# Octave Matrices

Zeros → Zeros Array

Ones → Ones Array

Eye → Identity Matrix

Repmat → Replicate and tile array

rand → Uniformly distributed random numbers

randn → Normally distributed random numbers

→ The function rand produces a matrix of numbers from the uniform distribution over the interval [0,1]. For this distribution the proportion of numbers in an interval [a, b] with;

$0 < a < b < 1$ is $b-a$.

Note: If numbers are specified with a plus or minus sign take care not to leave a space after the sign, else MATLAB will interpret the sign as an addition or subtraction operator. Ex:

```
>> v=[-1 2 -3 4]
v=
  -1  2  -3  4
```

Correct ✓

```
>> v=[-1, 2 - 3 4]
v=
  -1  -1  4
```

$2 - 3 = -1$

Not correct ✓
→ Matlab will subtract these numbers

```
>> v=[-1,2,-3,4]
v =
  -1  2  -3  4
```

Also correct ✓ 'cuz we used comma(,)

• Matrices can be constructed in block form with B defined by B = [1 2;3 4],

we may create

```
>> C = [B, zeros(2); ones(2) eye(2)]
```

$$C = \begin{bmatrix} 1 & 2 & 0 & 0 \\ 3 & 4 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 \end{bmatrix}$$

• Block diagonal matrices can be defined using the function blkdiag, which is easier than using the square bracket notation. Ex:

```
>> A = blkdiag(2* eye(2), ones(2))
```

A =

```
2 0 0 0
0 2 0 0
0 0 1 1
0 0 1 1
```

• Useful for constructing "tiled" block matrices is repmat: repmat(A,m,n) creates a block m-by-n matrix in which each block is a copy of A. If m is omitted, it defaults to n. Ex:

```
>> A= repmat (eye(2),2)
```

A=

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

# Subscripting and the colon Notation

- For integers i and j, i:j denotes the row vector of integers from i to j (in steps of 1). A nonunit step (or stride) s is specified as i:s:j. This notation is valid even for non integer i, j and s. Ex;

```
>>1:5
ans=
    1 2 3 4 5
>> 4:-1:-2
ans=
    4 3 2 1 0 1 -2
>> 0:.75:3
ans=
    0  0.7500  1.5000  2.2500  3.000
```

- As a special case, a lone colon as the row or column specifier covers all entries in that row or column; thus A(:,j) is the jth column of A and A(i,:) the ith row.
- The keyword end used in this context denotes the last index in specified dimension like;

A(end,:), A(:,end)

```
>>A=[2,3,5;7,11,13;17,19,23]
 A=
    2 3 5
    7 11 13
    17 19 23
>>A(end:-1:1, end
ans= 23
     13
     5
>>A([1 3],[2 3])
   3 5
   19 23
```

2
7
11
⋮
23

>>A=zeros(3);
A(:)=primes(23);

A= 2 3 5
7 11 13
17 19 23

>>A=ones(3);
A(2:3,2:3)=0

1 1 1
1 0 0
1 0 0

- linspace(a,b,n) generates n equally spaced points between a and b. If n is omitted it defaults to 100,

>>linspace(-1,1,9)
ans=
-1 -0.75 -0.5 -0.25 0 0.25 0.5 0.75 1

- The notation [] denotes an empty, 0-by-0 matrix. Assigning [] to a row or column is one way to delete that row or column from a matrix.

>>A(2,:)=[]

A= 2 3 5
17 19 23

Matrix and Array operation

$a/b \to \frac{a}{b}$ ✓

$a\backslash b \to \frac{b}{a}$

$A=\begin{bmatrix}1&2\\3&4\end{bmatrix}$

$\begin{bmatrix}1&2\\3&4\end{bmatrix}\begin{bmatrix}1&2\\3&4\end{bmatrix}\begin{bmatrix}7&10\\15&22\end{bmatrix}$

>>A=[1,2;3,4];

>>A^2, A.^2

$ans=\begin{bmatrix}7&10\\15&22\end{bmatrix}, \begin{bmatrix}1&4\\9&16\end{bmatrix}$

>>x=[1,2,3];y=[2,3,4]; z=[1,2;3,4];

>>x.^y

ans= 1 8 81

>>2.^x

ans=2 4 8

>>2.^z

$ans=\begin{bmatrix}2&4\\8&16\end{bmatrix}$

Anonym functions

```
>> f = @(x) (sin(x));
>> f(1)
ans = 0.8415
```

Subfunctions

- A function M-file may contain other functions, called subfunctions, which appear in any order after the main (or primary) function.

Nargin: number of input arguments. * EXAM

Ex

```
a(1,2) , nargin=2
a(1,2,3) , nargin=3
```

Nargout: Number of output arguments

Varargin: Variable argument list

Varargout: Variable output argument list

strcat

```
>> strcat('Hello', ' world')
ans = Hello world
>> strcat('Hello ', 'world')
ans = Helloworld
```

strcmp

```
>> strcmp('Merhaba', 'merhaba')
ans = 0
>> strcmpi('Merhaba', 'merhaba')
ans = 1
```

Ex

```
'Matlab6' == 'Matlab7'
ans = 1 1 1 1 1 1 0
```

find str

```
>> findstr('abacad', 'a')
ans = 1 3 5
```

strmatch

```
>> strmatch("apple", "apple juice")
ans = 1
```

strncmp

```
>> strncmp("abc", "abd", 3)
ans = 1
```

Cell array (Hücre dizisi) (Page 270)

```
>> xc = {'Chemistry', 'Physics'}

xc =
{
   [1,1] = Chemistry
   [1,2] = Physics
}
>> xc{1}
ans = Chemistry
>> xc{2}
ans = Physics
>> xc1 = xc(1)
xc1 =
{
 [1,1] = Chemistry
}
>> xcp1 = xc{1}
xcp1 = Chemistry
>> whos
  Name     Class
  xc1  --> cell
  xcp1 --> char
```

Graphics (Page 85)

- plot3(x, y, z)
- mesh (x, y, z)
- surf (x, y, z)
- meshgrid (x, y)

mesh and surf: no need to order between these parametres

Mid EXAM: 1-2-3-4-5-6-7-8-10-18

Matrix Manipulation

- The reshape function changes the dimensions of a matrix; reshape(A,m,n) produces an m-by-n matrix whose elements are taken columnwise from A. For example:

```
>> A=[1 4 9;16 25 36], B=reshape(A,3,2)
A =
    1  4  9
   16 25 36

B= 1  25
   16  9
   4  36
```

| | |
|---|---|
| reshape | Change size |
| diag | Diagonal matrices and diagonals of Matrix |
| blkdiag | Block diagonal matrix |
| tril | Extract lower triangular part |
| triu | Extract upper triangular part |
| fliplr | Flip matrix in left/right direction |
| flipud | Flip matrix in up/down direction |
| rot90 | Rotate matrix 90 degrees |

- The function diag deals with the diagonals of a matrix and can take a vector or a matrix as argument. For a vector x, diag(x) is the diagonal matrix with main diagonal x:

```
>>diag([1 2 3])
ans= 1 0 0
     0 2 0
     0 0 3
```

- More generally, diag(x,k) puts x on the kth diagonal

Data Analysis

```
>> x=[4,-8,-2,1,0]
x=
   4 -8 -2 1 0
>>[min(x), max(x)]
ans= -8 4
>> sort(x)
ans: -8 -2 0 1 4
```

CamScanner ile tarandı

Chapter 9 - Lineer Algebra

9.1. Norms and condition numbers

Ex//

```
>>A=[1 2 3; 4 5 6; 7 8 9]

A= 1 2 3
   4 5 6
   7 8 9

>>[norm(A,1) norm(A,2) norm(A,inf) norm(A,'fro')]

ans=

18.0000  16.8481  24.0000  16.8819
```

norm(A,1) = Sum of the greatest column of the our matrice

norm(A,inf) = Sum of the gratest row of the our matrice

norm(A,'fro') = Sum of the all indices and taking their squares after taking their sqrt this will be our result.

Basic Matrices

- $A*x=b$ result of $x = A\backslash b$

```
>>2*x1+3*x2=4;
>>3*x1+5*x2=5;
```

$A=\begin{bmatrix}2 & 3\\ 3 & 5\end{bmatrix}$ $x=\begin{bmatrix}x_1\\ x_2\end{bmatrix}$ $b=\begin{bmatrix}4\\ 5\end{bmatrix}$

9.2 Overdetermined System (Aşırı tanımlı sistemler)

- Equation count is more than variable number.

- pinv: pseudo inverse sözde ters, genelleştirilmiş ters, moore penrose anlamında ters
- inv(A) olması için A nxn olmalı ve det(A)!=0 olmalı
- Her matrisin pinv() değeri vardır.
- Ax=b şeklinde bir aşırı tanımlı sistem için;

$x = pinv(A)*b$

Hocanın derste yazdıkları

9.3 undetermined system ②

```
>>A=[1 1 1; 1 1 -1], b=[3; 1]
A= 1 1 1
   1 1 -1
b= 3
   1
```

ÖNEMLİ

$x_1+x_2+x_3=3$
$x_1+x_2-x_3=1$

[Equation < Variable

```
>>x=A\b; y=pinv(A)*b;
>>[x y]
   2 1
   0 1
   1 1
```

• Equation count, is less than variable count

```
>>x=pinv(A)*b
   1
   1
   1
>>x=A\b
   1
   1
   1
>>linsolve(A,b)
   1
   1
   1
```

*** Same results

11. bölümde sadece buradan finalde sorumluyuz...

11.1 Polynomials and Data filtering

```
>>v=polyval(p,x)% finds p(x)
>>roots(p) % finds roots of 'p' polynom
>>p=poly(r)
>>p=polyfit(x,y,order) : x, y noktalarını order mertebesinden en uygun şekilde modelleyen p polinomu
```

Hocanın notları...

```
>>p=[1 2 1]
p=1 2 1   % x^2+2x+1 gibi düşün
>>r=roots(p); b=poly(r)
r= -1   b= 1 2 1
   -1
```

roots ve poly birbirinin tam tersidir

>> poly([-1 -1 -1 -1])

ans =

1 4 6 4 1

>> P4=poly([-1 -1 -1 -1])

P4 =

1 4 6 4 1

>> polyval(P, 0.9)

ans= 3.6100

>> polyval(P4, 0.9)

ans= 13.032

>> x=[1 2 3]

x=1 2 3

>> y=[2 4 -1]

roots

y=

2 4 -1

>> P3=polyfit(x, y, 3) % x ve y'den geçen 3. mertebe polinom

P3 = -1.0335 2.7010 1.3816 -0.7590

>> xval=0:0.01:4; yval=polyval(P3, xval);

>> hold on; plot(xval, yval)

Chapter 12 Numerical Methods Part II

12.1 Quadrature → numerik integral hesaplar

q >> quad(fun, a, b, tol) → tolerans

>> quad(@(x) x.*log(x), 2, 4)

ans = → belirli integral soruyorsa quad ile elde edilir

6.7041

>> x=[1 2 3 4 5];

>> cumsum(x)

ans =

1 3 6 10 15 //

cumsum(x) function explained → cumulitave sum

Page 174:

~~t~~trapz: Elimde xi ve f(xi) varsa fakat f() fonksiyonu yoksa kullanılır

Sınav sorusu: Trapz verilen bir fonksiyonu quad cinsinden yaz

```
>> x=linspace(0,2*pi,10);
f=sin(x).^2./sqrt(1+cos(x).^2);
>> trapz(x,f)
ans=2.8478
```

```
function f=deneme(x)
    f=sin(x).^2./sqrt(1+cos(x).^2);
```

```
>>quad(@deneme,0,2*pi)
```

veya

```
quad('deneme',0,2*pi)
ans= 2.8478
```

dblquad: Çift katlı integral

triplequad: 3 katlı integral için

12.2 ordinary Differential Equations (ode)

12.2.1. Examples with ode45

```
function yPrime=myf(t,y)
yprime=-y-5*exp(-t)*sin(5*t);
```

and then type;

```
tspan=[0 3];yzero=1;
[t,y]=ode45(@myf,tspan,yzero);
plot(t,y,'*--')
xlabel t, ylabel y(t)
```

Chapter 19. Symbolic Toolbox s.277 (5)

- syms komutu sembolik değişken oluşturur
- d=sym('d')
- syms ile tek veya daha çok oluşturabiliriz
- solve: denklem çözme

Ör:
$ax^2+bx+c$ =0'a x'e göre çöz
```
>>y=solve(a*x^2+b*x+c, x)
>>y=solve(a*x^2+b*x+c, b)
```
- simplify

x^2+2x+1 } 1-2+1=0
y1=-1, y2=-1
```
>>cevap=a.*y.^2+b*y+c;
>>simplify(cevap)
= [0]
  [ ]
  [0]
>>a=1; b=-1; c=-1;
>>subs(y) => yerine koymak demek
```
subs() => substitute (bilinen nümerik değerleri yerine koy)

19.2 Calculus sayfa

int: sembolik integral
```
>>int(f(x),x)
>>int(x,x)
```
diff: sembolik diferansiyel
- Nümerik değer gönderirsek diff yine çalışır.
```
>>diff([1 2 3])
```
2-1=1, 3-2=1
ans= 1 1
```
>>syms x; diff(x^2)
  ans = 2*x
```
Nümerik işlemler için ODE45 vb.
```
syms a x n
diff(x^2); diff(x^n,3)
```
factor()
```
a =x^2-2*x+1
factor(a)
 2
(x-1)
```
CamScanner ile tarandı

6)

diff(diff(f,x),y)

dsolve() → dif solver

ex/

```
>>syms b c v t;
>>syms y(x);
>>DE=diff(y,x)-4*y==0;
>>sol=dsolve(DE);
```

---

13.12.2021 Answers

Soru 1) a) A, B, C polinomlarını elde ediniz.

A=[1 0 0 3 7 4]   C=[

B=[1 0]

C=polyfit([0,5 10 15],[3 8 -2 9],3)

b) A, B, C polinomlarının x=3 için elde edilen değerleri yA, yB ve yC'ye ata

yA=polyval(A,3)

yB=polyval(B,3)

yC=polyval(C,3)

c) f(x)=0 sağlayan x değerini Matlab komutlarıyla elde et.

roots(A), roots(B), roots(C)

D) B=[zeros(1, length(A)-length(B)) B]

0 0 0 0 2 3 2 3

D=A+B //

Soru 2) S bas katrisini elde et.

n=4

S1=sparse([n:1],[n:1],[n:-1:1],n,n)

S2=sparse([n:n-1],[2:n],[-2:-2:-2,n+2],n,n]

S=S1+S2 //

Soru 3)

X= özel matris(S) durumunda olursa X matrisini elde et.

Soru 4)

$$y=\int_0^2 \frac{1}{x^3-2x-5}\,dx$$ integral işleminin nümerik olarak yapılması istenmektedir.

a) Fonksiyon dosyası yazarak ve komut satırından bu fonksiyonu kullanarak çöz.

quad(@(x) 1./x.^3-2.*x-5, 0, 2)

Ya da;

function y=f(x)
x=1./x.^3-2.*x-5

end

>> quad(f, 0, 2)

Soru 5)

Veriler fonksiyonu çiz (dakika: 1:20:16)

x=linspace(-5,5,100);
y=linspace(-12,12,200);
[x,y]=meshgrid(x,y);
z=y.*sin(x)-x.*cos(y);
title('f(x,y)=y*sin(x)-x*cos(y)')
xlabel('x değeri')
ylabel('y değeri')
zlabel('z değeri')

Soru 6)

Denklemi sembolik olarak çöz

$2x-3y+4z=5$

$y+4z+x=10$

$-2z+3x+4y=0$

>> syms x y z;
>> d1=2*x-3*y+4*z-5;
>> d2=y+4*z+x-10;
>> d3=-2*z+3*x+4*y;
>> solve(d1,d2,d3);

8

8/ $A=[0,1; -2,-1]$, $B=[0,0;0\ 1]$ ve $C=[1, 1]$ ise, $\dot{x} = Ax+Bu$ , $y=Cx$ simulasyon blok diyagramını çiz.

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0 & 0\\ 0 & 1\end{bmatrix}.u$$

$$y=\begin{bmatrix}1 & 1\end{bmatrix}.\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$

$\dot{x}_1 = x_2$ , $\dot{x}_2 = -2x_1 - x_2 + u$ , $y = x_1 + x_2$