AFRICA UNIVERSITY

(A United Methodist-Related Institution)

"Investing in Africa's Future"

FACULTY OF MANAGEMENT AND ADMINISTRATION

COURSE TITLE: **MEC406 – Business Cycles and Forecasting**

SEMESTER 1: **Final Examination – November 2016 (Mutare Parallel)**

LECTURER: **Dr S. Murairwa**

TIME: **3 Hours**

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. Given the Effective Demand model:
   $Y_t = C_t + I_t$
   $Y_t = \pi_t + W_t$
   $W_t = w + gY_t$
   $C_t = a + b\pi_{t-1} + W_{t-1}$
   $I_t = v(C_t - C_{t-1})$
   Let a = 5, g = 0.75, b = 0.05, w = 4 and v = 2. Does this specification of parameters warrant an explosive cycle? [12 Marks]
2. Define the following Business Cycles and Forecasting terms:
   a) Business Cycle [2 Marks]
   b) Recession [2 Marks]
   c) Forecast error [2 Marks]
   d) Random walk [2 Marks]

3. Discuss the business cycle theories [10 Marks]

4. State and explain the key elements of the four stages of business cycle theory [12 Marks]

5. Show that the autoregressive model can be inverted into the moving average model [8 Marks]

6. Given the AR(p) model,
   a) Derive the Yule Walker equations [11 Marks]
   b) For an AR(1) model with $\alpha_1 = 0.9$ and $\delta = 4$, plot the correlogram of the model [9 Marks]
7. Given the business cycles model below
   $Y_t = C_t + I_t$
   $C_t = bY_{t-1}$
   $\frac{Y}{K_t} = a - cY_t$
   $\frac{\pi}{K} = \left(\frac{\pi}{Y}\right)\left(\frac{Y}{K}\right)$
   $I_t = r + p\left(\frac{\pi}{K_{t-1}} - \frac{\pi}{K_{t-2}}\right)$
   $\frac{\pi}{Y} = k$
   (a) What is the name of the business cycles model? [2 Marks]
   (b) Derive the reduced form of the business cycles model [10 Marks]

8. Given the MA(q) model
   a) Show that the mean is independent of time [2 Marks]
   b) Calculate
      i) Variance [3 Marks]
      ii) Covariance [4 Marks]
      iii) Auto-correlation [2 Marks]

c) For an MA(1) model with $\mu = 6$ and $\beta_1 = 0.9$, plot the Auto-Correlation Function (ACF) of the model [7 **Marks]**

End of paper

ADDITIONAL INFORMATION

i) *MA(q) model:*

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

ii) AR(p) model:

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

iii) Model:

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

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:

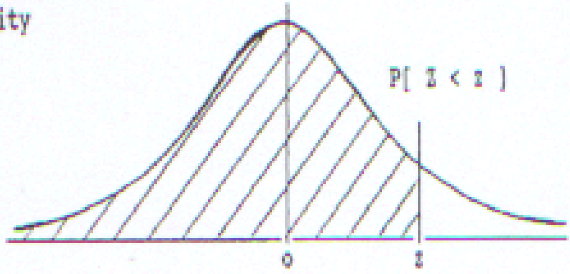
$$F = (n-k)\frac{(\sum v^2 - \sum w^2)}{q \sum w^2}$$

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