The Language of Technical Computing by MATLAB

Class 5 : Programming

Outline

- operators
- for
- if-else
- while
- 習題

Operators

運算子	說明
<	小於
<=	小於等於
>	大於
>=	大於等於
==	等於
~=	不等於
&	and
|	or
~	nor運算。False ~ False → True。

for loop – ex.1

```
1  clc; clear all;
2  A = zeros(5);
3  for  i=1:5
4      for j=1:5
5          A(i,j)=i+j;
6      end
7  end
8
9  B = ones(5);
10 for  i=1:5
11     for j=1:5
12         if A(i,j)>6
13             B(i,j)=0;
14         end
15     end
16 end
```

```
>> A,B

A =

     2     3     4     5     6
     3     4     5     6     7
     4     5     6     7     8
     5     6     7     8     9
     6     7     8     9    10

B =

     1     1     1     1     1
     1     1     1     1     0
     1     1     1     0     0
     1     1     0     0     0
     1     0     0     0     0
```

for loop – ex.2

```
18      % Find n such that n! > 77777777
19 —    a = 1;
20 —    for  i=1:20
21 —        a = a*i;
22 —        if a > 77777777
23 —            n = i;
24 —            fprintf("n = %g\n",n)
25 —            break;
26 —        end
27 —    end
```

for loop – ex.3, Guass-Jordan elimination

```
function [x_b] = gauss(A,b)
%Gaussian Elimination
 n=length(b);
  for i=1:1:n-1
      for j=i+1:1:n
          b(j)=b(j)-A(j,i)/A(i,i)*b(i);
          A(j,:)=A(j,:)-A(j,i)/A(i,i)*A(i,:);
      end
  end

  x_b=b;
  for i=n:-1:1
      for j=i+1:1:n
          x_b(i)=x_b(i)-A(i,j)*x_b(j);
      end
      x_b(i)=x_b(i)/A(i,i);
  end
end
```

```
>> A=magic(3);
>> b=[1;1;1];
>> gauss(A,b)

ans =

    0.0667
    0.0667
    0.0667

>> inv(A)*b

ans =

    0.0667
    0.0667
    0.0667
```

if-else

Current Folder | Editor - sign_of_number.m

sign_of_number.m

```
1   function out = sign_of_number(num)
2       if num > 0
3           out = "positive";
4       elseif num < 0
5           out = "negative";
6       else
7           out = "zero";
8       end
9   end
10
11  % function外面不可有其他statement
12  % function名稱要和檔名一致
```

```
>> sign_of_number(30)

ans =

    "positive"
```

while

```
18      % Find n such that n! > 77777777
19 —    n = 1;
20 —    fact_n = 1;
21 —    while fact_n < 77777777
22 —        n=n+1;
23 —        fact_n=fact_n*n
24 —    end
```

習題1

1. 求解方程式x=tan(x)最靠近原點的非零解。

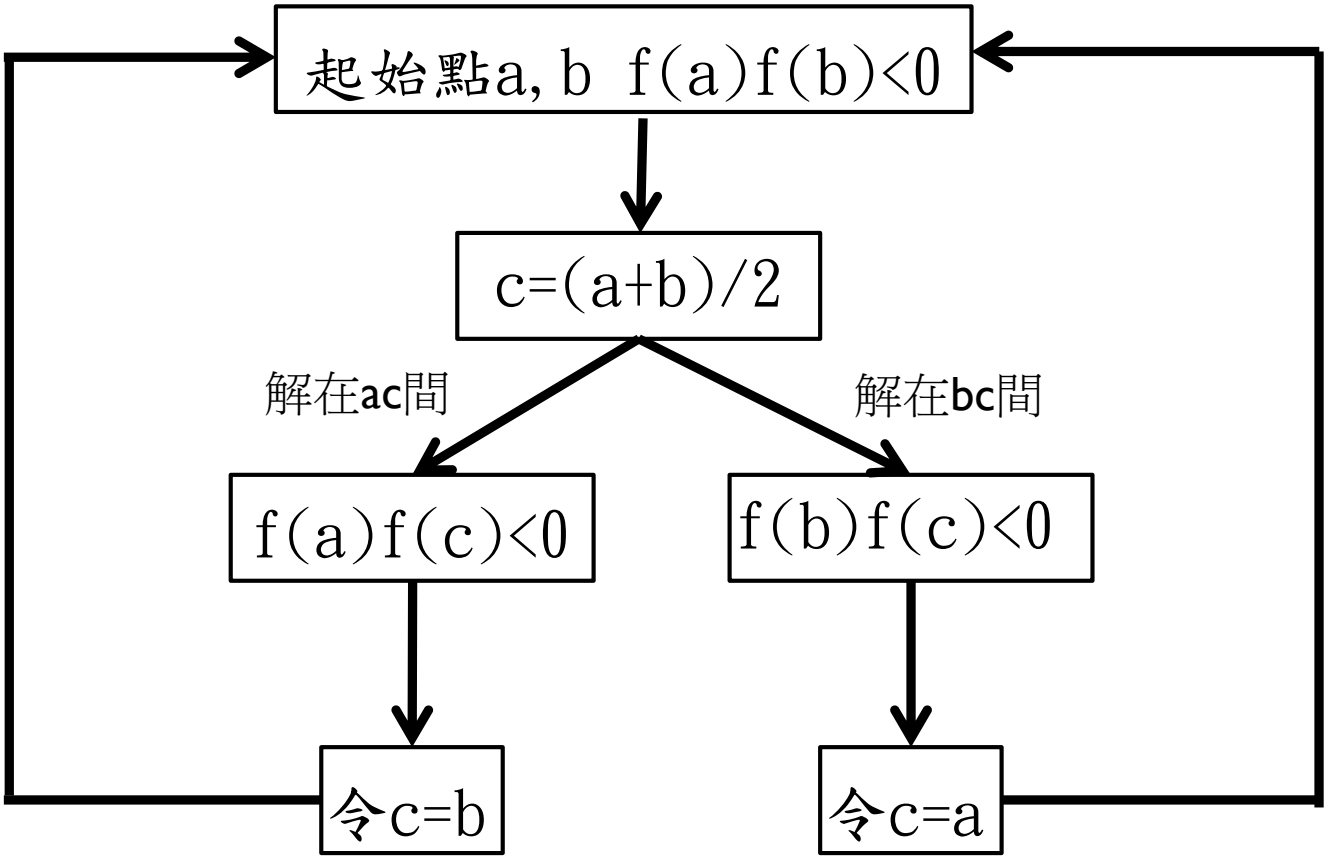
解=4.4934094579090642 誤差為-0.0000000000000009

think：勘根定理

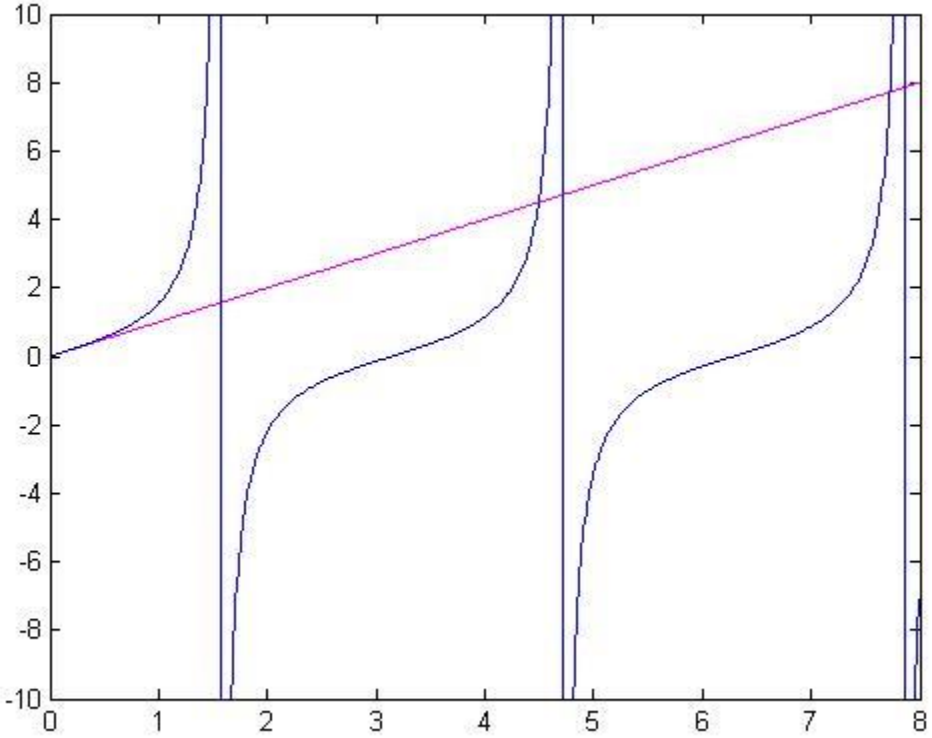
當f(a)f(b)<0時，代表x=a~b中間有奇數個解。

做法：先假設a和b點(起始點），然後利用2分逼近法去逼近a和b之間的解，請準確到小數點後第15位數。

流程圖



起始值挑選(看圖)



習題2

2. 請寫出一個GSO函數，可以將輸入的矩陣列/行向量作Gram－Schmidt正交化(GSO)。

GSO：

$$\{V_1, V_2, V_3, \ldots\} \rightarrow \{u_1, u_2, u_3, \ldots\}$$

$$U_1 = V_1 \longrightarrow u_1 = \frac{U_1}{|U_1|}$$

$$U_2 = V_2 - \frac{V_2 \cdot U_1}{|U_1|^2} U_1 \longrightarrow u_2 = \frac{U_2}{|U_2|}$$

$$U_3 = V_3 - \frac{V_3 \cdot U_1}{|U_1|^2} U_1 - \frac{V_3 \cdot U_2}{|U_2|^2} U_2 \longrightarrow u_3 = \frac{U_3}{|U_3|}$$

.
.
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