

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](#) 的文档

The screenshot shows the MathWorks Help Center interface. At the top, there's a navigation bar with links for Products, Solutions, Academia, Support, Community, and Events. A search bar is prominently displayed on the right. Below the navigation bar, the 'makedist' function page is open. The left sidebar contains a 'CONTENTS' menu with links to various documentation sections. The main content area displays the function name 'makedist' and its description: 'Create probability distribution object'. Under the 'Syntax' section, the following code snippets are listed: `pd = makedist(distname)`, `pd = makedist(distname,Name,Value)`, `list = makedist`, and `makedist -reset`. The 'Description' section explains that `pd = makedist(distname)` creates a probability distribution object for the distribution `distname`, using the default parameter values. It also states that `pd = makedist(distname,Name,Value)` creates a probability distribution object with one or more distribution parameter values specified by name-value pair arguments. Finally, it notes that `list = makedist` returns a cell array `list` containing a list of the probability distributions that `makedist` can create. At the bottom, it mentions that `makedist -reset` resets the list of distributions by searching the path for files contained in a package named `prob` and implementing classes derived from `ProbabilityDistribution`. For details, it refers to the 'Define Custom Distributions Using the Distribution Fitter App'.

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
```

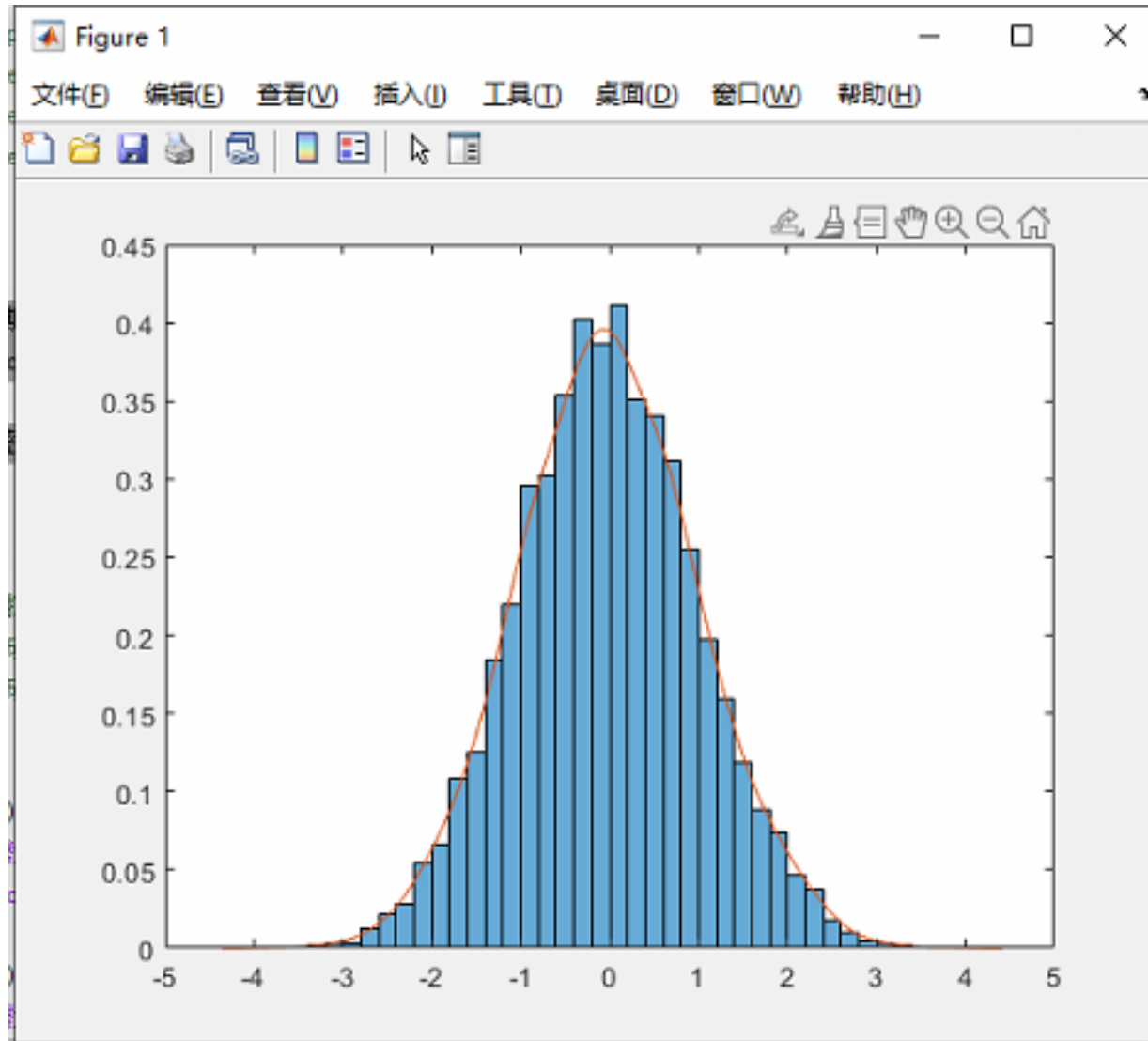
```
histogram(x,'normalization','pdf'); % creates a  
histogram plot of X
```

```
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)
```

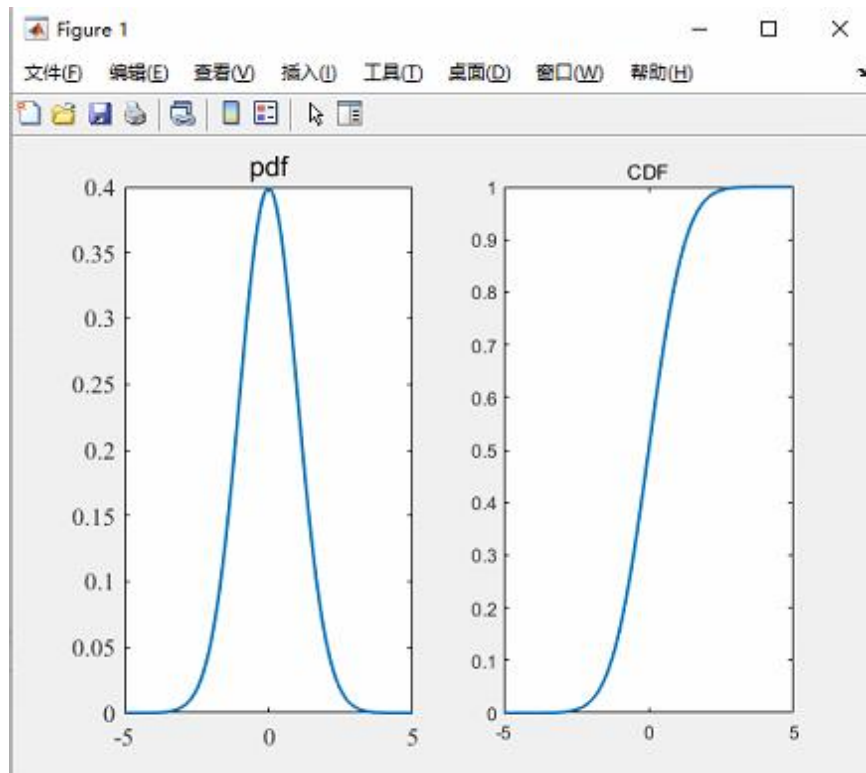
```
plot(x,y,'linewidth',1.5);
```

```
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
```

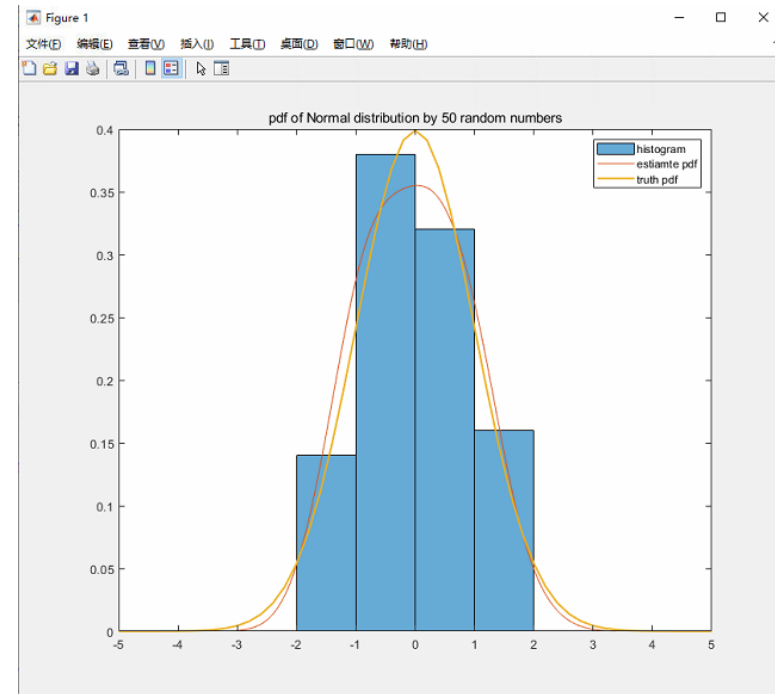
```
hold on
```

```
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
```

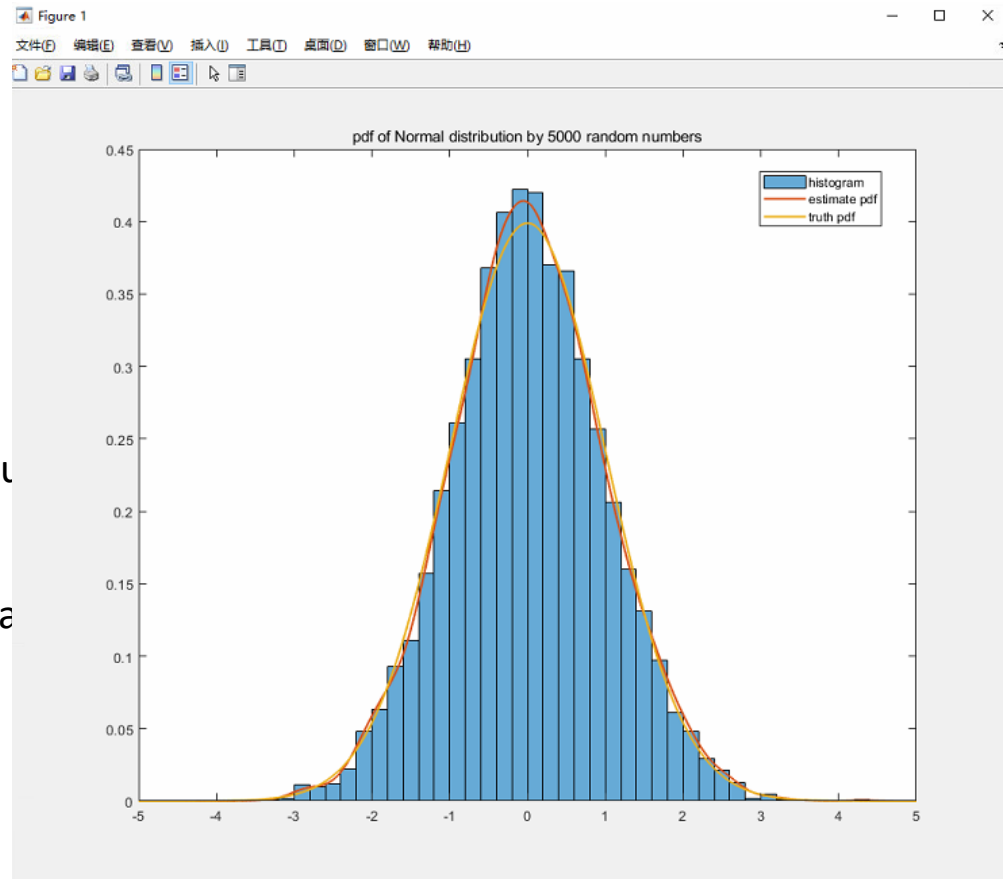
```
hold on
```

```
x = -5:0.2:5;
```

```
y = normpdf(x);          % Normal distribution
```

```
plot(x,y,'linewidth',1.5);
```

```
title('pdf of Normal distribution by 50 random numbers');
```



The Experimental Report 1

The experimental Report 1 contains 3+1 parts:

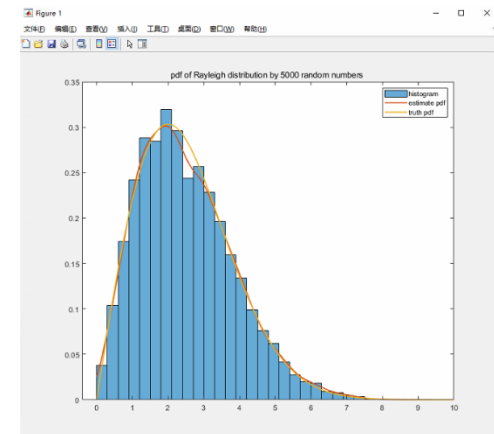
- Basic 1 (30 points) : submitted the program in weeks 1 and 2 and it is done.
 - You should submit your original codes submitted in weeks 1 and 2 again, without any changes
- Basic 2 (40 points) : a direct change of some program and figuring, will introduce next week.
- Advance (30 points) : Correctly 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

 advance.rar
类型: WinRAR 压缩文件

 basic1.rar
类型: WinRAR 压缩文件

 basic2.rar
类型: WinRAR 压缩文件

 extra(选做).rar
类型: WinRAR 压缩文件

 学号_姓名.doc