Stochastic Signal Processing

Lesson 4: Experimental Report 1

Syntax

% returns a random scalar drawn from the uniform distribution in the interval (0,1).

```
X = rand(1)
```

% returns an n-by-n matrix of uniformly distributed random numbers.

```
X = rand(n)
```

%returns an sz1-by-...-by-szN array of random numbers where sz1,...,szN indicate the size of each dimension. For example, rand(3,4) returns a 3-by-4 matrix.

```
X = rand(sz1,...,szN)
```

Syntax

%creates a probability distribution object for the distribution distname, using the default parameter values.

pd = makedist(distname)

% creates a probability distribution object with one or more distribution parameter values specified by name-value pair arguments.

pd = makedist(distname,Name,Value)

list = makedist returns a cell array list containing a list of the probability distributions that makedist can create.

Syntax

- Commonly used distribution

  Binomial distribution

  Poisson distribution

  Uniform distribution

  Normal distribution

  Exponential distribution

  Rayleigh distribution

- Example

  pd = makedist('Normal');

  r = random(pd); % evaluate the Normal distribution and generate random numbers

use ‘help’ in Matlab

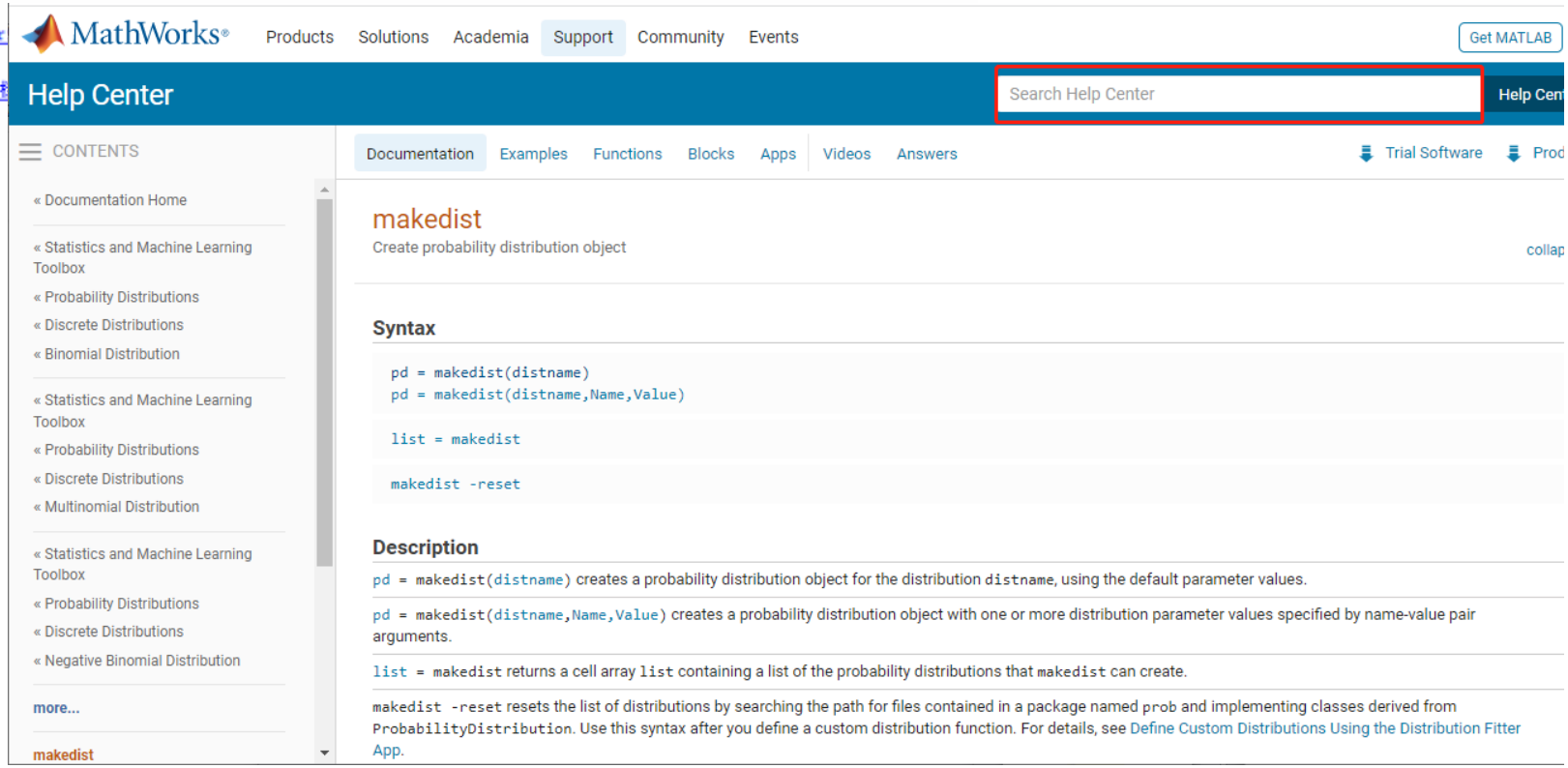
```
>>
>>
>>
>> help makedist
makedist - Create probability distribution object

    This MATLAB function creates a probability distribution object for the
    distribution distname, using the default parameter values.

    pd = makedist(distname)
    pd = makedist(distname,Name,Value)
    list = makedist
    makedist -reset

另请参阅 distr

makedist 的文
fx >>
```



Practice 1

Generate two groups of standard normal distribution numbers X and Y, compute its mean, variance, standard deviation and their 2-by-2 covariance.

```
L = 1000;        % length
x = randn(1,L);    % create a new 1-by-L vector of random numbers

y = randn(1,L);
m = mean(x);       % compute the mean
v = var(x);        % compute the variance
s = std(x);        % compute the standard deviation
c = cov(x,y);    % compute the covariance between two random variables X and Y
```

Practice 2

Generate a 1-by-5000 vector of standard normal distribution , Plot its histogram and probability density function(pdf). （tips: use histogram and ksdensity）

N = 5000; % length

x = randn(1,N); % create a new 1-by-L vector of random numbers

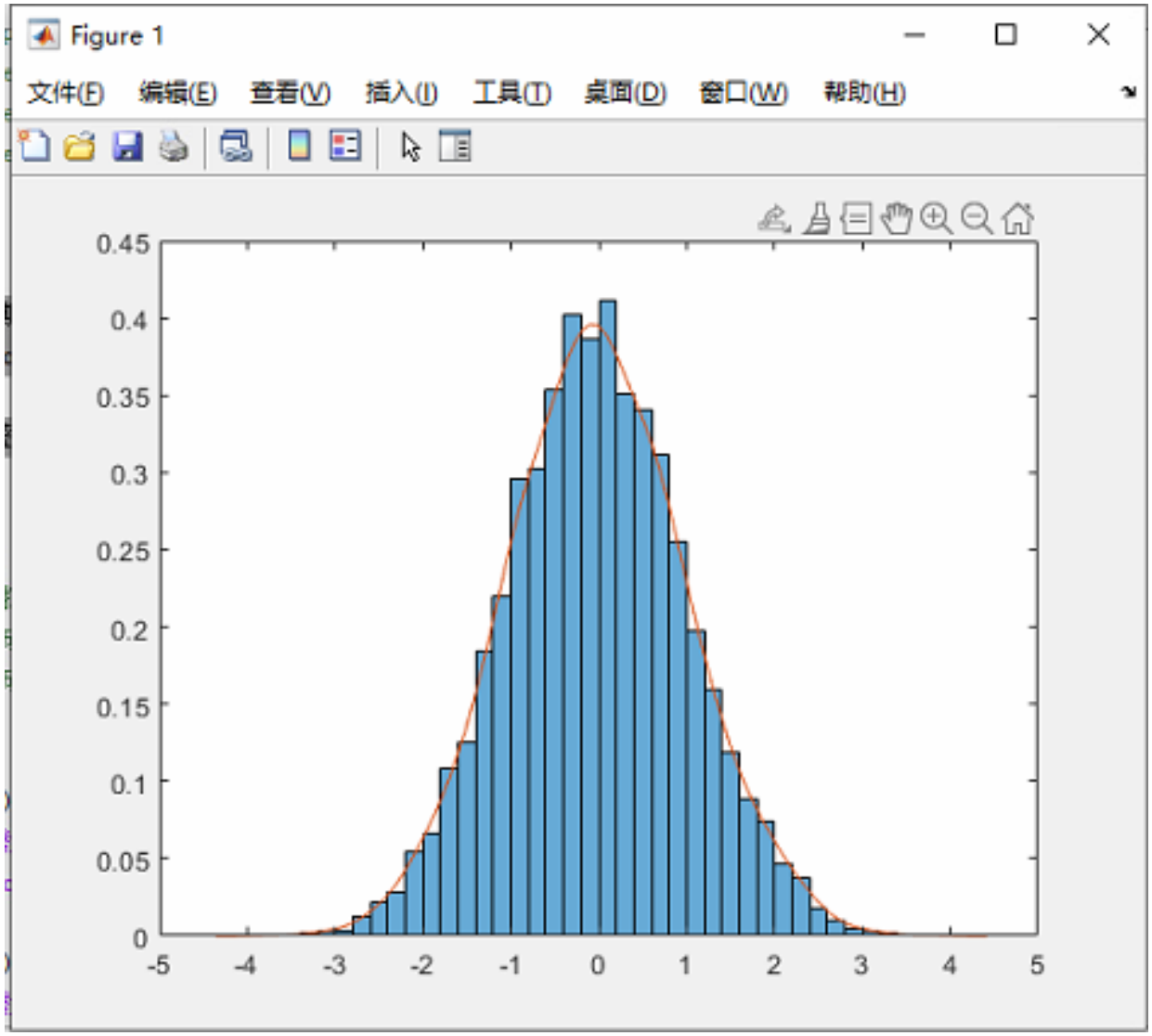
histogram(x,'normalization','pdf'); % creates a histogram plot of X

hold on

ksdensity(x); % Kernel smoothing function estimate

Practice 2

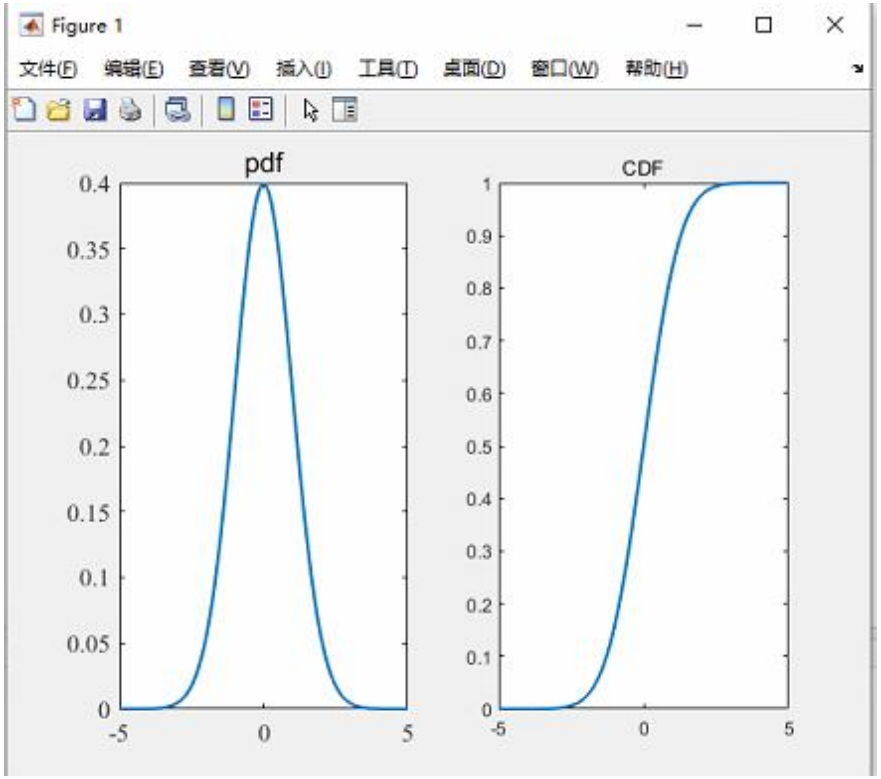
Generate a 1-by-5000 vector of standard normal distribution , Plot its histogram and probability density function(pdf). （tips: use histogram and ksdensity）



Practice 3

Plot the probability density function and distribution function of the normal distribution. (tips: pdf , cdf)

```
pd = makedist('Normal');    % Create a Normal distribution object
x = -5:0.01:5;              % range
y = pdf(pd,x);              % the probability density function
z = cdf(pd,x);              % the cumulative distribution function
subplot(1,2,1)
plot(x,y,'linewidth',1.5);
title('\fontname{}pdf');
subplot(1,2,2)
plot(x,z,'linewidth',1.5);
title('\fontname{}CDF');
```



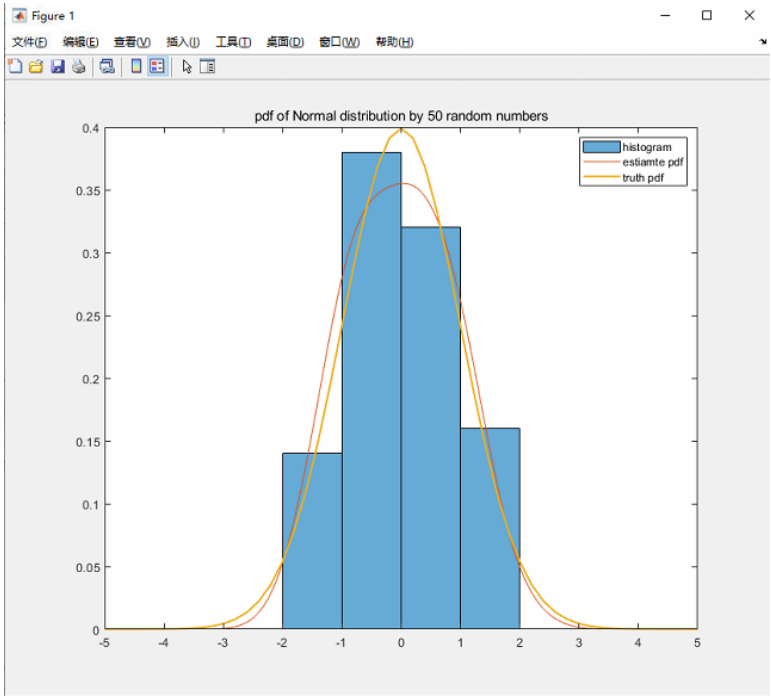
Common pdf (Probability density function) and CDF (Cumulative distribution function)

	pdf	CDF
Binomial distribution	binopdf	binocdf
Poisson distribution	poisspdf	poisscdf
Uniform distribution	unidpdf	unidcdf
Normal distribution	normpdf	normcdf
Exponential distribution	exppdf	expcdf
Rayleigh distribution	raylpdf	raylcdf

Practice 4

Plot the truth pdf, estimated pdf, and histogram of a Normal distribution by 50 and 5000 random numbers on the same graph.

```
% pdf of Normal distribution by 50 random numbers
x1 = randn(1,50);
histogram(x1,'normalization','pdf');
hold on
ksdensity(x1);              % estimate pdf
hold on
x = -5:0.2:5;
y =normpdf(x);              % Normal distribution pdf;
plot(x,y,'linewidth',1.5);
title('pdf of Normal distribution by 50 random numbers');
```

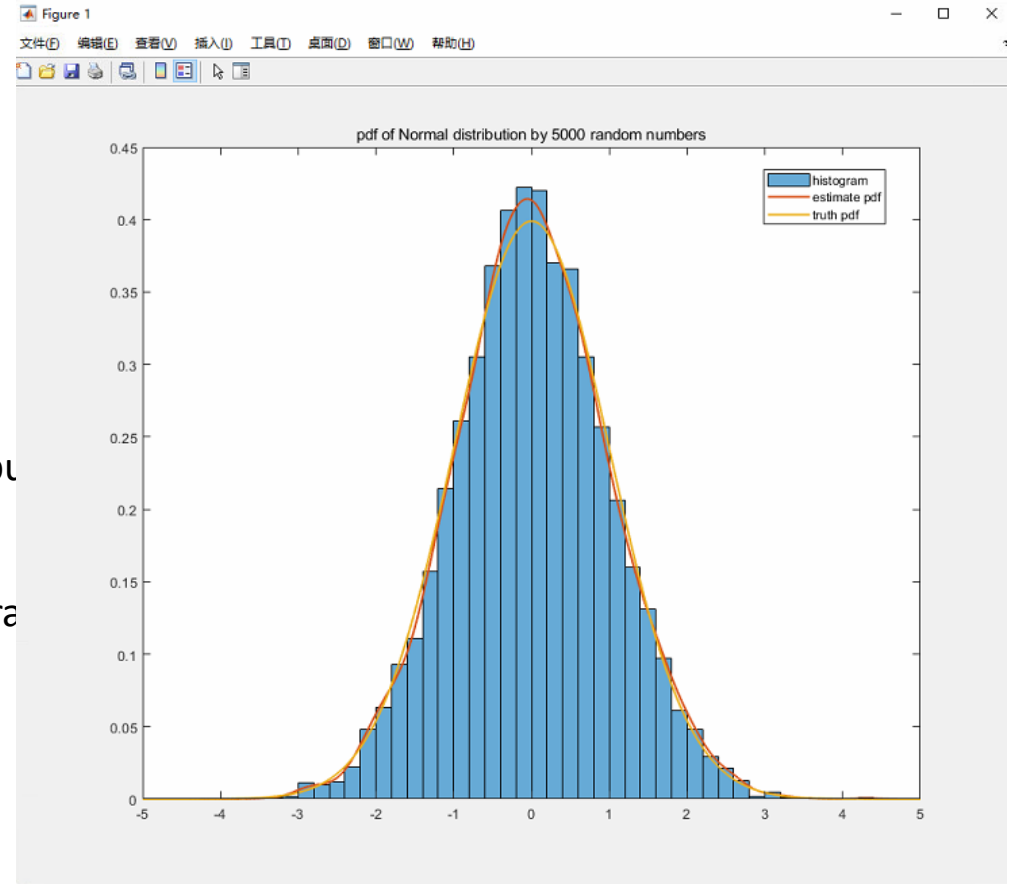


When only 50 random numbers are used to shown the histogram, it might seems not that 'Normal distributed'

Practice 4

Plot the truth pdf, estimated pdf, and histogram of a Normal distribution by 50 and 5000 random numbers on the same graph.

```
% pdf of Normal distribution by 50 random numbers
x1 = randn(1,5000);
histogram(x1,'normalization','pdf');
hold on
ksdensity(x1);              % estimate pdf
hold on
x = -5:0.2:5;
y =normpdf(x);              % Normal distribu
plot(x,y,'linewidth',1.5);
title('pdf of Normal distribution by 50 ra
```



The Experimental Report 1

The experimental Report 1 contains 3+1 parts:

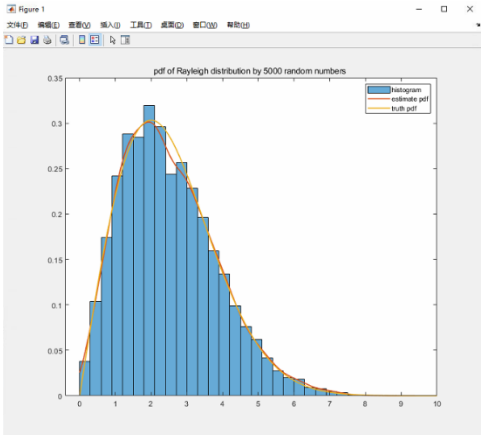
- Basic 1 (30 points) : submitted the program in weeks 1 and 2 and it is done.
  - You should submit your original codes submitted in weeks 1 and 2 again, without any changes
- Basic 2 (40 points) : a direct change of some program and figuring, will introduce next week.
- Advance (30 points) : Correctly use the Bayesian rule to determined the strategy 1 for game 1 and use appropriate system to perform the testing of strategy 1.
- Extra (10 points) :Correctly design the game 2, and correctly use the Bayesian rule to determined the strategy 2 for game 2, and use appropriate system to perform the testing of strategy 2.

Experimental Report 1: Part 2 (40 points)

Refer to practice 4 and plot Rayleigh distribution， Poisson distribution， Uniform distribution and Exponential distribution. The figure should contains the truth pdf, estimated pdf, and histogram.

Requirement

1. Your code must be runnable (no error, warning accepted), otherwise, 0 point.
2. Explain the characteristics of each function and the different between 50 and 5000 random numbers for pdf.
3. Totally 8 figures , each figure 5 points.



The Experimental Report 1

- Advance (30 points) +Extra (+10 points)
  - Requirement already given in Lesson 3
  - Default program already given in Lesson 3

Format requirements

- Email to 刘译哲 before 23:59:59, 05/04
  - All files packed into one .rar file, including:
    - At most 4 rar files containing codes from the 4 parts: basic1, basic2, advance and extra(Optional)
    - One experimental report file in .doc or .docx or .pdf format; it is better to submit both .doc and .pdf formatted files
    - Electronic files are enough