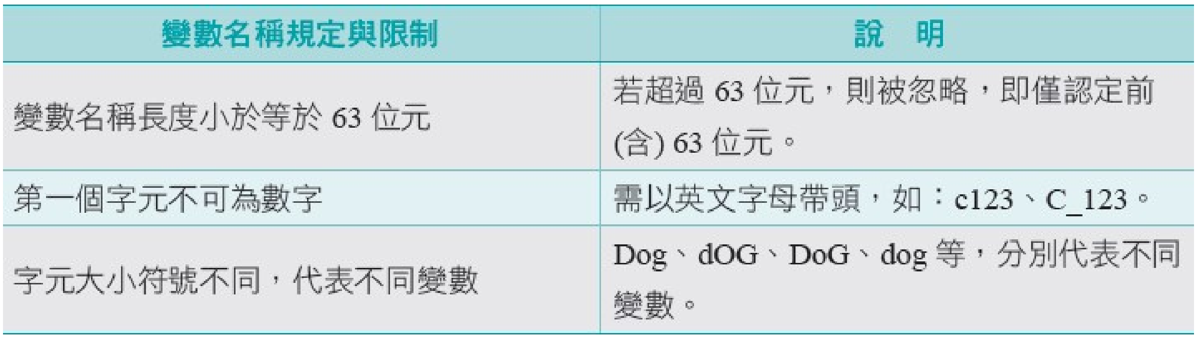
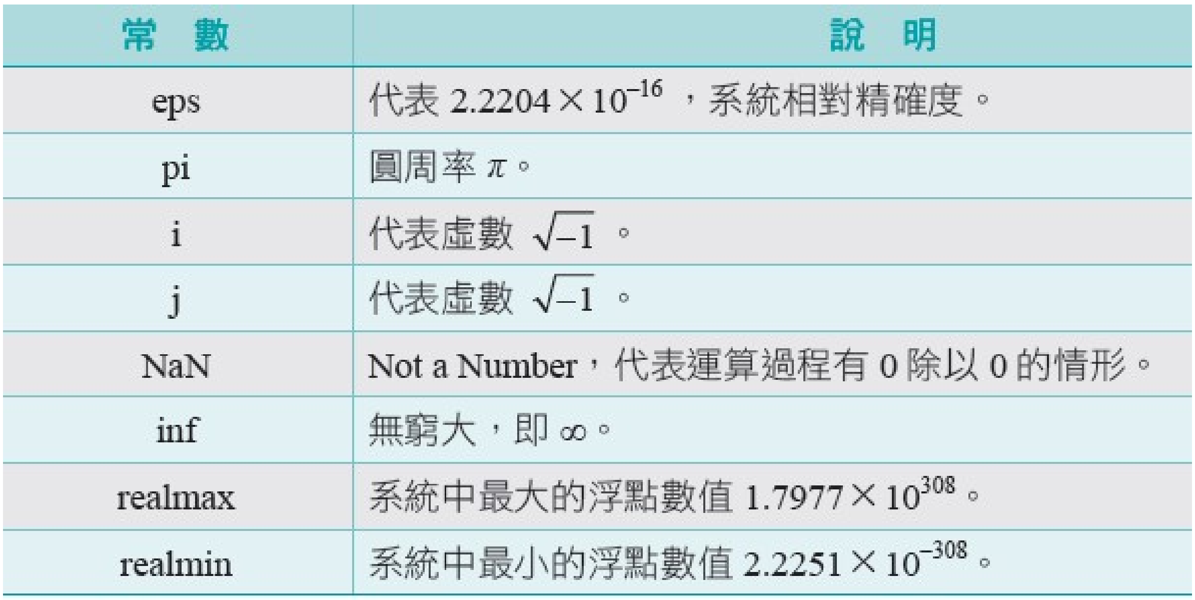
```
close all; clear all;

%% A simple example using MATLAB
load score_data % input N score

N=input('    number of student:    ');
score=zeros(2,N);

% input the name and score of the student evaluate the average score
for i=1:N
    str1= input('student name:','s');
    eval(['name',int2str(i),'=str1;']);
%     if (i==1)
%         name=str1;
%     else
%         name=char(name,str1); % Create a character array.
%     end
score(1,i)=input('math score:   ');
score(2,i)=input('english score:');
avg(i)=(score(1,i)+score(2,i))/2;% avg(i) = sum(score(:,i))/2;
end

% output value
for i=1:N
    eval(['str1=name',int2str(i),';']);
 fprintf('the average score of %s is %3.2f \n',str1,avg(i));
end
save score_data N score
```

Table 2.1 : 變數名稱限制與規定



變數名稱規定與限制	說　明
變數名稱長度小於等於 63 位元	若超過 63 位元，則被忽略，即僅認定前 (含) 63 位元。
第一個字元不可為數字	需以英文字母帶頭，如：c123、C_123。
字元大小符號不同，代表不同變數	Dog、dOG、DoG、dog 等，分別代表不同變數。

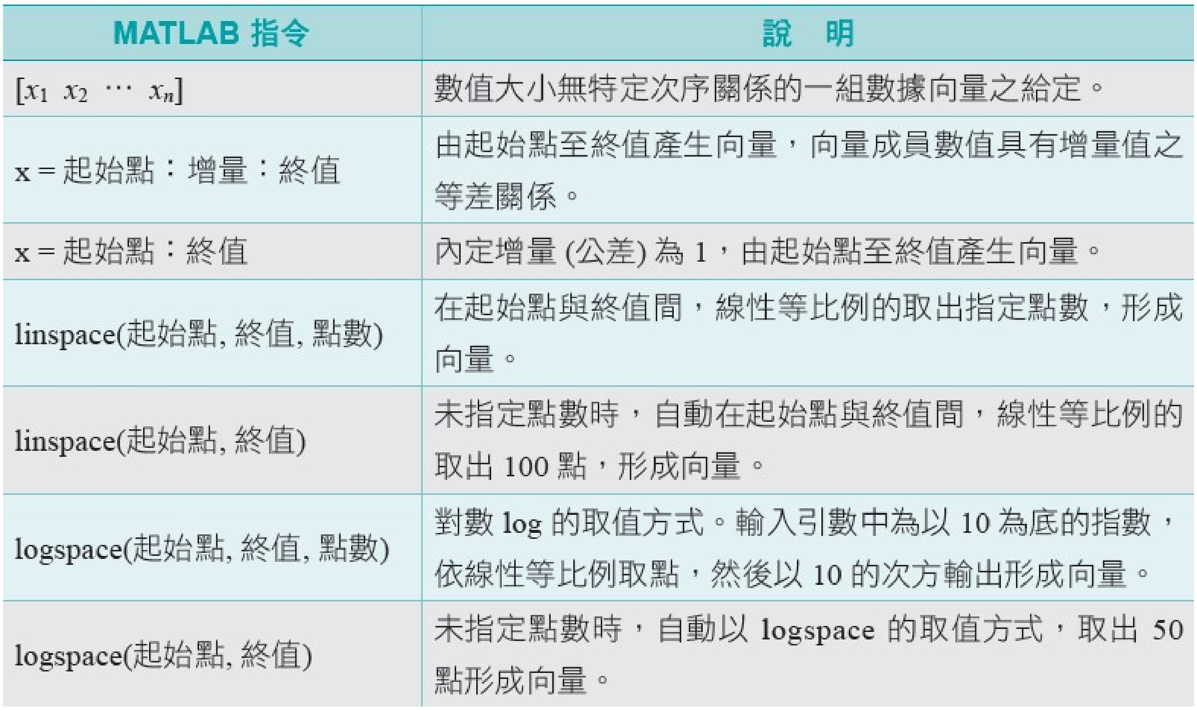
Table 2.2 : Constant symbol (Cannot be used as variable name)



常　數	說　明
eps	代表 2.2204×10^{-16}，系統相對精確度。
pi	圓周率 π。
i	代表虛數 $\sqrt{-1}$。
j	代表虛數 $\sqrt{-1}$。
NaN	Not a Number，代表運算過程有 0 除以 0 的情形。
inf	無窮大，即 ∞。
realmax	系統中最大的浮點數值 1.7977×10^{308}。
realmin	系統中最小的浮點數值 2.2251×10^{-308}。

```
%% prog 2.3-1   Variable stored as array
% Array (scalar, vector, matrix0 in matlab
% vectors, and matrices...

```

Table 2.3 (I) : Intialize row vector



MATLAB 指令	說　明
[x_1 x_2 ⋯ x_n]	數值大小無特定次序關係的一組數據向量之給定。
x = 起始點：增量：終值	由起始點至終值產生向量，向量成員數值具有增量值之等差關係。
x = 起始點：終值	內定增量 (公差) 為 1，由起始點至終值產生向量。
linspace(起始點, 終值, 點數)	在起始點與終值間，線性等比例的取出指定點數，形成向量。
linspace(起始點, 終值)	未指定點數時，自動在起始點與終值間，線性等比例的取出 100 點，形成向量。
logspace(起始點, 終值, 點數)	對數 log 的取值方式。輸入引數中為以 10 為底的指數，依線性等比例取點，然後以 10 的次方輸出形成向量。
logspace(起始點, 終值)	未指定點數時，自動以 logspace 的取值方式，取出 50 點形成向量。

```
N   = 5             % a scalar
v   = [1 0 0]           % a row vector
v   = [1;2;3]           % a column vector
v   = v'                % transpose a vector (row to column or column to row)
v   = [1:.5:3]          % a vector in a specified range:
v   = pi*[-4:4]/4           %   [start:stepsize:end]
v   = []                % empty vector
```

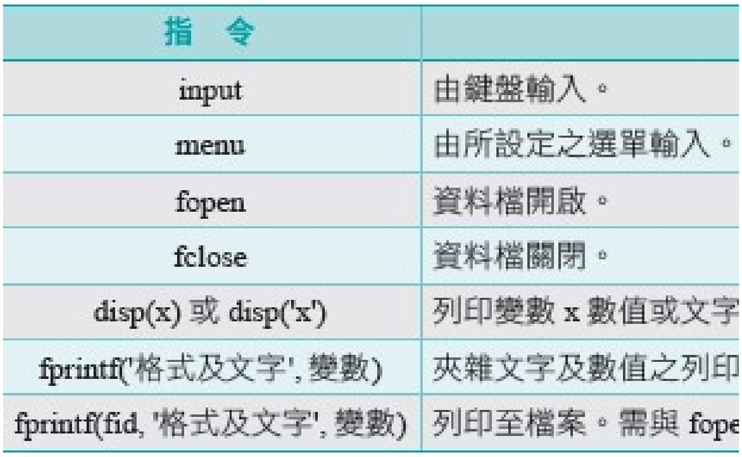
```


m   = [1 2 3; 4 5 6]        % a matrix: 1ST parameter is ROWS, 2ND parameter is COLS
m   = zeros(2,3)            % a matrix of zeros
v   = ones(1,3)             % a matrix of ones
m   = eye(3)            % identity matrix
v   = rand(3,1)         % rand matrix (see also randn)
save matrix_data m      % save the variable m to a file named matrix_data.mat

clear all               % clear all variables currently used by MATLAB

load matrix_data            % read data from the saved file
m                           % display it - it is still there!

v   = [1 2 3];          % access a vector element
length(v)               % length of a vector
v(2:3)                  %   vector(number)


% 2.3.5 subscripts
a=[ 1 2 3 4 5 6 7 8];
a(2:6)
a(2:2:6)

m   = [1 2 3; 4 5 6;7 8 9]
m(1,3)                  % access a matrix element
                    %   matrix(rownumber, columnnumber)
m(2,:)                  % access a matrix row (2nd row)
m(:,1)                  % access a matrix column (1st row)


size(m)                 % size of a matrix
size(m,1)               % number rows
size(m,2)               % number of columns


% to chane the value by finding the subscript

[i j]=find(m>=3);
disp([i j]);

pp=find(m>=3);
m(pp)=0


m1  = zeros(size(m))        % create a new matrix with size of m

who                 % list of variables
```

```
whos                    % list/size/type of variables

%% chap2.5-1  Array operations
% (A) Pointwise (element by element) Operations:

% addition of vectors/matrices and multiplication by a scalar
% are done "element by element"
a   = [1 2 3 4];            % vector
2 * a                   % scalar multiplication
a / 4                   % scalar multiplication
b   = [5 6 7 8];            % vector
a + b                   % pointwise vector addition
a - b                   % pointwise vector addition
a .^ 2                  % pointise vector squaring (note .)
a .* b                  % pointwise vector multiply (note .)
a ./ b                  % pointwise vector multiply (note .)

log( [1 2 3 4] )            % pointwise arithmetic operation
round( [1.5 2; 2.2 3.1] )       % pointwise arithmetic operation
110
111
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% (B) Vector Operations (no for loops needed)
% Built-in matlab functions operate on vectors, if a matrix is given,
% then the function operates on each column of the matrix

a   = [1 4 6 3]         % vector
sum(a)                  % sum of vector elements
mean(a)                 % mean of vector elements
var(a)                  % variance (sigma^{2})
std(a)                  % standard deviation (sigma)
max(a)                  % maximum


a   = [1 2 3; 4 5 6]        % matrix
mean(a)                         % mean of each column
max(a)                          % max of each column
max(max(a))                 % to obtain max of matrix
max(a(:))                   % another way to obtain max of matrix


xx = linspace(0, pi/2, 10)

yy = logspace(0, 2, 10)
% ddy=diff(yy);
% yy1=yy(1:end-1+ddy./2);
% figure(1);plot(yy1,ddy)

%%%%%%%%%%%%%%%%%%%%%%%%
% (C) Matrix Operations:

[1 2 3] * [4 5 6]'              % row vector 1x3 times column vector 3x1
                                % results in single number, also
                            % known as dot product or inner product

[1 2 3]' * [4 5 6]              % column vector 3x1 times row vector 1x3
                                % results in 3x3 matrix, also
                                % known as outer product

a   = rand(3,2)         % 3x2 matrix
b   = rand(2,4)         % 2x4 matrix
c   = a * b             % 3x4 matrix

a   = [1 2; 3 4; 5 6]       % 3 x 2 matrix
b   = [5 6 7];          % 3 x 1 vector
b * a                   % matrix multiply
a' * b'                 % matrix multiply

%%
%(D) Saving your work

save mysession                  % creates session.mat with all variables
save mysession a b              % save only variables a and b


clear a b                       % clear variables a and b
clear all               % clear all variables

load mysession              % load session
a
b


%%  Prog 2.6 format , disp statement

format long % (1) short e ; (2) bank (3) compact
x=[ 1e3 1 1e-4]

%   2.7-1  p. 58 square roots with newton's method
a = 2;
```

```
% a=input('input a number for the computation:');
x = a/2;
% display a variable
disp(['The approach to sqrt(a) for a =', num2str(a)]) % an str variable
for i = 1:6
x = (x + a / x) / 2;
disp( x )
end
disp( 'Matlab''s value: ' )
disp( sqrt(a) )

aa=[1:4]   % row vector
bb=[5:8]
disp([aa' bb']) % a matrix variable of 4*2 matrix

aa=[-pi:0.25*pi:pi]
disp([ aa' sin(aa)'] ) % math. expression

format

```

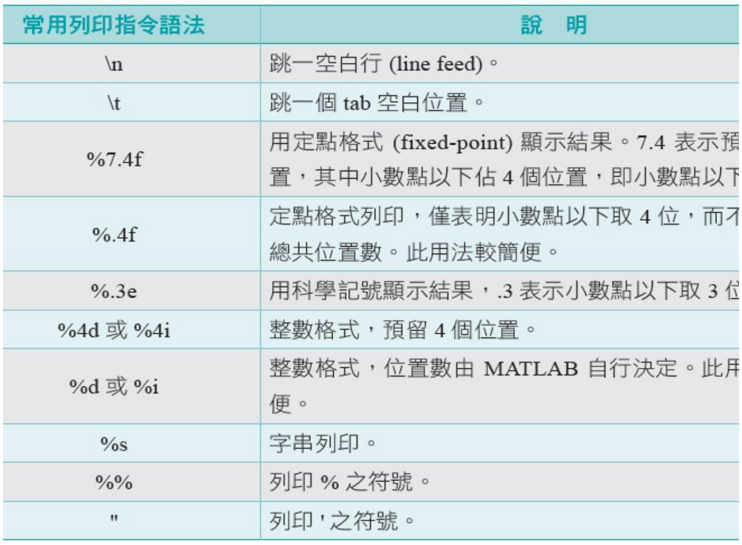
Table 2.6: (Common Input-Output functions)

```
A1 = [9.9, 9900];
A2 = [8.8,  7.7 ; ...
      8800, 7700];
formatSpec = 'X is %4.2f meters or %8.3f mm\n';
fprintf(formatSpec,A1,A2)
```



指　令	
input	由鍵盤輸入。
menu	由所設定之選單輸入。
fopen	資料檔開啟。
fclose	資料檔關閉。
disp(x) 或 disp('x')	列印變數 x 數值或文字
fprintf('格式及文字', 變數)	夾雜文字及數值之列印
fprintf(fid, '格式及文字', 變數)	列印至檔案。需與 fope

fprintf format



常用列印指令語法	說　明
\n	跳一空白行 (line feed)。
\t	跳一個 tab 空白位置。
%7.4f	用定點格式 (fixed-point) 顯示結果。7.4 表示預 置，其中小數點以下佔 4 個位置，即小數點以下
%.4f	定點格式列印，僅表明小數點以下取 4 位，而不 總共位置數。此用法較簡便。
%.3e	用科學記號顯示結果，.3 表示小數點以下取 3 位
%4d 或 %4i	整數格式，預留 4 個位置。
%d 或 %i	整數格式，位置數由 MATLAB 自行決定。此用 便。
%s	字串列印。
%%	列印 % 之符號。
''	列印 ' 之符號。

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% 2.7 Prog 2.7-1 Repeating with for statements

% Example: given a vector v, create a new vector with values equal to
% v if they are greater than 0, and equal to 0 if they less than or
% equal to 0.


v    = [3 5 -2 5 -1 0];       % 1: FOR LOOPS
%  initialize; generate zero matrix with same dimension
u    = zeros( size(v) );
for i = 1:length(v)
    disp([i v(i)]);   % i=1 then [i v(i)]=[ 1 3 ]
    if( v(i) > 0 )
        u(i) = v(i);
    end
end
u

v    = [3 5 -2 5 -1 0]        % 2: NO FOR LOOPS
u2   = zeros( size(v) );      % initialize
ind = find( v>0 )             % index into >0 elements
u2(ind) = v( ind )

%% Exercise For loop  p.78 translate between Celsius and Fahrenheit
```

```

% input
%   the initial value of the temperture in degree C : 20
%   the final value of the temperture in degree C : 30
%   the step of the temperture in degree C f: 2

% output using fprintf
%    Celsius 20.00 Fahrenheit 68.00
%    Celsius 22.00 Fahrenheit 71.60
%    Celsius 24.00 Fahrenheit 75.20
%    Celsius 26.00 Fahrenheit 78.80
%    Celsius 28.00 Fahrenheit 82.40
%    Celsius 30.00 Fahrenheit 86.00


%%=============================================================================
Avoid "for" loops by vectorizing
%%=============================================================================

t0 = clock;
s = 0;
for n = 1:100000
s = s + n;
end
etime(clock, t0)

t0 = clock;
n = 1:100000;
s = sum( n );
etime(clock, t0)

%%=============================================================================
%%=============================================================================
% pp. 62   :  sum(1/n^2) for n=1:100000
tic
s = 0;
for n = 1:100000
s = s + 1/n^2;
end
toc

% n is a vector
tic
n = 1:100000;
s = sum( 1./n.^2 );
```

```
toc


%%=========================================================================
%%=========================================================================

% p.63
sign = -1;
s = 0;
for n = 1:9999
sign = -sign;
s = s + sign / n;
end
display(s);

% n is a vector
n = 1:2:9999;
s = sum( 1./n - 1./(n+1) )

%% Exercise

% input the number of the student
clear all;close all;
N=input('   number of student:   ');
score=zeros(2,N);
% input the name and score of the student evaluate the average score
MAXN=10;
name=zeros(MAXN,10);
for i=1:N
name(i,:)= input('student name:','s');
score(1,i)=input('math score:   ');
score(2,i)=input('english score:   ');
avg(i)=(score(1,i)+score(2,i))/2;% avg(i) = sum(score(:,i))/2;
end
% output value
for i=1:N
 fprintf('the average score of %s is %3.2f \n',name(i,:),avg(i));
end


%%=========================================================================
% 2.8.2 p. 66 if-lese statement
%%=========================================================================
% Relational operations p.65 table 2,4
x= (3>2)
```

```
x= (2>3)
x= (3==3)

bal = 10000 * rand;
if bal < 5000 % relational
    rate = 0.09;
else
    rate = 0.12;
end
newbal = bal + rate * bal;
disp( 'New balance after interest compounded is:')
format bank
disp( newbal )


%%=========================================================================
% 2.8.4 p. 67 elseif  statement
%%=========================================================================


bal = 15000 * rand;
if bal < 5000
    rate = 0.09;
elseif bal < 10000
    rate = 0.12;
else
    rate = 0.15;
end
newbal = bal + rate * bal;
format bank
disp( 'New balance is:' )
disp( newbal )




%%=========================================================================
% multiple logical condition
%%=========================================================================
bal=7000;
rate=0;
if ((5000 < bal) & (bal< 10000)) % if 5000 < bal < 10000(wrong)
rate = 0.12;
end
newbal = bal + rate * bal;
```

```
format bank
disp( 'New balance is:' )
disp( newbal )



%%====================================================================
% 2.8.9 p. 71 switsh elseif  statement
%%====================================================================

d = floor(3*rand) + 1
switch d
case 1
disp('That''s a 1!' );
case 2
disp( 'That''s a 2!');
otherwise
disp( 'Must be 3!');
end



d = floor(10*rand);
switch d
case {2, 4, 6, 8}
disp( 'Even' );
case {1, 3, 5, 7, 9}
disp( 'Odd' );
otherwise
disp( 'Zero' );
end

%% Exercise
% (1) score case.
% (2) Hw. 1
% (3) To write the code for the root of quadratic equation in p. 94
%%====================================================================
% complex number p. 72
%%====================================================================

i=sqrt(-1);
circle = exp( 2*i*[1:360]*pi/360 );
figure, plot(circle)
% axis([-1 1 -2 2])
axis('equal')
axis([-2 2 -2 2])

a=3;
b=5;
a=[a b];
b=a(1);
a(1)=[]
%%==========================================================================
%%==========================================================================

a = [1+i 2+2i; 3+3i 4+4i]
a'
a.'


%%==========================================================================
%%==========================================================================
tic
k=1:40000;
s=sum(1./k.^2);
disp(sqrt(6*s))
toc


clc;clear;close all

money=50;%%本金
newBalance = zeros(1,12);

for k=1:12 %% 月份
   money = money *1.01;%%本金加利息
    newBalance(k)=money;%%每月存款結算
    money=money+50;%%每月定存
end

display(['Month' ' New Balance']);
display(num2str([ (1:12)' newBalance' ]));


%% Exercise answer
close all;clear all;

aa = floor(100*rand(20,1)) + 1
for i=1:length(aa)
    bb(i)='n';
    if (aa (i) >= 60)
        bb(i)='p';
    end
    disp([ '       ' num2str(aa(i)) '    ' bb(i) ]);
end



```