Computer Programming in Financial Engineering
Problem Set 1

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1 Matrix indexation

```
>> A  = reshape(1:18, 3, 6);

% change elements with values of 2^i i=[1 2 3 4] to NaN
for i = [1 2 3 4]
A(2^i) = nan;
end
% change the last two columns to Inf
A(:,[5 6])  = inf;
A
A =
1    NaN      7     10    Inf    Inf
NaN      5    NaN     11    Inf    Inf
3      6      9     12    Inf    Inf
```

2 Character array

```
% character array
>> A = 'Hello World';
whos A
Name        Size                Bytes  Class     Attributes
A           1x11                   22  char

>> size(A)
ans =
1     11

>>A(end+1) = '!'
A =
'Hello World!'

% string
>> A = "Hello World";
size(A)
ans =
1      1

>> A + "!"
ans =
"Hello World!"
```

I cannot use the array commands to add the exclamation mark to A. Using commands A=”Hello World” makes A a string, and its size is 1 1, which means a 1*1 string.

3 Random Number

```
>> rng('default');
A = randn(5);
% find the list of elements which are larger than 0.5
find(A>0.5)
ans = 1 2 4 9 10 12 13 15 18 19 20 21 23 24

>> [I,J] = find(A>0.5)
I = 1 2 4 4 5 2 3 5 3 4 5 1 3 4
J = 1 1 1 2 2 3 3 3 4 4 4 5 5 5

>> [X,Y] = ind2sub(size(A), find(A>0.5))

X = 1 2 4 4 5 2 3 5 3 4 5 1 3 4
Y = 1 1 1 2 2 3 3 3 4 4 4 5 5 5
```

4 Calculate the sum

```
>> tic
loopsum = 0;
for i = 1:1:100
loopsum = loopsum + i;
end
timeloop = toc
timeloop =
3.9000e-06

>> tic
A = 1:1:100;
S = sum(A);
timearraysum = toc
timearraysum =
7.6000e-06

>> tic
i =1;
whilesum = 0;
while i ≤ 100
whilesum = whilesum + i;
i = i +1;
end
timewhile = toc
timewhile =
1.8000e-06
```

time spending : arraysum > for loop > while loop

5 Hilbert matrix

```
>> K = 5;
A = ones(K);
for m = 1:1:K
    for n = 1:1:K
        A(m,n) = 1 / (m + n - 1);
    end
end

% look in baidu
M = ones(K, 1)*(1:K);
N = M';
H = 1 ./ (M+N-1);
```

6 NaN and Inf

```
>> A = [nan inf]';
A == A
ans =
2×1 logical 数组
0   1
```

NaN means Not a Number. NaN is different. When we need to check whether there is NaN in an array, we use isnan().

inf means infinity. Inf is the same so Inf==Inf, ans = 1.

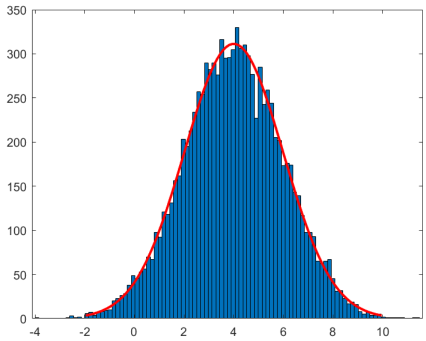
7 hist and histfit

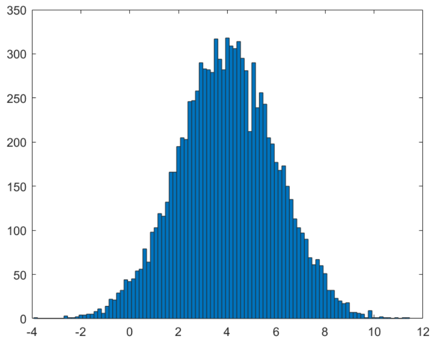
```
>>K = 10000;
mean = 4;
std = 2;
A = normrnd(mean, std, [1 K]);

figure(1)
histfit(A)

figure(2)
hist(A,sqrt(K))
h=findobj(gca,'Type','patch');
h.FaceColor = [0.00 0.45 0.74];
```

Set hist-nbins = sqrt(K), and change the bin color.



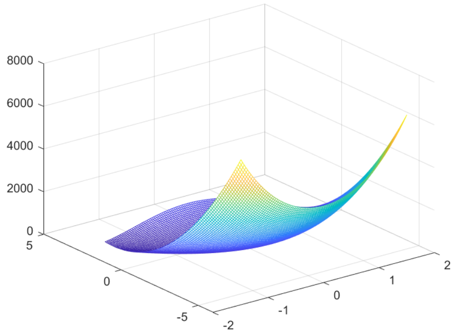


8 Banana function

```
>> x1= linspace(-1.5,1.5,100);
x2 = linspace(-6,2.8,100);
[X1,X2] = meshgrid(x1,x2);
Y = 100 * (X2-X1.^2).^2+(1-X1).^2;
mesh(X1,X2,Y)

options.MaxIter=2000;
options.TolFun = 1e-4;%函数值的终止容差

fun = @(x)100*(x(2)-x(1)^2)^2 +(1-x(1))^2;
lb = [0,0];
ub = [1,2];
A = [];
b = [];
Aeq = [];
beq = [];
x0 = (lb + ub)/2;
nonlcon = [];
x = fmincon(fun,x0,A,b,Aeq,beq,lb,ub,nonlcon,options)
x =
0.9960    0.9920
```



9 dcount.m

```
function [NPV] = dcount(cashflow, r, varargin)
NPV = 0;
```

```
periods = length(cashflow);
for t = 1:1:periods
if(nargin == 2 | varargin{1} == 'cp' )
NPV = NPV + cashflow(t) * exp(-r*t);
else
NPV = NPV + cashflow(t) /(1+r)^t;
end
end
end
```

10 Function handles

```
>> cashflow = [5,5,105];
fun = @(x) dcount(cashflow,x,1)-95;
ansrate = fsolve(fun,0);
ansrate

ansrate = 0.0690
```