AFRICA UNIVERSITY
(A United Methodist-Related Institution)

"Investing in Africa's Future"

# COLLEGE OF BUSINESS, PEACE, LEADERSHIP AND GOVERNANCE

## MEC406 – BUSINESS CYCLES AND FORECASTING

## SECOND SEMESTER FINAL EXAMINATION

## APRIL/MAY 2017 (CONVENTIONAL)

## LECTURER: DR S. MURAIRWA

## TIME: 3 HOURS

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## INSTRUCTIONS

Answer **All** questions.

Start **each** question on a new page in your answer booklet.

The marks allocated to **each** question are shown at the end of the question.

**Show all your workings.**

Credit will be given for logical, systematic and neat presentations.

1. State and explain three criticisms of the Long-Run Stagnation theories. **[6 Marks]**

2. With a well labelled diagram, explain the Box-Jenkins iterative method. **[8 Marks]**

3. Business cycles has gone through a number of evolution stages such as six, four and three stages.
   (a). Draw a diagram of the three stages of the business cycles. **[6 Marks]**
   (b). State and explain the four stages of the theories of business cycles. **[12 Marks]**

4. Given the following material cost theory:
   $Y_t = C_t + I_t$
   $C_t = bY_{t-1}$
   $\frac{Y}{K_t} = a - cY_t$
   $\frac{\pi}{K} = \left(\frac{\pi}{Y}\right)\left(\frac{Y}{K}\right)$
   $I_t = r + p\left(\frac{\pi}{K_{t-1}} - \frac{\pi}{K_{t-2}}\right)$
   $\frac{\pi}{Y} = k$
   a) Explain how the model works. **[6 Marks]**
   b) Show that the model can be reduced to $Y_t = H + AY_{t-1} + BY_{t-2}$ where H = r, A = b – pkc and B = pkc. **[8 Marks]**
   c) Let a = 0.05, b = 5, $c = 4$, $k = 0.75$ and $p = 2$. Does this specification of parameters warrant an explosive cycle? **[4 Marks]**

5. Given the model $Y_t = \rho Y_{t-1} + \mu_t$. If $\rho = 1$, find the
   a) forecast of $Y_t^*$ **[4 Marks]**
   b) $var(Y_t^*)$ **[5 Marks]**
   c) forecast of $Y_{t+1}^*$ **[4 Marks]**
   d) $var\ (Y_{t+1}^*)$ **[5 Marks]**
   e) 95% confidence interval of $Y_t$, if $E(Y_t) = 4$ and $\sigma_u^2 = 16$ **[3 Marks]**

6. Attempt the following questions:
   a) Given the model $Y_t = 6 + U_t + 0.9U_{t-1}$
      i) Identify the model **[2 Marks]**
      ii) Find $\mu, \rho_0, \rho_1$ and draw the correlogram **[7 Marks]**
   b) Given the model $Y_t = \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots\ldots + \alpha_p Y_{t-p} + \delta + u_t$, derive the Yule Walker equations **[10 Marks]**

7. Given the following time series data:

| | Year | | | |
|---|---|---|---|---|
| **Quarter** | **1** | **2** | **3** | **4** |
| **1** | 96 | 116 | 120 | 126 |
| **2** | 82 | 104 | 112 | 118 |
| **3** | 120 | 136 | 150 | 160 |
| **4** | 130 | 144 | 156 | 168 |

Calculate the seasonal indexes and interpret. **[10 Marks]**

End of paper

## ADDITIONAL INFORMATION

i) *MA(q) model:*

$$Y_t = \mu + u_t + \beta_1 U_{t-1} + \beta_2 U_{t-2} + \cdots \ldots \ldots \ldots + \beta_q U_{t-q}$$

ii) AR(p) model:

$$Y_t = \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \cdots \ldots \ldots \ldots + \alpha_p Y_{t-q} + \delta + u_t$$

iii) Model:

$$Y_t = \alpha + \beta T + \rho Y_{t-1} + \sum_{i=1}^{k} \lambda_i \Delta Y_{t-i} + \varepsilon_i$$

iv) Unrestricted model:

$$\Delta Y_t = \alpha + \beta T + (\rho - 1) Y_{t-1} + \lambda_1 \Delta Y_{t-1} + w_t$$

v) Restricted model:

$$\Delta Y_t = \alpha + \lambda_1 \Delta Y_{t-1} + v_t$$

vi) Model:

$$Y_t = \propto + \beta T + \rho Y_{t-1} + \varepsilon_t$$

vii) Unit root test statistic:

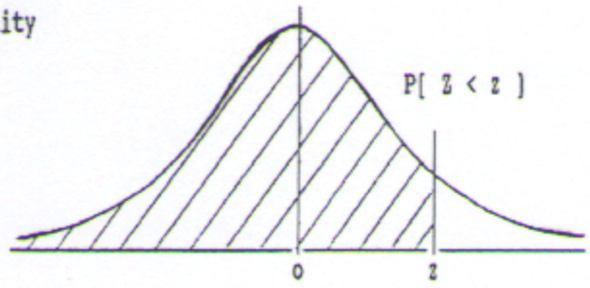
$$F = (n - k) \frac{(\sum v^2 - \sum w^2)}{q \sum w^2}$$

# STANDARD STATISTICAL TABLES

## 1. Areas under the Normal Distribution

The table gives the cumulative probability up to the standardised normal value z

i.e. $$P[\, Z < z \,] = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} \exp(-\tfrac{1}{2}Z^2)\, dZ$$




| z | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.5000 | 0.5040 | 0.5080 | 0.5120 | 0.5159 | 0.5199 | 0.5239 | 0.5279 | 0.5319 | 0.5359 |
| 0.1 | 0.5398 | 0.5438 | 0.5478 | 0.5517 | 0.5557 | 0.5596 | 0.5636 | 0.5675 | 0.5714 | 0.5753 |
| 0.2 | 0.5793 | 0.5832 | 0.5871 | 0.5910 | 0.5948 | 0.5987 | 0.6026 | 0.6064 | 0.6103 | 0.6141 |
| 0.3 | 0.6179 | 0.6217 | 0.6255 | 0.6293 | 0.6331 | 0.6368 | 0.6406 | 0.6443 | 0.6480 | 0.6517 |
| 0.4 | 0.6554 | 0.6591 | 0.6628 | 0.6664 | 0.6700 | 0.6736 | 0.6772 | 0.6808 | 0.6844 | 0.6879 |
| 0.5 | 0.6915 | 0.6950 | 0.6985 | 0.7019 | 0.7054 | 0.7088 | 0.7123 | 0.7157 | 0.7190 | 0.7224 |
| 0.6 | 0.7257 | 0.7291 | 0.7324 | 0.7357 | 0.7389 | 0.7422 | 0.7454 | 0.7486 | 0.7517 | 0.7549 |
| 0.7 | 0.7580 | 0.7611 | 0.7642 | 0.7673 | 0.7704 | 0.7734 | 0.7764 | 0.7794 | 0.7823 | 0.7854 |
| 0.8 | 0.7881 | 0.7910 | 0.7939 | 0.7967 | 0.7995 | 0.8023 | 0.8051 | 0.8078 | 0.8106 | 0.8133 |
| 0.9 | 0.8159 | 0.8186 | 0.8212 | 0.8238 | 0.8264 | 0.8289 | 0.8315 | 0.8340 | 0.8365 | 0.8389 |
| 1.0 | 0.8413 | 0.8438 | 0.8461 | 0.8485 | 0.8508 | 0.8531 | 0.8554 | 0.8577 | 0.8599 | 0.8621 |
| 1.1 | 0.8643 | 0.8665 | 0.8686 | 0.8708 | 0.8729 | 0.8749 | 0.8770 | 0.8790 | 0.8804 | 0.8830 |
| 1.2 | 0.8849 | 0.8869 | 0.8888 | 0.8907 | 0.8925 | 0.8944 | 0.8962 | 0.8980 | 0.8997 | 0.9015 |
| 1.3 | 0.9032 | 0.9049 | 0.9066 | 0.9082 | 0.9099 | 0.9115 | 0.9131 | 0.9147 | 0.9162 | 0.9177 |
| 1.4 | 0.9192 | 0.9207 | 0.9222 | 0.9236 | 0.9251 | 0.9265 | 0.9279 | 0.9292 | 0.9306 | 0.9319 |
| 1.5 | 0.9332 | 0.9345 | 0.9357 | 0.9370 | 0.9382 | 0.9394 | 0.9406 | 0.9418 | 0.9429 | 0.9441 |
| 1.6 | 0.9452 | 0.9463 | 0.9474 | 0.9484 | 0.9495 | 0.9505 | 0.9515 | 0.9525 | 0.9535 | 0.9545 |
| 1.7 | 0.9554 | 0.9564 | 0.9573 | 0.9582 | 0.9591 | 0.9599 | 0.9608 | 0.9616 | 0.9625 | 0.9633 |
| 1.8 | 0.9641 | 0.9649 | 0.9656 | 0.9664 | 0.9671 | 0.9678 | 0.9686 | 0.9693 | 0.9699 | 0.9706 |
| 1.9 | 0.9713 | 0.9719 | 0.9726 | 0.9732 | 0.9738 | 0.9744 | 0.9750 | 0.9756 | 0.9761 | 0.9767 |
| 2.0 | 0.9773 | 0.9778 | 0.9783 | 0.9788 | 0.9793 | 0.9798 | 0.9803 | 0.9808 | 0.9812 | 0.9817 |
| 2.1 | 0.9821 | 0.9826 | 0.9830 | 0.9834 | 0.9838 | 0.9842 | 0.9846 | 0.9850 | 0.9854 | 0.9857 |
| 2.2 | 0.9861 | 0.9865 | 0.9868 | 0.9871 | 0.9874 | 0.9878 | 0.9881 | 0.9884 | 0.9887 | 0.9890 |
| 2.3 | 0.9893 | 0.9896 | 0.9898 | 0.9901 | 0.9904 | 0.9906 | 0.9909 | 0.9911 | 0.9913 | 0.9916 |
| 2.4 | 0.9918 | 0.9920 | 0.9922 | 0.9924 | 0.9927 | 0.9929 | 0.9931 | 0.9932 | 0.9934 | 0.9936 |
| 2.5 | 0.9938 | 0.9940 | 0.9941 | 0.9943 | 0.9945 | 0.9946 | 0.9948 | 0.9949 | 0.9951 | 0.9952 |
| 2.6 | 0.9953 | 0.9955 | 0.9956 | 0.9957 | 0.9959 | 0.9960 | 0.9961 | 0.9962 | 0.9963 | 0.9964 |
| 2.7 | 0.9965 | 0.9966 | 0.9967 | 0.9968 | 0.9969 | 0.9970 | 0.9971 | 0.9972 | 0.9973 | 0.9974 |
| 2.8 | 0.9974 | 0.9975 | 0.9976 | 0.9977 | 0.9977 | 0.9978 | 0.9979 | 0.9980 | 0.9980 | 0.9981 |
| 2.9 | 0.9981 | 0.9982 | 0.9982 | 0.9983 | 0.9984 | 0.9984 | 0.9985 | 0.9985 | 0.9986 | 0.9986 |
| z | 3.00 | 3.10 | 3.20 | 3.30 | 3.40 | 3.50 | 3.60 | 3.70 | 3.80 | 3.90 |
| P | 0.9986 | 0.9990 | 0.9993 | 0.9995 | 0.9997 | 0.9998 | 0.9998 | 0.9999 | 0.9999 | 1.0000 |