r
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==0.8/0.1}"
```

```r
l = nchar(sln)
l
```

```
## [1] 13
```

```r
sln_str = gsub("==","=",substr(sln,2,l-1))
```

```r
sln_expr = parse(text = sln_str)
sln_expr
```

```
## expression(t1 = 0.8/0.1)
```

```r
eval(sln_expr)
(P.max   = eval(P))
```
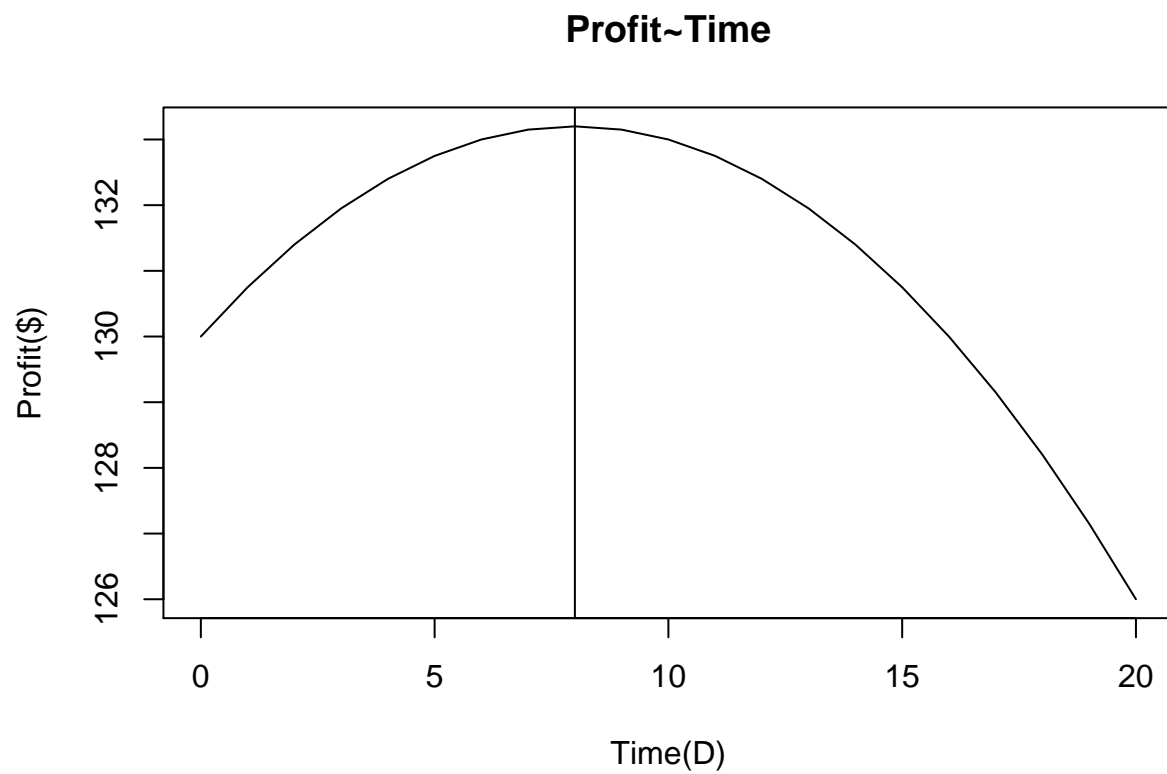
```
## [1] 133.2
```

```r
eval(dPdt)
```

```
## [1] 6.106227e-16
```

```r
eval(d2Pdt2)
```

```
## [1] -0.1
```

```r
#-------------------------------------------------------------------
plot(0:20,eval({t1=0:20;P}),type="l",xlab="Time(D)",ylab="Profit($)")
title("Profit~Time")
abline(v=8,untf=FALSE)
```

Profit~Time


```r
#---------------------------------------------------------------------
sln_expr = parse(text = sln_str)
sln_expr
```

```
## expression(t1 = 0.8/0.1)
```

```r
eval(sln_expr)
t.opti=t1
```

```r
P.max=eval({t1<-t.opti;P})
list("t.opti"=t.opti,"P.max"=P.max)
```

```
## $t.opti
## [1] 8
##
## $P.max
## [1] 133.2
```

```r
#detach("package:Ryacas", unload=TRUE)
#detach("package:Deriv", unload=TRUE)
```