

Šî ˇ Ĥä:äi: / ˘ œ

;ĩ; ĥĩt ĥkr ĥòót ĥksrk

" | Æ Œ " Û ù " Û ù , xä ˇ Ā Ĩ ; Ó Ò ã ħ ħ
) Š Ũ ĩ ¾ Ĥ " ä Œ Œ



MATLAB آموزش نرم افزار

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😊 An easy way to learn MATLAB is to sit down at a computer and follow along with the examples given in this tutorial.

😊 MATrix LABoratory = MATLAB



) äy | ~ iöÀ à Öyá'ÜQ â ~ x YËâ x | 😊

Ú šŮyşxBrowse ˘xâ ˘yfi lâx; â l'ÔĀ ˘yšx 😊

) šŮyşxMake New Folder â l'ÔĀ ˘x`||

ÖyĀ. lâx; ˘ â ˘yfi lâx; Öyá'ÜQ â xfx â x | 😊

) š; ˘xÁ

lâx; Set Path ŬĀÊ˘xí àö â ŬŎ˘ ˘ šŮĀÓ 😊

) šŮyşxMatlab ˘ă ÓÛ ˘ Öyá'ÜQ



دانشگاه یزد

preferences

)/

Java

Matlab

Java Matlab

... interpreted

)/



i àf y ä\$à)¥ , xautocomplete Öÿ Òà 😊
 ~Û\$; ÖÛäÓtab `äÃxÜy\$ xÚ~Û\$; ~xä\$Ô Á
);ÛÛ ÖÛz y\$Öx ~±Ö~ÛÓ
 Ú Script ©ã¬ Ú Û Öÿ Òà ~; x̃ ¼ÛF 😊
)¥ aÛÛÖÛäÓFunction

edit test1.m



– ä|f â x| ÖÜäÓ Function ¹ ..Òâú ˘x ☺
);-ÄÛy\$ x¹/4f help
 Üf\$ Í .x. Script ~; Üª – ä|f â y ă\$ ☺
 â y ă\$ äâÚ `ŠÝ ä, -\$; Í |Á Matlab
 yää, -\$; Í |Á Matlab Üf\$ Í .x. Function
)`Š ãf



MATLAB 7.7.0 (R2008b)

File Edit Debug Parallel Desktop Window Help

Current Directory: C:\Acads\CSE455

Shortcuts How to Add What's New

Current Directory

C:\Acads\CSE455

Name	Date Modified
CSE 455.pptx	1/3/10 2:04 PM
~\$CSE 455.pptx	1/3/10 2:00 PM

CSE 455.pptx 1/3/10 2:04 PM

~\$CSE 455.pptx 1/3/10 2:00 PM

Command Window

fx >> |

Workspace

Stack Base

Name	Value	Min
------	-------	-----

Workspace

Files in current directory

Command Prompt

Command History

Command History

1/3/10 2:06 PM

```
cd ..
```

```
ls
```

```
cd ..
```

```
ls
```

```
cd Acads
```

```
ls
```

```
cd CSE455
```

```
clear
```

```
clrscr 9/12/2018
```



)ŠyãÓx̄| / ~û ùý ¤óxòì - Õòà~; 😊

`äÄö ; àf~x" €¥ , xäöÄÛ§ ; -Ý â x̄fxâ x̄| 😊

)û Ü Enter

ÿ ù ÚÄ¥ Ó ÷ ÿ - ¤óâ - µ â ý x̄| - ä!fâ x̄| 😊

)ûäÓ- ä!föí .x̄.çx̄→xò§ ÛÛÛ | Ú

a = [1 2 3 4 5]



دانشگاه یزد

~xÖxÛäÓâ~μ ~x̄ | Ààâ yÛe-Ö; Åxfiâx | 😊
)i- ÅÛy\$ x' ãÛÓÅ

a = [1, 2, 3, 4, 5]

~xÖxÛäÓâ~μ ~x̄ | Ààâ yÛe-Ö; Åxfiâx | 😊
)i- ÅÛy\$ x' ãÛpÿÓÅ

a = [1 2, 3 4, 5]



xcase-sensitive ~xđì -Ōòà😊
)Ōξ³ -đÑÝψζ~|® -, ψ-đ\$ŌÚÀ#Ū® -, ψ

a = [1 2 3]

A

??? Undefined function or variable 'A'.



دانشگاه یزد

â Û Æ Ñ ã x Æ Ö Ö Û Å Ô ~ Û § ç À à â y Æ ~ ç - Ê ☺
 / y Æ Ñ ã x Æ Ö Ö Û Å Ô - Ê ä Î Ú ç Æ ã Ó Û à / y ç y Ó
) ; Æ ã Ö Û à / y ç y Ó ä Æ ã Î Ú ç Æ ã Ó y

>> a = 2+3-5

a =

0

>> a = 2+3-5;

>>



دانشگاه یزد

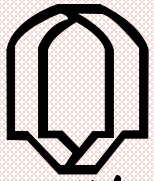
ÖÛäÓEnter Ö; γ " äfóÀà – ä|f â x| ☺
) ; Å ð ñ Ñ Ý ~ x x̃ ỹ μ

a = [1 2 3

4 5 6

7 8 9]

μ Ú^a À à ~ x " äfó Ú ~ x̃ | " Å š x ` š Æ Á; ☺
) ; Û ä Ó



دانشگاه یزد

Í Ô ã ì ð ù ç ð ã x Ü Ú „ Ó À à – ã | f â x | ☺
); Û ã Ó

$$e = 1:5$$

$$p = 1:2:10$$

$$q = 10:0$$

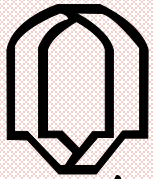
$$e = 100:-10:50$$



Ö; ÅCE%óγ " äfóûe ÀàÛ ä, -§; â x | 😊
) ; Åxä, -§; ûe-Öl Û Öxãóöû\$ Úµ

$t = g(2, 3)$

˘x`Šãõóöyãlõ ùÄäà\$ xâ y'óõ ~; 5Åf 😊
) ; ùãóµ .yã' -ÿ Ú Šãóüy\$ xù ÚÄ



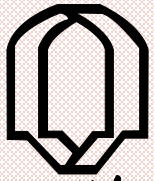
دانشگاه یزد

Àâ ~xÊ Åšx" ãfó-Àä, -ş; âx| ☺
 äŒ / ~û ù" Åš);-ÄÿşxÖÛãó ãâ`||
);ûãóÛô

t = g(7)

ÿsxlÿçÖxÿ`aÿùÛó Õx«ÿ.." Åš-Ê ☺
);ûãôî ðxùÛó

t = g(4,1)



دانشگاه یزد

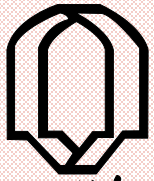
ÖÛ\$ ì yôf yâ-µ ì yôf z yôâ x | 5¥ Ó÷-x 😊
) :ûãóÿ\$ x

$$c = a(:, 3)$$

$$b = a(1:3, 3)$$

$$r = a(2, :)$$

$$t = a(1:2, 1:3)$$



دانشگاه یزد

Üyşxcclc ~Û\$; ~xÆ àõã Ù× Ö; ÅÄyçâ x| ☺
);ÛäÓ

ÜÖÝ Ù clear ~Û\$; ~x-ã\$À àÖ; Å® ^, â x| ☺
);ÛäÓÜyşxy'ã\$à-ã\$î y

clear all ~Û\$; ~x y'ã\$â ÙÖ® ^, â x| ☺
);ÛäÓÜyşx



/ xÛ\$; ÖÛäÓÒàçÚí y â yô ÿñâ y' äÅ~x 😊
);~Ú x äi}ÁÚâ `|

` äÄ äÄ History ¥ Ô Á~; ~Û\$; Ààâ Ú | -Ê 😊
);ÛäÓx̄fx̄ fÓÛ\$; Ò

ä}Äf` äÅ~xÖÛäÓÒàçÚí Ààâ x̄fx̄ - ÁÛf â x̄| 😊
Ûy\$ XCTRL+BREAK ~xy' fÄÛÄäç| ~; yÀCTRL+C
);-Å



دانشگاه یزد

)؛ûâóÿxend ~x-ãóÀ àâ yíóÿxâ x̄| 😊

g(3, 2: end)

ö ÿû ~xä°ÿ.öûÿ yà-µ ö; ÅÆ%óâ x̄| 😊
)؛ûâóÿx-ã ì-ðÿ

h = g(:, [1 3 2 4 5])



m = []

for i = 1:10

m = [m; i]

end

~; " £ Ú¥ , xäly.x\$xm " äfjÓÈyÓÒà~; ☺
)!âÖ£~|" " äfjÓÒàfor â ÙÃ

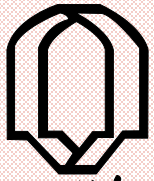


دانشگاه یزد

$5 \sim x \cup y \times y \sim x \mid \text{À} \text{à} \Psi \text{''} \text{ã} \text{f} \text{Ó} \text{À} \text{à} \text{í} \text{à} \text{f} \text{â} \text{x} \mid \text{😊}$
 $) \text{x} \text{ì} \text{y} \text{ã} / \sim \text{û} \text{ù} \text{''} \text{ã} \text{f} \text{Ó} \text{À} \text{à} \text{í} \text{à} \text{f} \text{â} \text{x} \mid \text{😊}$

$b = a(:)$

$\sim x \text{Ú} \text{ä} \text{Ö} \text{§} / \sim \text{û} \text{ù} \text{''} \text{ã} \text{f} \text{Ó} \text{À} \text{à} \text{í} \text{à} \text{f} \text{â} \text{x} \mid \text{😊}$
 $\text{ã} \text{f} \text{y} \text{:} \text{ù} \text{) } \text{Ö} \text{§} \text{Ó} \text{x} \text{Á} \text{Ñ} \text{Ý} \text{,} \text{¥} \text{Ł} \text{ç} \text{!} \mid \text{ù} \text{È} \text{Ú} \text{x} \text{Ö} \text{§}$
 $\sim \text{; } a(i, j) \text{-} \text{ã} \text{f} \text{y} \text{:} \text{ù} \text{) } \text{Ö} \text{§} \text{Ó} \text{x} \text{Á} \text{Ñ} \text{Ý} \text{,} \text{¥} \text{Ł} \text{ç} \text{!} \mid \text{ù} \text{È} \text{Ú} \text{x} \text{Ö} \text{§}$
 $\text{; } \text{ã} \text{f} \text{y} \text{:} \text{ù} \text{) } \text{Ö} \text{§} \text{Ó} \text{x} \text{Á} \text{Ñ} \text{Ý} \text{,} \text{¥} \text{Ł} \text{ç} \text{!} \mid \text{ù} \text{È} \text{Ú} \text{x} \text{Ö} \text{§}$



دانشگاه یزد

äÖÛŴç ÷ çÛŒŒ- ä|f â ~xÂÓj Úi â x| -Ê ☺
)ªÿäÓ

clear i

Í |yÁ ÛËfi · äÖÛŴ- äŒŒ ¥ ç x -Å Û ì ỹ ☺
)¥ ç x- ä|f

ii = sqrt(-1)



â y' aóâ x| Ú¥ ¢ 1/ â ÷ ÷ â y' aóâ x| ☺
)ûãóüÿx¥ ¢,1 â -ÿyÅ

s = 'Hello World'

)`a y' ® -, ` ÷ -ÿyÅòâú- aóì yôâ x| ☺

) ãüÿxÜ`a Ú~ / yôÄx` ãä|, ☺

Ü`a Ú~ / yôÄö; Ä ÷ â x| iskeyword 1/ÿ ☺

)ûãóüÿx



دانشگاه یزد

Üyş xÖ; Å Ú ÓÜö; ÄÿjÛfâ x| ‘ ¥ Ó÷~x 😊
);ÛäÓÜyş xÿjÛfâ x| .’ ¥ Ó÷~xÚ;ÛäÓ

z.’

)¥ , xxfkí |yÁ ãranspose ~Û§ ;yÍ Ô:Òà 😊
/ yãÛf/ ~Û ÷¹ ..Ààÿ ~xöè - ÕÜÀÒàâ x| 😊
);Û Üyş x" ¥ Ó÷~x¹ ..Ö Ûñ¥ , xäöÅ ŠÿÛ



دانشگاه یزد

â yïöŷ - à í « Ó x ð ì - Õ ù à ~ ; Ù Ä ä i ° x / y ï Õ : 😊
) ; Û ä Õ ì y Õ ä ~ à Õ Õ Õ

$$c = (-2 + 2^5) / (3 * 2)$$

) a y ä Ö y x ð ì - Õ ù à " š Ÿ Ÿ Û x ð ä y ï Õ à Û 😊



دانشگاه یزد

z -ø äÃ) ; x̄ - Ë - Ú z -ø â x̄ | ~ x̄ ð Ì - Õ ò à ☺
 . * ¥ Ó ÷ γ Ú ã Õ ù - ã Õ z -ø â - Ë Ú * ä Ì Õ Ó
 Ú - μ ù ù ù γ ì Õ ÷ Á ` à ã Ì Õ Ó z -ø ~ ; ☺
)^a γ ã Õ ÷ z -ø " ã Õ ÷
 " ã Õ ÷ γ ì Õ ÷ Á ` à ã Ì Õ Ó z -ø ~ ; ☺
)^a γ â ù Ó Ñ γ



$$a = [1 \ 2; 3 \ 4];$$

$$b = [5 \ 6 \ 7; 8 \ 9 \ 10];$$

$$c = a * a$$

$$c = a .* a$$

$$c = a * b$$

)ix" YxU" .i. yã a yÖãçÖyAz -ø"Ê☺

$$c = b * a$$



دانشگاه یزد

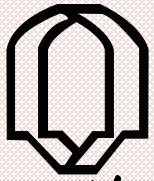
$$a = [1 \ 2 \ 3];$$

$$b = [4 \ 5 \ 6];$$

$$c = a+b;$$

$$d = a-b;$$

$$e = 2*a+3*b;$$



دانشگاه یزد

UyO` š Ÿ; ÖxãóÑã ÂfŸ ¥ , x-Å ù ì ı ☺
)ıŴŴ , x̃ È ŸıO` š

$$A * X = B$$

$$X = A \setminus B$$

$$X * A = B$$

$$X = B / A$$

)ıŸãó- äıf ä / ~Ŵ ù ¥ , x̃ ~xÑã Âf ☺

$$B / A = (A' \setminus B')'$$



Òà Ö;ψ â ~x̄ | Kxđl - ÕÒà NŃÓ äÉáÚ Àà ☺
)¥ , x̄xđl - Õ

$$t = 0:10;$$

$$x = \cos(2*t);$$

$$y = t.*\cos(t);$$



-ă ì -ð ù input ~Û\$; ~xâ ;úú¥ ðã; â x̄ | 😊
) ; ðãóü¥\$ x

t = input('Input the value of T: ')

¥ ðã; -ÛÿÅàú~x̄ | KÿÃxÖÛãÓ¥ Ìy Òà~ ; 😊
) ; -Å





۱۴ xÜ^a í ãf" ifóú Kfi ó~; ÙÀ; ÅÜÝŁÓ#Ø \$ì -ÅÈ Û~
 â-Ē ū;ŭäó' „ äó, x[®] ~yó~xöi ~; ÙÄÑ÷" ifóäã
 ū-ý òà 5ŭóđì -ÅÈ Û~) Šŭäóx̄ x̄..öi ~; ÙÅy; " ifó
 òà ū` Šäóy; ŬĒÖi) ۞, xòóâ ÙÄ ÷; Ŭóŭz ū." ifó
 ~x- f y ū- f | äö ÷ ŬĒäî ūKŠĪŬó, ~; ū` Šŭäó, ~; ŬĒ
 Ū^a α ŭ}óK; -óÑĪ; fâ x| ~Ēŭŭç[®] - ı ~xòóú` Š ý y; ŬĒ
 y ū ۞, Ŭä òäŭóúòäŭóŬĒŭ #Ø \$ì -ÅÈ Û~ " £) x
) ۞ ~ ŁÄÑ÷" ifó; öy

1/Ø K; ifiKy, 546

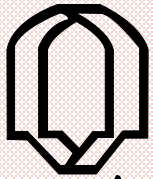


MATLAB آموزش نرم افزار

|| ~

|| ~

|| ~




دانشگاه یزد

U~x ÜÖ äoã 1/fâ ç|f Matlab ~xöì - Ö 😊
) ãÜyşx-ã ~Û§; ~xyÖ äđ!Óâ x|

help elfun


-ašöy lãÜkãoã â y'1/fâ lãÄ³ lã ~Û§; àfy 😊
) ;Ûã ÓÙkxä, ãÛ




hypot ¼ 

ä à ¼ 

Ñ Ñ ¼ 

¹ ï ï ¼ 

Ö ÿ Å ÿ Ê ¼ 



• \sqrt{x}	$\sqrt[n]{x}$
\sqrt{x}	sqrt
$\sqrt[n]{x}$	nthroot
$\text{nextpow2}(x)$	nextpow2
$\text{abs}(x)$	abs
$\text{angle}(x)$	angle
$\text{complex}(x)$	complex
$\text{imag}(x)$	image
$\text{real}(x)$	real
$\text{isreal}(x)$	isreal



دانشگاه یزد

ÙÀĩxę yí" ãfóù ßÛ ÓÙâú¼fâ çìföÿ Òà😊
)¥ , xÜÝŁÓ |Á-ă ~Û§;ç¼fÛÒà¥ `â

help elmat

"ç|yÅ çÚØ y"â yí" ãfó âÛf;ÛÓ;ç¼fÛÒà😊
)ªyãÓ



• اءف	ءف
Öy Äí °xöy"è-x' äf	linspace
Û"À ä' äf	meshgrid
-äöÀ äy x	size
-äöÀ äÈ Û	length
' "è f	ndims
°y"è f	numel
Æ äöä x	display
M ,xäy" äöä	isempty
M ,xä y' ö äöä	isequal



• æŪ	¼f
ÖŪ ‡	cat
Í Æ" æf	reshape
â µÁ	diag
ä Æ" Æ	tril
ä Æ" y	trilu
¥ , x" Ūj ‡Æ . ‡	fliplr
Ò æ" Ūj y"Æ . ‡	flipud
` "À æÈ Ū"Æ . ‡	flipdim
Ūj ; 4Æ . ‡	rot90



• $\hat{a}U$	$\frac{1}{4}U$
$\bar{x}^{\prime\prime} \hat{a}^{\prime\prime} \bar{y}^{\prime\prime} \hat{a}^{\prime\prime} \bar{x}^{\prime\prime}$	find
$\hat{O}U$	end
$\hat{a}^{\prime\prime} \hat{U}^{\prime\prime} \hat{a}^{\prime\prime} \hat{U}^{\prime\prime}$	circshift
$\hat{O}U \hat{a}^{\prime\prime}$	eps
$\hat{a}^{\prime\prime} \hat{U}^{\prime\prime} \hat{a}^{\prime\prime} \hat{U}^{\prime\prime}$	realmax
$\hat{a}^{\prime\prime} \hat{U}^{\prime\prime} \hat{a}^{\prime\prime} \hat{U}^{\prime\prime}$	realmin
$\hat{y}^{\prime\prime} \hat{U}^{\prime\prime} \hat{a}^{\prime\prime} \hat{U}^{\prime\prime}$	hadamard
$\hat{a}^{\prime\prime} \hat{U}^{\prime\prime} \hat{a}^{\prime\prime} \hat{U}^{\prime\prime}$	magic



۵۹ یازد 😊

$\rho = (1 + \sqrt{5})/2$

$a = \text{abs}(3 + 4i)$

$a = 5 * \text{ones}(3, 3)$

$z = \text{zeros}(3, 4)$

$i = \text{ones}(3)$

$n = \text{round}(10 * \text{rand}(1, 10))$



$$b = [1 \ 2; 3 \ 4]$$

$$c = [b \ b, \ b+4 \ b-1]$$

~ă ì ð ù ö û ã ó" ã ð ° ÿ ð ö ç Å® ^, â x | 😊
) : ũ ũ Ő

$$c(:,2) = []$$



```
c = [b, b; b+4 b-1]
```

```
c(1:3:4, :) = []
```

```
c(:, 1:3:4) = []
```

```
c = [b b; b+4 b-1]
```

```
c(1:2:16) = []
```

```
a = rand(3)
```

```
b = [a, zeros(3,2); zeros(2,3), eye(2)]
```



$n = (0:10)'$

$pows = [n, n.^2, 2.^n]$

$x = (1:0.1:2)'$

$logs = [x, \log_{10}(x)]$



title

grid

axis

stem

subplot

hold on

hold off



```
t = -pi:0.1:pi;  
y = cos(t);  
plot(t, y)  
z = sin(t);  
plot(t, y, t, z)  
plot(t, y, '--')  
plot(t, y, '+.')
```



plot(t, y, 's')

plot(t, y, '-g')

) ; Å Ñ ~ Ö Ü Æ Ó Ñ Ý ÿ x ä Š Š Ö Š ☺

) ; Û Õ Ñ Æ Š Ö Ü Æ Ó x ä Š Š Ö É Õ Ú Ñ ~ Þ Õ ☺

x ~ Û § ; Ò à í ó Å y æ ö k ä ~ Û § ; x ü y § x y ☺

) ; Ä ä , ~ |

help plot



دانشگاه یزد

â ħ Ő: Úä Åx ~ Ū Óâ x̄ | Öx ſ Óä ŠŠ ŌŊ ~ ˘ x ` | | ☺
) ; Åz y ŠÖ Ōx ſ : À à ä ŠŠ Óâ x̄ | Ú ħ { ˘ ſ | ä ŠŠ Ō

xlabel({'first line';'second line'})

ylabel('George's
Popularity','fontsize',12,'fontweight','b')



" ãex"ä˘ aîlôô"õxjãóã ~xê ˘ ñ|˘; ☺
);- Åÿx\$ x

xlabel("\it{\omega_N = e^{(-
 2\pii)/N}}')

);- Åâ ` \$ÿã x äššöõjãóäššõñ ~˘x`|| ☺

grid



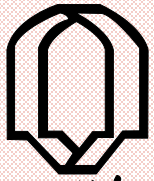
/ $\bar{x} \hat{a} f \rightarrow \tilde{O} \tilde{O} \hat{u} \hat{a} \acute{O} axis \sim \hat{u} \xi \gamma \ddot{a} \check{\check{S}} \check{N} \sim \check{x} \text{!} | \text{😊}$
 $) ; \tilde{O} \tilde{O} \hat{u} \hat{a} \acute{O} \check{x} \ddot{a} \check{\check{S}} \check{O}$

axis([-2, 2, 1, 10])

$\hat{u} \xi \check{v} \hat{E} \hat{a} \check{y} \check{x} \tilde{O} \tilde{O} \hat{u} \hat{a} \acute{O} \check{x} \sim \hat{a} \bar{x} | stem \tilde{O} \acute{O} \check{d} \check{x} \text{😊}$
 $) ; \hat{u} \hat{a} \acute{O} \check{y} \check{x}$

$y=1:10$

stem(y)



دانشگاه یزد

äššó`š öyóñý Ñ ~ â x| subplot öyóð`x 😊
) ; Åüyş xÖtËó

```
t = 1:10;
```

```
z = cos(t)
```

```
y = t.^2;
```

```
subplot(211)
```

```
plot(t, z)
```



subplot(212)

plot(t, y)

~Y ~; Ú; Á à}f¥ Ô Á ~y# Ù x Ù× Öxäó😊
) ÁÑ ~ x äššó¥ Ô Á

subplot(221),....., subplot(222),....

subplot(223),....., subplot(224)



111

211

221

222

121

122

212

223

224

221

222

121

222

212

224



دانشگاه یزد

â Ú â `|| ä ŠŠŃÁXŪ-Ê ä ŠŠŌÀàŃ~ `x`|| ☺
 ÒâúŃ~ `x`|| ¥ , x ä ð Å;ê Ń~ ý Ūóòâý
); Āÿşxhold on Öóð`xäŠŠŌ
 `x` à ŃŠŌÿşx-Ê ä ÊáÚÒà`xŃÁXŪ-ÿËÝ ☺
); Āÿşxhold off Öóð



دانشگاه یزد

~) @äó¥ ~ â"üx"ñiö/pû š; àfx" ä"1/f ☺
) a" šxû"ä, ~|1/pû'òä"lòx

help datafun



$\cdot \hat{\alpha} \hat{U}$	$\frac{1}{N} \sum f$
$\hat{N} \hat{G} \hat{A} \hat{O}$	max
$\hat{N} \hat{G} \hat{B} \hat{O}$	min
$\hat{1} \hat{,} \hat{U} \hat{O}$	mean
$\hat{U} \hat{O}$	median
$\hat{y} \hat{I} \hat{O}^{\oplus} \hat{x} \hat{,} \hat{Q}$	std
$\hat{''} \hat{Q} \hat{x} \hat{U}$	var
$\hat{O} \hat{;} \hat{A} \hat{f} \hat{O}$	sort



$\cdot \hat{\alpha} \hat{U}$	$\frac{1}{4} \hat{U}$
$\overset{\circ}{\circ} \hat{S} \hat{U} \hat{U}$	sum
$\overset{\circ}{\circ} \hat{S} \hat{Z} \hat{U}$	prod
$\hat{I} \hat{x} \hat{E} \hat{S} \hat{a}$	hist
$\hat{a} \hat{I} \hat{U} \hat{U} \hat{a} \hat{U}$	cumsum
$\hat{a} \hat{I} \hat{U} \hat{a} \hat{I} \hat{U} \hat{U} \hat{a} \hat{U}$	cumprod
$\hat{C} \hat{S} \hat{O}$	diff
$\hat{a} \hat{E} \hat{S} \hat{U} \hat{I} \hat{U} \hat{a} \hat{U}$	corrcoef
$\hat{U} \hat{S} \hat{U} \hat{U} \hat{a}$	cov



دانشگاه یزد ☺

$b = [5 \ 1 \ 2; 3 \ 9 \ 4; 7 \ 6 \ 8]$

$index = find(b == 6)$

$[r,c] = find(b == 6)$

$m = max(b)$

$m = max(max(b))$

$[v,r] = max(b)$



`min(b)`

`s = size(b)`

`d = b(2,:)`

`s = size(d)`

`l = length(d)`

`max(size(d))`



`n = ndims(b)`

`length(size(b))`

`p = numel(b)`

`"MATLAB";` 😊

`a = [5 7 8;0 1 9; 4 3 6]`

`a(:, :, 2) = [1 0 4;3 5 6; 9 8 7]`



$a(:, :, 3) = 5$

$r = \text{rand}(4, 3, 2)$

$r(4, 1, 2)$

$r([1\ 3\ 4], 2, 1)$

$r(3, :, 2)$

$s = \text{size}(r)$



” ãfóí ãfÚÑÝ ù ” ãfóú ö`ÿ ðâx̄ | 😊
)ûãóÿxcat ~Û;`x`àfi

$$b = \text{cat}(3, [2,8; 0\ 5], [1\ 3; 7\ 9])$$

$$a = [1\ 2; 3\ 4]$$

$$b = [5\ 6; 7\ 8]$$

$$c = \text{cat}(1, a, b)$$

$$[a; b]$$



{ \hat{y} \acute{o} \hat{a} \sim \acute{U} \grave{y} \acute{a} \pounds \ddot{y} \grave{n} \grave{E} \acute{y} \acute{o} \grave{o} \grave{a} \check{s} \pounds \acute{O} \acute{A} \grave{o} \grave{a} \sim \grave{z} 
 \grave{z} \hat{u} \grave{a} \acute{O} \grave{u} \check{x} \grave{L} \acute{S} \hat{E}

$$a = 1 + 2i$$

$$b = \text{Real}(a)$$

$$c = \text{imag}(a)$$



`abs(a)`

`angle(a)`

`conj(a)`

`complex(2,3)`

`pow2(5)`

`nextpow2(13)`



`log10(10)`

`x = rand(1,10)`

`x(4:-1:2)`

`x = (0:0.1:1)*pi`

`linspace(0, pi, 11)`

`logspace(0, 2, 11)`

`linspace(0,10,11)`



linspace(0,50)

logspace(0,50)

)؛ûâóÿx" ¥ Ó÷~x/ yâÛFÒ§x¥ ÿñ😊

"a = 50

-ă ì -ð ù äö÷ÿ ~û ù ÿ ÷ Æ àÿôâx|😊
)ŠĂÓÍ Ô-

x = 2e5



```
b = [5:-1:1 3 8]
```

```
c = [b, 0]
```

```
d = [a(1:2:5) 1 0]
```

```
c, d
```

```
who
```

```
clear b c
```



2^4

$a = [1\ 2\ 3]$

$a.^2$

$a.^3$

$a = 2:3:8$

$\text{size}(a)$

$b = [a' a' a']$



`size(b)`

`c = b(1:2:3, 1:2:3)`

`size(c)`

`d = a+b(2, :)`

`size(d)`

`w = [zeros(1, 3) ones(3,1)'] 3:5'`

`size(w)`



$$b([1, 3], 2) = b([3, 1], 2)$$

Size(b)

$$e = 1:-1:5$$



دانشگاه یزد

pi

format long

pi

¥ îy ù x̃ ~ y → x ç x | f Æ à y Õ format ~ ũ \$; ☺
) š ä ó à } ö | - ð Æ å



دانشگاه یزد

â x̂ / yî ð- üÿ ; ä x̂ ; Matlab x̂ ð- õ 😊
Òà Ìó x̂ ; ÌÅ , x̂ - ä ~ Ì ; ~ ; ¼ ð- Òà x̂ ~ â) ; x̂
) Ì ä Óä , ~ | ¼ ð-

help relop



/ yæŭ	¼f
-ξ̃	>
-À#Û	<
â ŷ Ó Æ̃ ξ̃	>6
â ŷ Ó Æ̃ À#Û	<6
â ŷ Ó	66
-îóó	~6
-μ:ŭ&	&



/ yāf	yāf
yāf - μ	&&
äiäf	
yāf í äf	
t äf	~
â yäf à	xor



ÈyÓ Š ☺

`tf = [30 40 50 60 70] > 40`

`a = [2.5 6.7 9.2 inf 4.8 NaN];`

`b = isfinite(a)`

`c = islogical(a)`

`d = islogical(b)`



```
x = -3:3
```

```
tf = logical(x)
```

```
x = randperm(12)
```

```
x = reshape(x,3,4)
```

```
tf = (x <= 5)
```

```
whos tf, x
```



```
c = [true false]
```

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

```
b = rem(a,2) ~= 1
```

```
a(b)
```

```
clear
```

```
a = 0;
```

```
c = a&b
```



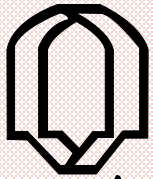
c = a && b

~ à Ü Ó ä à ÿ s y . â ~ À à Matlab ~ ; ☺
~ ; ¼ Û Ò à í Ó Æ ~ â) ; x ; Û Ü ä ~ à Û Ó ã à y Ò y
~ a y ä Ó ä ¼ y

help lang



/ yābŪ	۱/۲f
ä-ā"۱/۲f	if
ä-ā"۱/۲f	else
ä-ā"۱/۲f	elseif
ÜÄ,"Úß-a"Öx	end
ÜÄ,	for
ÜÄ,	while
ÜÄ,"x: Ú...	break



دانشگاه یزد

if expression

statements

end

if expression

statements

else

statements

end



if expression

statements

elseif expression

statements

else

statements

end



```
for variable = value1:value2
```

```
    statement
```

```
    ...
```

```
    statement
```

```
end
```

```
    n=100;
```

```
    for r = 1:n
```

```
        for c = 1:n
```

```
            a(r,c) = 1/(r+c-1);
```

```
        end
```

```
    end
```



```
x = [];  
for i = 1:10  
x = [x, i^2];  
end
```



while expression

statements

end

switch switch_expr

case case_expr

statement, ..., statement

case {case_expr1, case_expr2, case_expr3,...}

statement, ..., statement

otherwise

statement, ..., statement

end



```
method = 'Bilinear';  
    switch lower(method)  
    case {'linear','bilinear'}  
        disp('Method is linear')  
    case 'cubic'  
        disp('Method is cubic')  
    case 'nearest'  
        disp('Method is nearest')  
    otherwise  
        disp('Unknown method.')  
    end
```



```
for n=1:10
```

```
x(n)=sin(n*pi/10)
```

```
end
```

```
n=1:10;
```

```
y=sin(n*pi/10);
```



eps $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{128}$, $\frac{1}{256}$, $\frac{1}{512}$, $\frac{1}{1024}$, $\frac{1}{2048}$, $\frac{1}{4096}$, $\frac{1}{8192}$, $\frac{1}{16384}$, $\frac{1}{32768}$, $\frac{1}{65536}$, $\frac{1}{131072}$, $\frac{1}{262144}$, $\frac{1}{524288}$, $\frac{1}{1048576}$, $\frac{1}{2097152}$, $\frac{1}{4194304}$, $\frac{1}{8388608}$, $\frac{1}{16777216}$, $\frac{1}{33554432}$, $\frac{1}{67108864}$, $\frac{1}{134217728}$, $\frac{1}{268435456}$, $\frac{1}{536870912}$, $\frac{1}{1073741824}$, $\frac{1}{2147483648}$, $\frac{1}{4294967296}$, $\frac{1}{8589934592}$, $\frac{1}{17179869184}$, $\frac{1}{34359738368}$, $\frac{1}{68719476736}$, $\frac{1}{137438953472}$, $\frac{1}{274877906944}$, $\frac{1}{549755813888}$, $\frac{1}{1099511627776}$, $\frac{1}{2199023255552}$, $\frac{1}{4398046511104}$, $\frac{1}{8796093022208}$, $\frac{1}{17592186044416}$, $\frac{1}{35184372088832}$, $\frac{1}{70368744177664}$, 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$\frac{1}{3291009114642412084309938365114701009965471731267159726697218048}$, $\frac{1}{6582018229284824168619876730229402019930943462534319453394436096}$, $\frac{1}{13164036458569648337239753460458804039861886925068638906788872192}$, $\frac{1}{26328072917139296674479506920917608079723773850137277813577744384}$, $\frac{1}{52656145834278593348959013841835216159447547700274555627155488768}$, $\frac{1}{105312291668557186697918027683670432318895095400549111254310977536}$, $\frac{1}{210624583337114373395836055367340864637790190801098222508621955072}$, $\frac{1}{421249166674228746791672110734681729275580381602196445017243910144}$, $\frac{1}{842498333348457493583344221469363458551160763204392890034487820288}$, $\frac{1}{1684996666696914987166688442938726917102321526408785780068975640576}$, $\frac{1}{3369993333393829974333376885877453834204643052817571560137951281152}$, $\frac{1}{6739986666787659948666753771754907668409286105635143120275902562304}$, $\frac{1}{13479973333575319897333507543509815336818572211270286240551805124608}$, $\frac{1}{26959946667150639794667015087019630673637144422540572481103610249216}$, $\frac{1}{53919893334301279589334030174039261347274288845081144962207220498432}$, $\frac{1}{107839786668602559178668060348078522694548577690162289924414440996864}$, $\frac{1}{215679573337205118357336120696157045389097155380324579848828881993728}$, $\frac{1}{431359146674410236714672241392314090778194310760649159697657763987456}$, $\frac{1}{862718293348820473429344482784628181556388621521298319395315527974912}$, $\frac{1}{1725436586697640946858688965569256363112777243042596638790631055949824}$, $\frac{1}{3450873173395281893717377931138512726225554486085193277581262111899648}$, $\frac{1}{6901746346790563787434755862277025452451108972170386555162524223799296}$, $\frac{1}{13803492693581127574869511724554050904902217944340773110325048447598592}$, $\frac{1}{27606985387162255149739023449108101809804435888681546220650096895197184}$, $\frac{1}{55213970774324510299478046898216203619608871777363092441300193790394368}$, $\frac{1}{110427941548649020598956093796432407239217743554726184882600387580788736}$, $\frac{1}{220855883097298041197912187592864814478435487109452369765200775161577472}$, $\frac{1}{441711766194596082395824375185729628956870974218904739530401550323154944}$, $\frac{1}{883423532389192164791648750371459257913741948437809479060803100646309888}$, $\frac{1}{1766847064778384329583297500742918515827483896875618958121606201292619776}$, $\frac{1}{3533694129556768659166595001485837031654967793751237916243212402585239552}$, $\frac{1}{7067388259113537318333190002971674063309935887502475832486424805170479104}$, $\frac{1}{14134776518227074636666380005943348126619871775004951664972849610340958208}$, $\frac{1}{28269553036454149273332760011886696253239743550009903329945699220681916416}$, $\frac{1}{56539106072908298546665520023773392506479487100019806659891398441363832832}$, $\frac{1}{113078212145816597093331040047546785012958974200039613319782796882727665664}$, $\frac{1}{226156424291633194186662080095093570025917948400079226639565593765455331328}$, $\frac{1}{452312848583266388373324160190187140051835896800158453279131187530910662656}$, $\frac{1}{904625697166532776746648320380374280103671793600316906558262375061821325312}$, $\frac{1}{1809251394333065553493296640760748560207343587200633813116524750123642650624}$, $\frac{1}{3618502788666131106986593281521497120414687174401267626233049500247285301248}$, $\frac{1}{7237005577332262213973186563042994240829374348802535252466099000494570602496}$, $\frac{1}{144740111546645244279463731260859884816587486976050$



$a=1; b=2; c=1;$

$\text{if}(b^2-4*a*c)<0$

$\text{disp}(\text{'This equation has two complex root.'})$

$\text{elseif } (b^2-4*a*c)==0$

$\text{disp}(\text{'This equation has two identical real roots.'})$

else

$\text{disp}(\text{'This equation has two distinct real roots.'})$

end

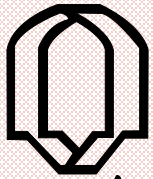


```
eps = 1;  
for num = 1:1000  
eps = eps/2;  
if(1+eps) <= 1  
eps = eps*2  
break  
end  
end
```



دانشگاه یزد

```
eps = 1;  
for num = 1:1000  
eps = eps/2;  
if(1+eps)>1  
continue  
end  
eps = eps*2;  
break  
end
```



دانشگاه یزد

$x = 2.7$

units = 'm'

switch units

case { 'inch', 'in' }

$y = 2.54 * x$

case { 'feet', 'ft' }

$y = 2.54 * x / 12$

case { 'millimeter', 'mm' }

$y = x$

case { 'meter', 'cm' }

$y = x / 100$

otherwise

disp('unkonwn Units!')

$y = \text{NaN}$

end



```
a = ones(4,2);  
b = 5*eye(3);  
try  
c = a*b;  
catch  
errmsg = lasterr;  
disp(errmsg)  
end
```



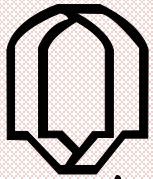
دانشگاه یزد

Í à}À #Û-ŠÿÅ Ù ã â ¿ÚÚ-ŠÿÅ lower ¼f ☺
) ŠÿÓ

lower(‘A’)

) ŠÿÓ à}Ç ~ | Ù ã À #Û-ŠÿÅ upper ¼f ☺

upper(‘a’)



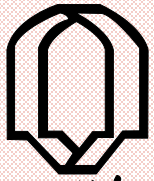
دانشگاه یزد

Üÿşx-ă Ööóđ~xâ`äÅ yôÄ¥`â Ö`à âx| ☺
)ÛäÓ

iskeyword

â`äÅ yôÄx~Û§; Ààÿ ÙÀòxÖ;ÛÛÀ#âx| ☺
)ÛäÓÜÿşx-ă Ööóđ~x-â.yà¥ ,x

tf=iskeyword('while')



دانشگاه یزد

Ù ~xÙó Ààâx̄fxÖó/ `Óâ - ÆÿxØâx| ☺
) ;ÛãÓÿxxtoc Útic ~Û ;

tic

- ÆÿxØâx|

toc



```
tic
```

```
for i = 1:10^6
```

```
sin(i);
```

```
end
```

```
toc
```




دانشگاه یزد

Ù ÖxÛäÓ~xòì-ÕÒà help ~x Üyşx â x| ☺
)i-Á Ô-ă/ ~û

help ~ûş;ì yõ

help plot

Üx ~ûş; Òà; ~ûó; â `ãó yãÛ¥ Ìy Òà; ☺
Òà `áÛyô Û`ay şă / y#-x Ñf) -Ê) ;ûäó
Í Ô-ă/ ~û Ù `ă| â xÛ / ~û Ù x / y#-x

)šĂ
9/12/2018



more on

help plot

more off ˘x ˘Û§ ; Òà Ö ; ÅÈ yð - ¼â x | ☺
) ăÛy§ x

Ûy§ x ÛÛŒ ; ŒŒ ; ä f# x help help ˘Û§ ; ˘x ☺
); Œă ÓÛx help ˘x



دانشگاه یزد

/ doc help help doc
help doc help help

doc help

help doc

html / help help
doc help help help



x̃ â ` aó yî x̃-ý Öx̃ä Ólookfor ~û\$; x̃ 😊
); ÅÛ\$ fiØ y.Í. Ô-Àà; ~Û;

lookfor string

` Öx̃ ~yÅÚ, string y ÛÄä|px̃ÛÄÄ~û\$; Òàx̃; 😊
) ŠÄÓ¥ ` â x̃



grayscale images (gray level)

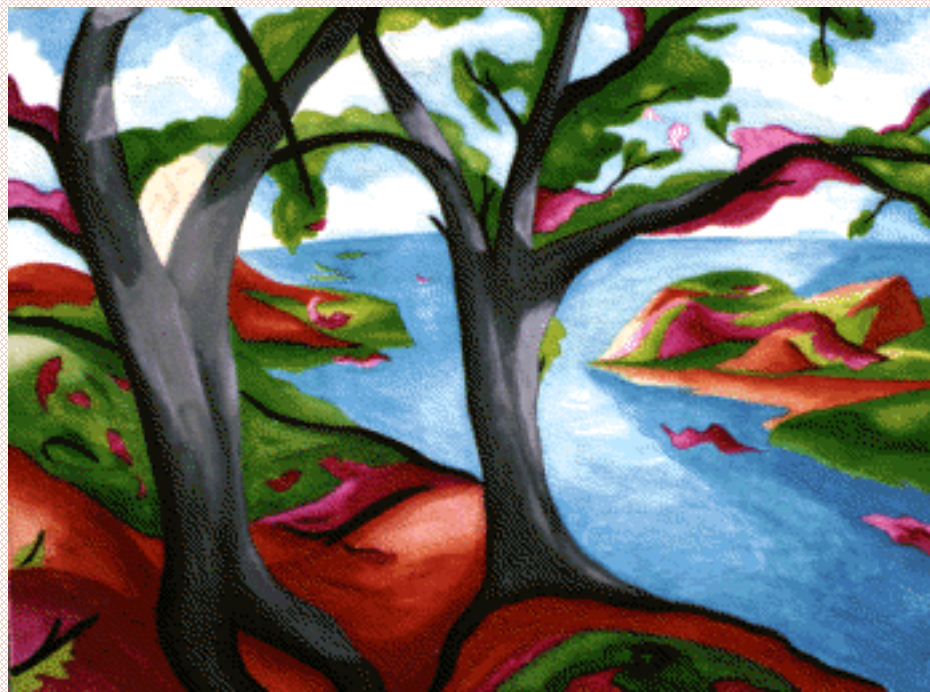
RGB images

index color images

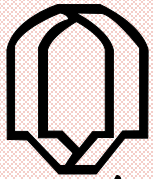
BW images











دانشگاه یزد

```

Öx y ÖxäÓimpixel ~Û$; ~x Üy$xy ☺
< x̄x̄ - âäf ä|| K} KÓÁÉ Ö - âäf Àà / y$óó
) ; - Å

```

```

RGB = imread('peppers.png');
c = [12 146 410];
r = [104 156 129];
pixels = impixel(RGB,c,r)

```

```

٩١٣ - âäf Àà 1/4f Òà ÖyÖË ÙääfÛ ~; ☺
`YÛ.â Úy Óä|| K} KÓÁâ y$ Ö Á`a y â - $ Å..
) ; Û

```



~ ĩ ä fÿâ ÷ ÖxÛä Óimfinfo ~ Û\$ ĩ ~ xÛy\$ xy ☺
) ĩ Û ¥ , ĩ Û - äæf À à ĩ Û

imfinfo('cameraman.tif')

ı ÷ Kâæf È Û Kâæf PÛ Û ĩ Û / yâ ÷ Öà ☺
 Öà) Šä Ó Ö% Ó x))) Ú à K ã © Ö: Kâæf
) Û ä Ó Û Û . äæf í à ÷ ~ Ý ~ x / yâ ÷



یونیورسیتی یازد 😊

, -2 y, -3 ä × Ö ð ä § 3 ÷ ÷ À à Int8

-00 y + Ö ð ä § 3 ÷ ÷ À à Unit8

ä × Ö Ú ¥ } Ö ä § , 1 ÷ ÷ À à Int16

¥ } Ö ä § , 1 ÷ ÷ À à Uint16

ä × Ö Ú ¥ } Ö ä § . - ÷ ÷ À à Int32

¥ } Ö ä § . - ÷ ÷ À à Uint32



äÄ, ç ÷ À à double