First and Last Names:

Student ID:

Group Number:

Exam of Techniques of Econometrics (January 2018)

Version A

Read each question carefully. Mark clearly the answers to each question in the answer sheet. Note that the decimal numeric values are denoted by a "point" instead of "comma". **Each question** is for 2 points. Wrong answer subtracts 0.5 of the points for each question

The grades will appear in Aula Global on January 25. The place and the time of the revision (most probably on January 30) will be announced by each professor in Aula Global.

Time: 100 minutes. Total Points: 60.

GOOD LUCK

- 1. The Wold decomposition states that any weakly stationary time series can be expressed as:
 - a) A linear combination of dependent random variables.
 - b) A sum of causal and non-causal process.
 - c) A non-causal process of infinite order.
 - d) A linear combination of uncorrelated random variables.

Answer: d

- 2. Let $\{x_t\}$ be a weakly stationary process. Which of the following statements is true?
 - **a)** $E(x_t) = \mu_t$.
 - **b)** $\operatorname{Var}(x_t) = \sigma^2$, $\operatorname{Cov}(x_t, x_{t-1}) = \operatorname{Cov}(x_t, x_{t+1})$.
 - c) $\operatorname{Cov}(x_t, x_{t-1}) \neq \operatorname{Cov}(x_t, x_{t+1}), \operatorname{Var}(x_t) = \sigma_t^2$.
 - d) None of the above.

Answer: b

- 3. The growth rate of the price of "Torreznos de Soria", y_t , behaves as the following process: $y_t = z + x_t$, where $z \sim N(0, 1)$, x_t is the white noise with mean 0 and variance 5, and both variables are independent of each other. Which of the following statements is true?
 - a) $E(y_t y_{t-k}) = 0$ for all k.
 - **b)** $E(y_t y_{t-k}) = 0$ for all $k \ge 1$.
 - c) $E(y_t y_{t-k}) \neq 0$ for all k.
 - d) None of the above.

Answer: c

- 4. Let $x_t = 0.35 + 0.69x_{t-1} + \epsilon_t$, where $\epsilon_t \stackrel{iid}{\sim} N(0, 1.5)$. Is this process causal? Identify the correct root, z, of the characteristic lag polynomial and answer the question:
 - a) z = 0.69 and process is causal.
 - **b)** z = 3.226 and process is causal.
 - c) z = 1.449 and process is causal.
 - d) z = 0.507 and process is non-causal.

Answer: c

- 5. Let $x_t = 0.35 + 0.69x_{t-1} + \epsilon_t$, where $\epsilon_t \stackrel{iid}{\sim} N(0, 1.5)$. Calculate $E(x_t) = \mu$.
 - a) $\mu = 0.507$.
 - **b**) $\mu = 0.69$.
 - c) $\mu = 1.129$.
 - d) $\mu = 0.35$.

Answer: c

- 6. Let $x_t = 0.35 + 0.69x_{t-1} + \epsilon_t$, where $\epsilon_t \stackrel{iid}{\sim} N(0, 1.5)$. Calculate $Var(x_t) = \gamma_0$.
 - a) $\gamma_0 = 1.5000.$
 - **b**) $\gamma_0 = 4.839.$
 - c) $\gamma_0 = 0.668$.
 - d) $\gamma_0 = 2.863$.

Answer: d

- 7. Let $x_t = 0.35 + 0.69x_{t-1} + \epsilon_t$, where $\epsilon_t \stackrel{iid}{\sim} N(0, 1.5)$. Calculate the autocorrelation of order three, ρ_3 .
 - a) $\rho_3 = 0.6900.$
 - **b**) $\rho_3 = 0.3285.$
 - c) $\rho_3 = 0.4761$.
 - d) $\rho_3 = 0.0298$.

Answer: b

- 8. Let $x_t = -0.30 + 0.15x_{t-1} + 0.35x_{t-2} + \epsilon_t$, where $\epsilon_t \stackrel{iid}{\sim} N(0, 2.1)$. Calculate $E(x_t) = \mu$.
 - a) $\mu = 0.15$.
 - **b**) $\mu = -0.30$.
 - c) $\mu = -0.6$.
 - **d**) $\mu = 0.$

Answer: c

- 9. Let $x_t = w_t + \frac{1}{5}w_{t-1}$ with w_t white noise mean 0 and variance 25. There is another process $y_t = e_t + 5e_{t-1}$ with e_t also white noise, mean 0 and variance 5. Which of the following statements is true?
 - **a)** The correlations $\rho_x(k) = \rho_y(k)$ for every k.
 - **b)** The correlations $\rho_x(k) \neq \rho_y(k)$ for every k.
 - c) The correlations $\rho_x(k) \leq \rho_y(k)$ for every k.
 - d) None of the above.

Answer: a

10. Consider the following model

$$Y_t = \varepsilon_t + 0.7\varepsilon_{t-1}$$

where ε_t is a white noise (0, 1). The autocorrelation function for this process is

a)
$$\rho_k = \begin{cases}
1, & if \ k = 0 \\
0.7, & if \ k = \pm 1 \\
0, & en \ los \ demas \ casos
\end{cases}$$
b) $\rho_k = (0.7)^k .$
c) $\rho_k = \begin{cases}
1, & if \ k = 0 \\
0.47, & if \ k = \pm 1 \\
0, & en \ los \ demas \ caso.
\end{cases}$
d) $\rho_k = \begin{cases}
1, & if \ k = 0 \\
(0.7)^k, & if \ k \ge 1.
\end{cases}$

Answer: c

The following 6 questions consider the same situation. The village el Burgo de Osma (Soria) needs to finance its debt to pay some of its public services like one of the best High Schools in the country, part of unfinished Highway A-11, a new hospital, etc. For this reason the council decides to issue local bonds. The annual price, P_t , of these bonds follows the following stochastic process $P_t = P_{t-1} + u_t$ with $u_t = \theta a_{t-1} + a_t$ where $a_t \sim iid(0, 1)$. It has been observed at the beginning of 2018 that $a_{2017} = a_{2016} = 1$.

- 11. Suppose that $\theta = 0$ and $P_{2017} = 5$. What is the best prediction of P_{2019} in early 2018 in terms of minimum mean squared error?
 - a) 5+5=10.

b) 5.

- c) $E(P_t) = 0.$
- d) Cannot predict since it is a random walk.

Answer: b

- 12. Suppose that $\theta = 0$ and $P_{2017} = 5$. What is the best prediction of $(1 L)P_{2019}$ in early 2018 in terms of minimum mean squared error?
 - **a)** 0.
 - **b**) 5.
 - c) 5+1=6.
 - d) 5+2=7.

Answer: a

- 13. Suppose that $\theta = 0.4$ and $P_{2017} = 5$. What is the best prediction of P_{2019} in early 2018 in terms of minimum mean squared error?
 - a) 5+5=10.
 - **b**) 5.
 - c) 5x0.4=2.
 - d) 5+0.4=5.4.

Answer: d

- 14. Suppose that $\theta = 0.4$ and $P_{2017} = 5$. What is the best prediction of $(1 L)P_{2019}$ in early 2018 in terms of minimum mean squared error?
 - **a**) 0.
 - **b**) 5.
 - **c)** 0.4.
 - **d**) 1.4.

Answer: a

15. Suppose that $\theta = 0.4$. Which of the following statements is NOT TRUE?

- a) The process that generates prices P_t is causal.
- **b)** The process that generates prices P_t is not stationary.
- c) The process that generates growth of the prices $(1 L)P_t$ is invertible.
- d) The process that generates prices P_t does not contain deterministic trend.

Answer: a

16. Suppose that $\theta = 0.4$. Which of the following statements is NOT TRUE?

- a) The process that generates growth of the prices $(1 L)P_t$ is stationary.
- **b)** The process that generates growth of the prices $(1 L)P_t$ is invertible.
- c) The process that generates growth of the prices $(1 L)P_t$ is not causal.
- d) The process that generates growth of the prices $(1 L)P_t$ is causal.

Answer: c

For the next 5 questions consider the following dynamic model

$$\frac{1 - 0.4L - 0.2L^2}{1.54 + 3.24L} x_t = z_t + u_t, \quad u_t \stackrel{iid}{\sim} N(0, \sigma^2),$$

where z_t is an exogenous variable.

- 17. Specify what type of process it is:
 - **a)** This is ARDL(1,2); stable model.
 - **b)** This is ARDL(2,1); stable model.
 - c) This is ARDL(2,1); not stable model.
 - d) This is ARDL(1,2); not stable model.

Answer: b

- 18. Calculate short-run multiplier m_0 .
 - **a)** $m_0 = 1$.
 - **b**) $m_0 = 0$.
 - c) $m_0 = 1.54$.
 - d) $m_0 = 0.649$.

Answer: c

- 19. Calculate long-run multiplier m_T .
 - a) $m_T = 1.54$.
 - **b**) $m_T = 0.083$.
 - c) $m_T = 11.95$.
 - d) $m_T = 1$.

Answer: c

- 20. Calculate the second dynamic short-run multiplier m_2 .
 - **a)** 1.8504
 - **b**) 1.54
 - c) 3.856
 - **d**) 0

Answer: a

- 21. Calculate the median lag
 - **a**) 0
 - **b**) 1
 - **c)** 2
 - **d**) 3

Answer: c

22. The parameter values of this dynamic model are usually unknown, therefore you need to estimate them. A simple and great estimation method is OLS where you regress x_t on x_{t-1} , x_{t-2} , z_t and z_{t-1} . Which of the following statements is true?

- a) OLS will estimate the parameters consistently.
- b) OLS will not estimate the parameters consistently.
- c) OLS will estimate the parameters consistenly if robust standard errors are used.
- d) None of the above.

Answer: b

The next 4 questions consider the same situation. The company **IWANTTOBEAJEDI** manages investment funds whose quarterly returns y_t is given by the following process

$$y_t = \phi_0 + \phi_1 y_{t-1} + a_t, \quad a_t \stackrel{iid}{\sim} N(0, \sigma_a^2 = 2),$$
 (1)

where $\phi_0 = 2, \ \phi_1 = 0.5$

23. What is the moving average form of this model?

a)
$$y_t = 4 + \sum_{j=0}^{\infty} (0.5)^j a_{t-j}$$

- **b)** $a_t = -2 + \sum_{j=0}^{1} (0.5)^j y_{t-j}$
- c) There is no a moving average form of this model because is not invertible.
- d) There is no a moving average form of this model because is not causal.

Answer: a

- 24. What are the autocorrelations of y_t : ρ_k , k = 1, 2?
 - a) $\rho_1 = 1, \rho_2 = 0.5$
 - **b**) $\rho_1 = 0, \, \rho_2 = 0.5$
 - c) $\rho_1 = 0.5, \ \rho_2 = 0$
 - d) $\rho_1 = 0.5, \ \rho_2 = 0.25$

Answer: d

- 25. What is the mean of the process $x_t = (1 L)y_t$?
 - **a)** $E[x_t] = 4.$
 - **b)** $E[x_t] = 0$.
 - c) $E[x_t] = 0.5$.
 - **d**) $E[x_t] = 2$.

Answer: b

- 26. Some clients would like to know whether the mean returns of the company **IWANTTOBEA**-**JEDI** can be negative or not. Given that the sample mean of y_t over the last 100 periods is $\bar{y}_{100} = 1\%$, construct a 95% confidence interval for the mean value of y_t and answer the question of the clients.
 - a) On average the returns of the company cannot be negative, between 0.446% and 1.554%
 - b) On average the returns of the company can be negative, between -0.45% and 1.55%
 - c) On average the returns of the company cannot be negative, between 0.723% and 1.277%
 - d) There is no information to calculate it.

Answer: a

The next 4 questions consider the same situation. The rent, Y_t , in the independent country SoriaLand is generated by the following process: $Y_t = Y_{t-1} + e_t$ with $e_t \sim iid(0, 13)$. Consumption in SoriaLand, C_t , is generated by $C_t = \beta Y_t + u_t$, with $u_t = \rho u_{t-1} + a_t$ where $a_t \sim iid(0, 13)$ and independent of e_t .

- 27. In order to test if the variable Y_t has a unit root (integrated order 1) the following has to be performed:
 - a) The Dickey-Fuller test on Y_t .
 - b) Regress Y_t on Y_{t-1} and check if the corresponding coefficient is 1 using the critical values from N(0, 1).
 - c) Use the Dickey-Fuller test on $(1 L)Y_t$.
 - d) Use Box-Pierce test (or Ljung-Box test) on the correlations of the process Y_t .

Answer: a

- 28. The consumption and income in this country are cointegrated if:
 - a) $\beta < 1$.
 - **b**) $\beta = 0$.
 - c) $\beta \neq 0$ y $|\rho| < 1$.
 - d) $\beta = \rho = 1$.

Answer: c

29. If $\rho = 1$, then

- a) Consumption and income are cointegrated.
- b) The regression between consumption and income is spurious
- c) $\beta = 0$.
- d) $\beta \neq 0$.

Answer: b

- 30. The main objective of an econometrician in this country is to estimate parameter β ; with the suspicion that $\rho = 1$. If this is the case what is the best way to estimate β ?
 - a) Regress C_t on Y_t .
 - **b)** Regress C_t on Y_{t-1} .
 - c) Regress $(1-L)C_t$ on $(1-L)Y_t$.
 - d) Regress Y_t on C_t .

Answer: c

I HOPE YOU HAVE LEARNT SOMETHING in THIS COURSE REMEMBER that ECONOMICS without ECONOMETRICS becomes a COFFEE TALK.