* Home assignment (due next Tuesday)

1. Gaussian linear transform
2. Using Matlab, generate two RV which is independent

* Definition of independent :

1. Fact :

Gaussian random variables is independent if and only if

1. To generate a RV , which means its mean = 0, its variance = 1

Using matlab, randn : normally(= Gaussian) distributed random number generation.

Hence

>> x1 = randn(1000,1);

>> x2 = randn(1000,1);

* Check their independency

>> cov(x1,x2)

0.9972 0.0519

0.0519 1.0110

Are the correlated? How about this method in matlab;

>> rng(1) % random number generator with seed = 1

>> x1 = randn(1000,1)

>>rng(0.01) % random number generator with seed = 0.01

>> x2 = sqrt(2)\*randn(1000,1)

>> cov(x1,x2)

0.9970 0.0079

0.0079 1.9959

In this case, the correlation of RVs are less than the previous case. Are they uncorrelated (independent)? So far so good to be independent. Finish.

1. Find the probability of and

* In matlab, makedist( ) create probability distribution function, and

% calculate the probability

pd\_x1 = makedist('normal', 'mu',0,'sigma',1) % make PDF

p\_x1 = cdf(pd\_x1,0.5) % calculate of Prob{x<= 0.5}

p\_x1 = 0.6915

pd\_x2 = makedist('normal','mu', 0,'sigma', sqrt(2)) %make PDF

p\_x2 = cdf(pd\_x2,0.5) % calculate of Prob( y <= 0.5)

p\_x2 = 0.6382

1. Find the joint prob.

* Assuming they are independent,

1. Let’s define another RVs.
2. Calculate , covariance matrix of

* Calculate the Covariance

0.9970 2.0018

2.0018 6.0154

1. is independent? Verify

* So

1. Find the joint probability

* In matlab

%% multivariate gaussian RV's

mu = [ 0 0];

sigma = cov\_Y;

P = mvncdf([0 0], [ 1 1],mu,sigma) + 0.5 ;

But my matlab has no function of mvncdf…

%% matlab program ..

%% First home assignment

%generate the normal X (mean,variance);

clear all; clf; clc

size = 1000;

rng(1) % random number generator seed.

x1 =randn(size,1); % gaussian , mean =0, sig = 1, size of colum vector

rng(0.01)

x2 =sqrt(2)\*randn(size,1); % gaussian , mean =0, sig = 2, size of colum vector

% check the independency

r = cov(x1,x2)

%%

% calculate the probability

pd\_x1 = makedist('normal', 'mu',0,'sigma',1) % make PDF

p\_x1 = cdf(pd\_x1,0.5) % calculate of Prob{x<= 0.5}

pd\_x2 = makedist('normal','mu', 0,'sigma', sqrt(2)) %make PDF

p\_x2 = cdf(pd\_x2,0.5) % calculate of Prob( y <= 0.5)

%% multivariate gaussian RV's

C =[1 0;2 1];

P = C\*r\*C'

mu = [ 0 0];

P = mvncdf([0 0], [ 0.5 0.5],mu,P) + 0.5 ;

% in my matlab no mvncdf...

% but another PC, i got it 0.5260

%% probability density function

1. Rolling a die :

Probability {2} = 1/6 🡪 if it is a fair die.

1. Coin is head with probability p and tails with probability 1-p. How many independent flips X

until first heads?

%% how to get Probability density function? 🡪 statistics

1. The distribution of the heights of the students.

* Histogram (empirical density)
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