rom.R

evanjohnston

Tue Mar 29 08:10:16 2016

```
# Romberg Integration Method
# inputs:
#   a: first endpoint
#   b: last endpoint
#   n: + integer
#   f: function to integrate
romberg<-function(a, b, n, f){
  # initalize Rij matrix
  rmatout<-matrix(rep(0,n^2),nrow=n)

  # initlaize R(1-2)(1-2) matrix
  rmat<-matrix(rep(0,n*2),nrow=2)

  # create h
  h<-b-a

  # set r11
  rmat[1,1]<-h/2*(f(a)+f(b))

  # output r11
  rmatout[1,1]<-rmat[1,1]

  # set r2i's
  for(i in 2:n){

    # create sum
    sigma<-0
    for(k in 1:(2^(i-2))){

      # create x
      x<-a+(k-0.5)*h

      # update sigma
      sigma<-sigma+f(x)
    }

    # set r21
    rmat[2,1]<-1/2*(rmat[1,1]+h*sigma)

    # set r2j's
    for (j in 2:i){

      #update r2j's
      rmat[2,j]<-(rmatout[2,(j-1)]+(rmatout[2,(j-1)]-rmatout[1,(j-1)])/(4^(j-1)-1))
    }

    # output r2j's
```

```
    for (j in 1:i){
      rmatout[i,j]<-rmat[2,j]
    }

    # update h
    h<-h/2

    # update R1j
    for(j in 1:i){
      rmat[1,j]<-rmat[2,j]
    }
  }
return(rmatout)
}

# function to integrate
h<-function(x){
  return (cos(x)^2)
}

romberg(0,pi,6,h)
```

```
##          [,1]      [,2]      [,3] [,4] [,5] [,6]
## [1,] 3.141593  0.000000  0.000000    0    0    0
## [2,] 1.570796 -1.047198  0.000000    0    0    0
## [3,] 1.570796  1.047198 -1.117011    0    0    0
## [4,] 1.570796  1.047198 -1.117011    0    0    0
## [5,] 1.570796  1.047198 -1.117011    0    0    0
## [6,] 1.570796  1.047198 -1.117011    0    0    0
```