ECOM20001 Econometrics 1

Week 3

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Introduction

Zheng Fan

- Ph.D student in Economics at Unimelb
  - $\hookrightarrow$ Research interest: Bayesian and Financial Econometrics
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Seek for help:

- Ed discussion board
- Consultations: refer to Canvas for details
- Admin, assign, Covid, please reach Richard Hayes

Assessment

Assignment 1

- Due by 27 March, Monday, 5pm
- Group size: 1, 2 or 3. They may come from different tutorials
- You MUST register your group on Canvas before 5pm 20 March, Monday
- Only a sinlge pdf file with R code as appendix
- No more than 5 pages in 12pt font, excluding cover page and appendix
- See instructions for more details

Pre-tute questions

The R commands "dnorm()", "pnorm()" and "qnorm()" return the values of the pdf, cdf and quantile for the normal distribution respectively.

```
dnorm(-2.5, mean=0, sd=1)
## [1] 0.0175283

dnorm(0, mean=0, sd=1)
## [1] 0.3989423

dnorm(2.5, mean=0, sd=1)
## [1] 0.0175283
```

Pre-tute questions

The R commands "dnorm()", "pnorm()" and "qnorm()" return the values of the pdf, cdf and quantile for the normal distribution respectively.

```
pnorm(-2.5, mean=0, sd=1)
## [1] 0.006209665

pnorm(0, mean=0, sd=1)
## [1] 0.5

pnorm(2.5, mean=0, sd=1)
## [1] 0.9937903
```

Pre-tute questions

The R commands `"dnorm()"`, `"pnorm()"` and `"qnorm()"` return the values of the pdf, cdf and quantile for the normal distribution respectively.

```
qnorm(0.05, mean=0, sd=1)
## [1] -1.644854

qnorm(0.50, mean=0, sd=1)
## [1] 0

qnorm(0.95, mean=0, sd=1)
## [1] 1.644854
```

Pre-tute questions

Similarly, R has `"dchisq()"`, `"pchisq()"` and `"qchisq()"` for χ^2 distribuiton.

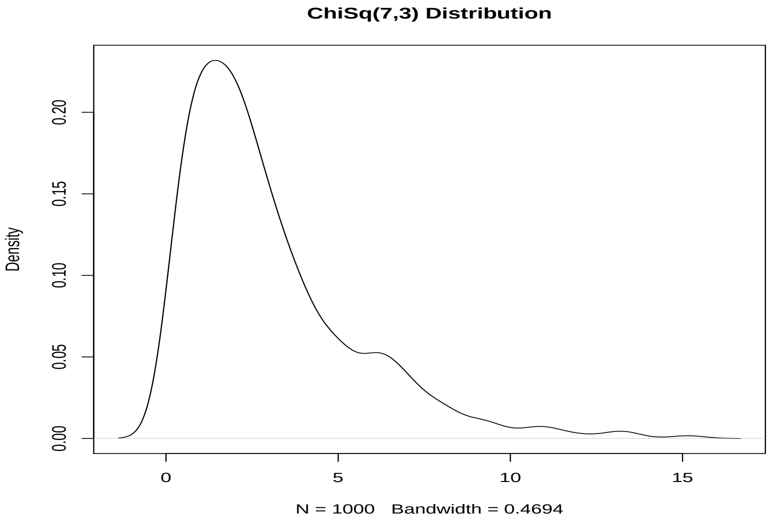
```
dchisq(7, df=3)      # PDF evaluated at 7
## [1] 0.0318734

pchisq(7, df=3)      # CDF evaluated at 7
## [1] 0.9281022

qchisq(0.95, df=3)   # Quantile function evaluated at probability p=0.95
## [1] 7.814728
```

Pre-tute questions

```r
# Chi-Square Distribution with df=3 degrees of freedom, plot PDF for 10
x2=rchisq(1000, df=3)
plot(density(x2), main="ChiSq(7,3) Distribution")
```



Pre-tute question 1

Explain why the following equality holds from the code

'pnorm(-1.65, mean=0, sd=1)‘ = ‘1-pnorm(1.65, mean=0, sd=1)’

Explain the relationship between the output from the following two lines of code:

```
pnorm(1.96, mean=0, sd=1)
## [1] 0.9750021

qnorm(0.975, mean=0, sd=1)
## [1] 1.959964
```

Pre-tute question 2

Consider the following table which describes the joint probability distribution for all combinations of studying and performance.

```
study <- matrix(c(0.2,0.07,0.01,0.28,0.1,0.3,0.05,0.45,0.02,0.10
                  ,0.15,0.27,0.32,0.47,0.21,1),ncol=4,byrow=FALSE)
colnames(study) <- c("High Grade","Medium Grade","Low Grade","Total")
rownames(study) <- c("**Study Hard**","**Sometimes**"
                     ,"**Never Study**","**Total**")
print(study)
##                 High Grade Medium Grade Low Grade Total
## **Study Hard**        0.20         0.10      0.02  0.32
## **Sometimes**         0.07         0.30      0.10  0.47
## **Never Study**       0.01         0.05      0.15  0.21
## **Total**             0.28         0.45      0.27  1.00
```

In-tute question 1

Comment on the shape of the **Normal** (‘mean=0, sd=1‘), **Chi-Square** (‘df=3‘), **t** (‘df=26‘), and **F** (‘df1=5, df2=2‘) distributions.

Discuss whether each distribution is symmetric, right or left skewed, and whether you would expect the mean of the distribution to equal the median, be smaller than the median, or larger than the median.

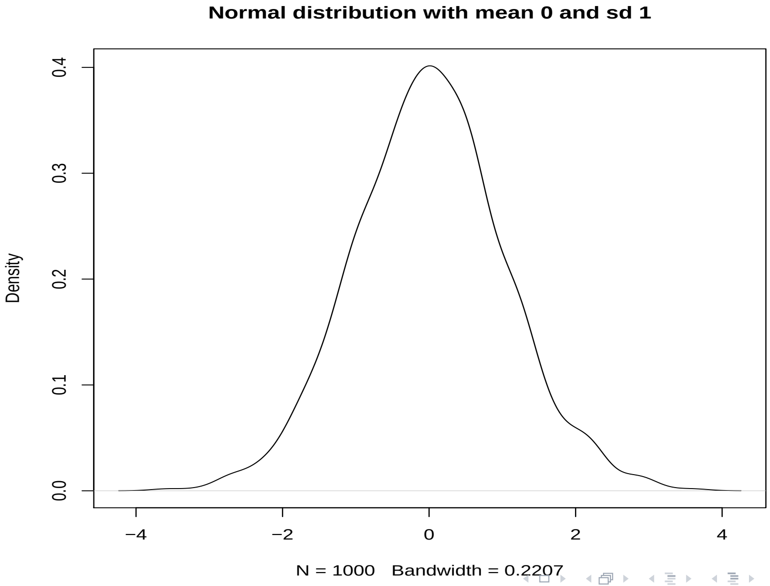
In-tute question 1

Simulate the samples

```
n = 1000
x1=rnorm(n,0,1) # or rnorm(1000, mean=0, sd=1)
x2=rchisq(n, df=3)
x3=rt(n, df=12)
x4=rf(n, df1=5, df2=2);
x4=x4[x4<20]  # Dropping x4 values bigger than 20 to make the graph nic
```

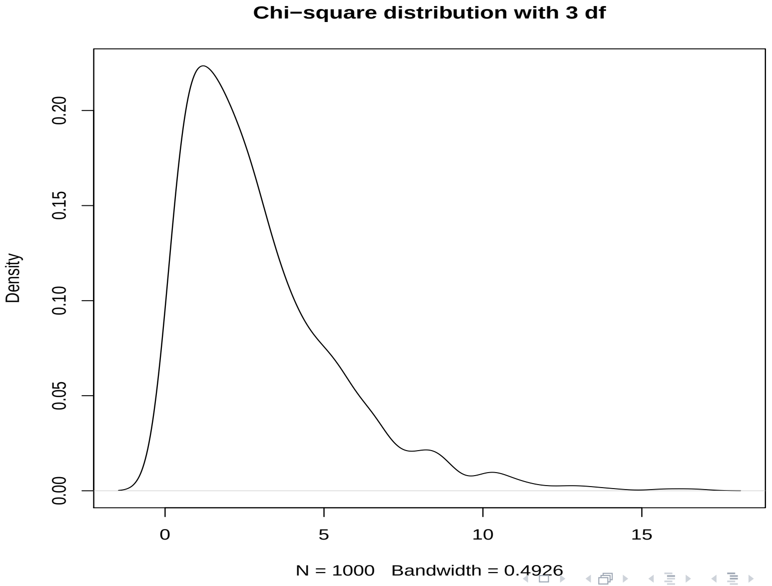
In-tute question 1

```
plot(density(x1), main="Normal distribution with mean 0 and sd 1")
```



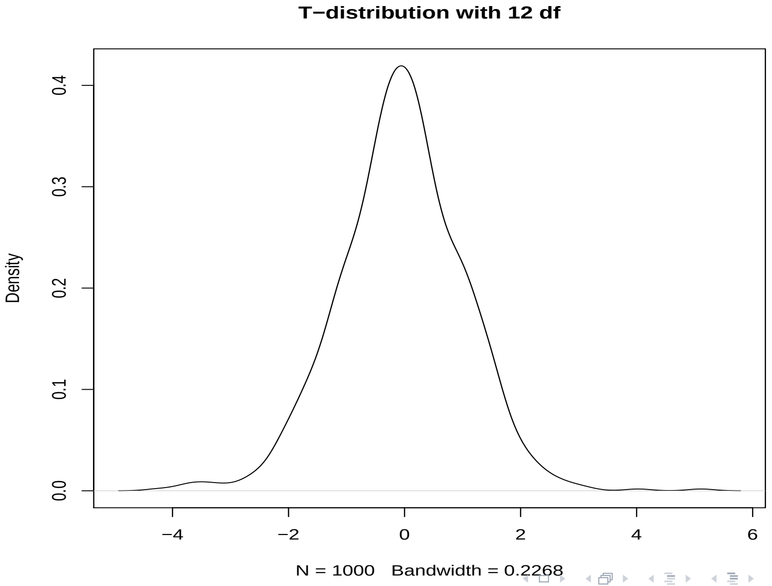
In-tute question 1

```
plot(density(x2),main="Chi-square distribution with 3 df")
```



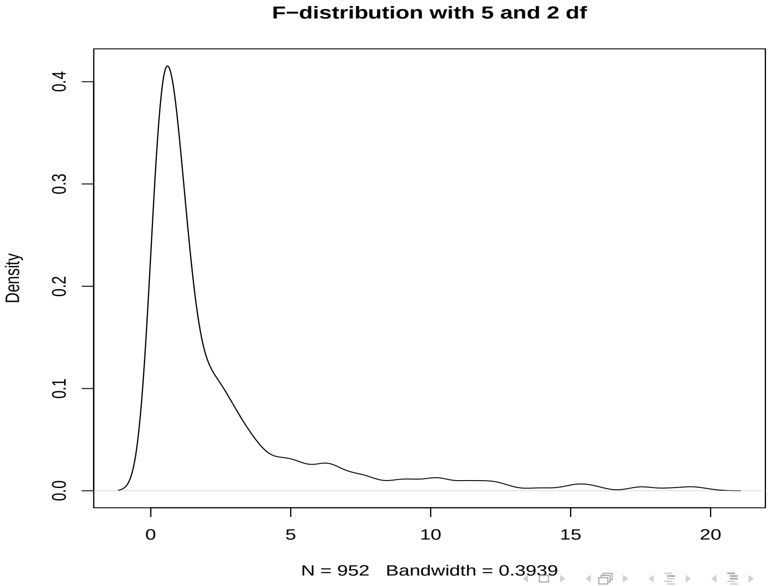
In-tute question 1

```
plot(density(x3), main="T-distribution with 12 df")
```



In-tute question 1

```
plot(density(x4), main="F-distribution with 5 and 2 df")
```



In-tute question 2

Compute the sampling distribution of the mean from an underlying sample that is **Chi-Square** with ‘df=3‘ for a sample size of ‘nobs=1000‘.

a. What is the variance of the sampling distribution of the means?
b. Suppose a sample average is "close" to the true value if it is within 0.3 of the true value. What percentage of sample means lies within 0.3 of the true population mean of 3?

In-tute question 3

See the question sheet.

In-tute question 4

Suppose you have a random variable X that is i.i.d. (independent and identically distributed) from a $N(\mu_X, 1)$ distribution, and another random variable Y that is defined as follows: $Y = 2 + 2X$.

a. What is the distribution of Y?

b. Graphically plot the distribution of Y for different values of μ_X ($\mu_X = 2, 5, 10$). What is happening to the distribution of Y for these different μ_X values?

In-tute question 4

Suppose you have a random variable X that is i.i.d. (independent and identically distributed) from a $N(\mu_X, 1)$ distribution, and another random variable Y that is defined as follows: $Y = 2 + 2X$.

c. Suppose Y was instead distributed as $Y = 2 + 4X$.
   - What is the distribution of Y now?
   - Again, graphically plot the distribution of Y for different values of μ_X ($\mu_X = 2, 5, 10$) and compare your results to what you found in part b.
   - What can you conclude about the magnitude of the shifts in the distribution of Y as a function of different μ_X values as the magnitude of the slope in the linear function that defines Y increases?