Golden Selection Method

Advanced Engineering Mathematics Assignment 11

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Problem

7.3 Let $f(x) = 8e^{1-x} + 7\log(x)$, where "log" represents the natural logarithm function.

a. Use MATLAB to plot $f(x)$ versus x over the interval $[1, 2]$, and verify that f is unimodal over $[1, 2]$.

b. Write a simple MATLAB program to implement the golden section method that locates the minimizer of f over $[1, 2]$ to within an uncertainty of 0.23. Display all intermediate steps using a table as in Exercise 7.2.

Function Definition

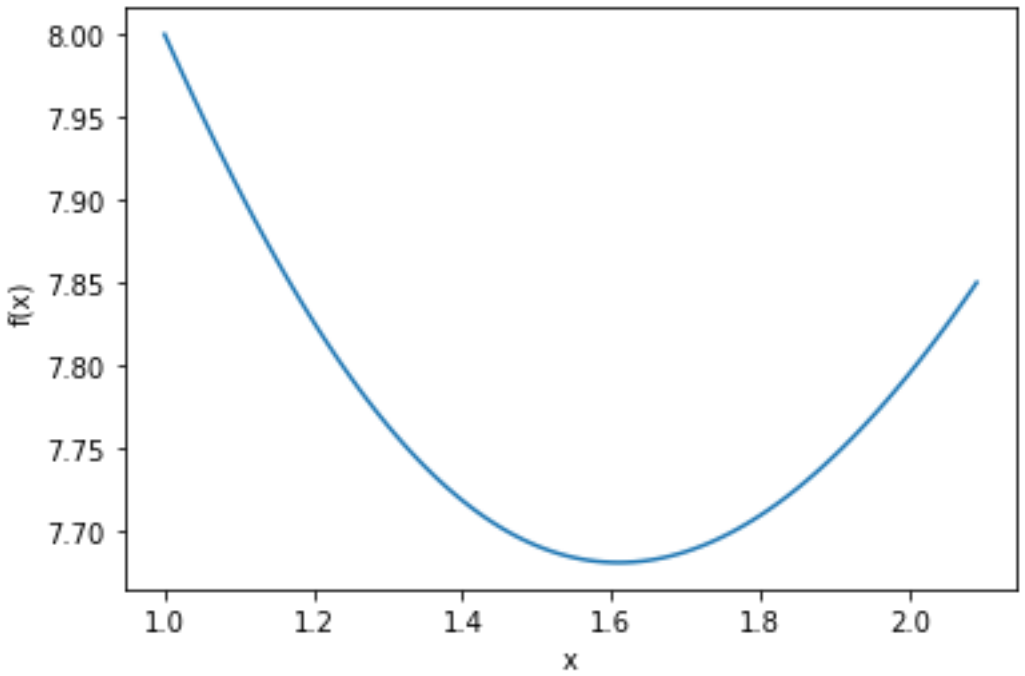

```
x = symbols("x")
f = 8*(E**(1-x))+7*log(x)
expr_func = lambdify(x, f,'numpy')
```

```
import matplotlib.pyplot as plt
import numpy as np
import math
from sympy import *
```

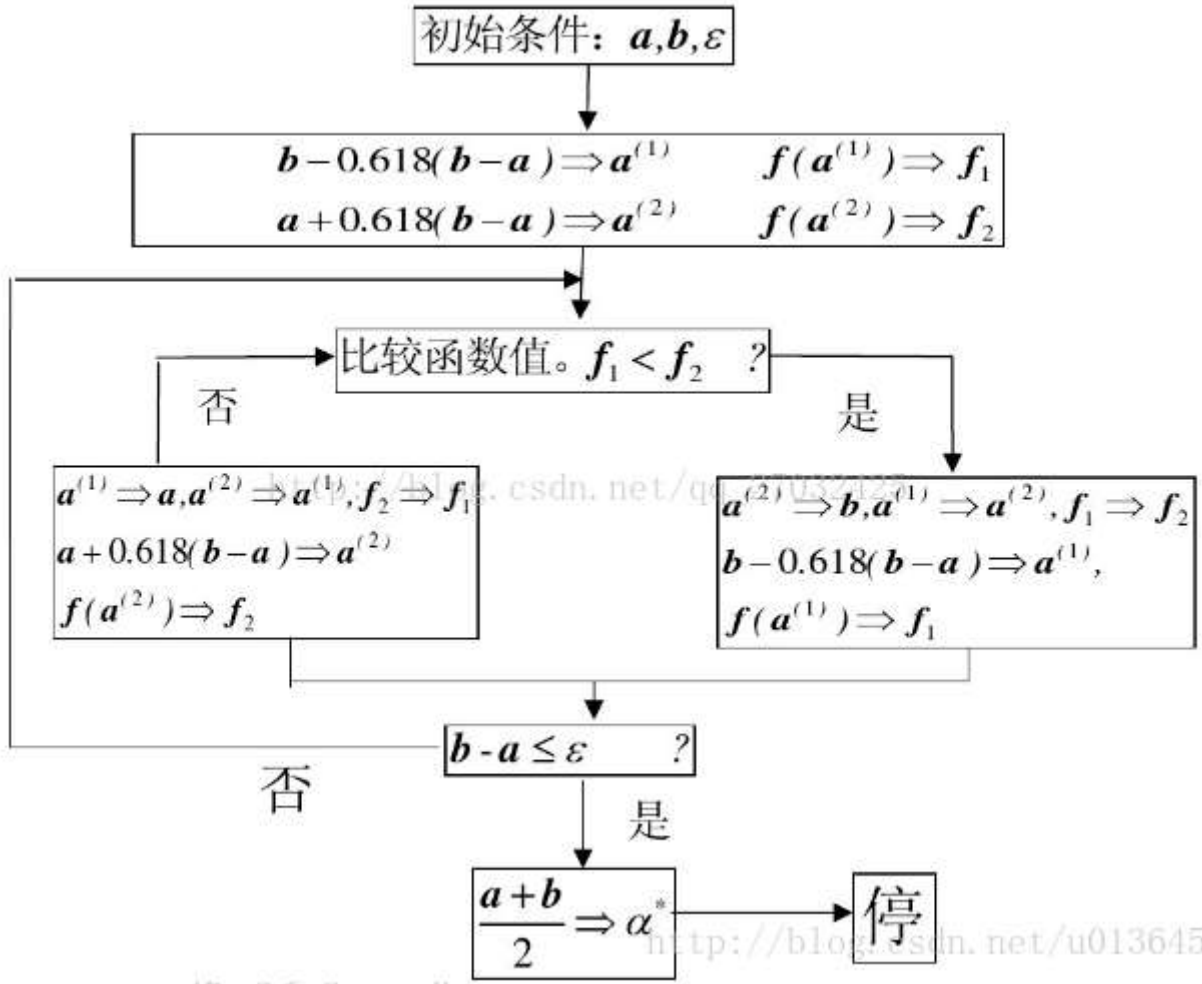
Plot


```
X = np.arange(1, 2.1, 0.01)
r = expr_func(X)
plt.xlabel('x')
plt.ylabel('f(x)')
plt.plot(X, r)
plt.show()
```

Plot



Algorithm


初始条件：a,b,ε
$b-0.618(b-a)\Rightarrow a^{(1)}$　$f(a^{(1)})\Rightarrow f_1$
$a+0.618(b-a)\Rightarrow a^{(2)}$　$f(a^{(2)})\Rightarrow f_2$
比较函数值。$f_1<f_2$?
否
是
$a^{(1)}\Rightarrow a, a^{(2)}\Rightarrow a^{(1)}, f_2\Rightarrow f_1$
$a+0.618(b-a)\Rightarrow a^{(2)}$
$f(a^{(2)})\Rightarrow f_2$
$a^{(2)}\Rightarrow b, a^{(1)}\Rightarrow a^{(2)}, f_1\Rightarrow f_2$
$b-0.618(b-a)\Rightarrow a^{(1)}$,
$f(a^{(1)})\Rightarrow f_1$
$b-a\le\varepsilon$?
否
是
$\frac{a+b}{2}\Rightarrow\alpha^*$
停

Loop init


```
a, b = 1, 2
rho = round(1 - (3 - math.sqrt(5)) / 2, 3)
a1 = round(b - rho*(b-a), 3)
a2 = round(a + rho*(b-a), 3)
f1 = round(expr_func(a1), 4)
f2 = round(expr_func(a2), 4)
i = 0
```

Loop


```
while b-a > 0.23:
    i += 1
    print('i = %d, f(%f) = %f, f(%f) = %f' % (i, a1, f1, a2, f2), end=' ')
    if f1 < f2:
        b = a2
        a2, f2 = a1, f1
        a1 = round(b - rho*(b-a), 3)
        f1 = round(expr_func(a1), 4)
    else:  # f1 > f2
        a = a1
        a1, f1 = a2, f2
        a2 = round(a + rho*(b-a), 3)
        f2 = round(expr_func(a2), 4)
    print([a, b])
```

Thank you

- End