

**UNIVERSITY OF SWAZILAND
FACULTY OF SOCIAL SCIENCE
DEPARTMENT OF ECONOMICS**

SUPPLEMENTARY EXAMINATION: JULY 2007

**TITLE PAPER: QUANTITATIVE METHODS
COURSE CODE: ECON 205
TIME ALLOWED: THREE (3) HOURS**

INSTRUCTIONS:

- 1. Answer two questions from each section to make a total of four.**
- 2. Show all relevant workings to your answer.**
- 3. All questions carry a total of 25 marks**

SPECIAL REQUIREMENTS: CALCULATOR

**DO NOT OPEN THE QUESTION PAPER UNTIL INSTRUCTED TO
DO SO BY THE INVIGILATOR**

SECTION A

QUESTION 1

The following is the general macroeconomic model for a closed economy with no external sector:

$$\begin{aligned} Y &= C + I + G \\ C &= a + bY^d && \text{(Consumption)} \\ I &= \gamma + \epsilon i && \text{(Investment)} \\ Y^d &= Y - T && \text{(Disposable income)} \\ T &= \beta + tY && \text{(Taxation)} \\ M_d &= \sigma + hY + ki && \text{(Demand for Money)} \\ M_s &= M_0 \end{aligned}$$

Where the values of the parameters are: $a = 150$, $b = 0.6$, $\gamma = 1150$, $\epsilon = -58$, $\sigma = 1850$, $H = 0.7$, $k = -77$, $\beta = 30$, $t = 0.3$, $G = 1160$, $I = 815.95$, $M_0 = 3950$

- Algebraically determine the expressions for IS and LM curve. (15 marks)
- Determine the equilibrium value of income and interest rate where commodity and money markets together are in equilibrium. (7 marks)
- Determine the value of government expenditure multiplier. (3 marks)

QUESTION 2

A firm assumes a cost function $C(Q) = Q(Q^2/10 + 200)$ and a revenue function $R(Q) = (2200 - 3Q)Q/2$, where Q is the monthly output.

- Determine the firm's break even point. (7 marks)
 - Find the output required per month to maximise profit, and find the profit at this level of output. (9 marks)
- Cholera, an intestinal disease, is caused by a cholera bacterium that multiplies exponentially by cell division as given approximately by:
$$N = N_0 e^{1.386t}$$
Where N is the number of bacteria present after t hours and N_0 is the number of bacteria present at the start ($t = 0$). If we start with 25 bacteria, how many bacteria (to the nearest unit) will be present in 3.5 hours? (5 marks)
- Suppose a firm expects from a certain project, a net return of E800 in the first year of initiation and net returns of E200, E700, E500, and E300 in succeeding 2nd, 3rd, 4th and 5th years. After the 5th year no returns are expected. What is the present value of the firm's returns assuming an interest of 5% per annum? (4 marks)

QUESTION 3

A publisher of books has the following production function:

$$40Q = 1800 - 4(x - 12)^2 - 3(y - 20)^2$$

where Q is the number of books published over the year, and x and y respectively are the amounts of labour and materials used. The price of the book is E500, and the costs per unit of inputs (under pure competition) are E200 for labour and E150 for materials.

- a) Using the method of Langrange, determine the optimum quantities of the two inputs. (18 marks)
- b) What is the effect on the solution if the price of the materials is raised to E225? (assume that the second order conditions are satisfied) (7 marks)

QUESTION 4

Write short explanatory notes on the following concepts:

- a) Type I and Type II errors in statistical inference.
- b) Correlation coefficient and coefficient of determination.
- c) The significance of the error term in model specification.
- d) The assumptions underlying the input - output model.
- e) The basic purpose of linear programming.

[5marks each]

SECTION B

QUESTION 5

a) A manufacturer of PVRs purchases a particular microchip, called the LS-24 from three suppliers: X, Y and Z. 30% of LS-24 chips are purchased from X, 20% from Y and 50% from Z. Through experience, the manufacturer knows that 3% of the chips from X are defective, 5% of the chips from Y are defective, and 4% of the chips from Z are defective. If one of the PVR manufacturing workers randomly selects a chip for installation in a PVR and finds it defective, what is the probability that it was purchased from Y? [7 marks]

b) Various problems arise in empirical econometrics. Several stem from the fact that in some situations certain of the assumptions of the Gauss-Markov theorem are not met. The least-squares estimators will therefore not necessarily be the best linear unbiased estimators (BLUE). Other problems involve the basic structure of the model. Mention and explain what these problems are. [18 marks]

QUESTION 6

a) Discuss the relative advantages and disadvantages of Laspeyres and Paasche price indices. [10 marks]

b) An investor holding shares of three companies in 2002 and 2005 is shown in the table below. The average price of these shares in each year is also given.

	2002	2002	2005	2005
Share	Price	Number of Shares	Price	Number of Shares
A	145	300	420	600
B	280	500	130	200
C	205	400	240	400

- Calculate the Laspeyres and Paasche price index numbers for the investor's holding shares with 2002 as base year. [10 marks]
- Explain why your results in part (i) differ? [5 marks]

QUESTION 7

Briefly explain the following concepts indicating their importance in econometric analysis:

- a) Autocorrelation
- b) Coefficient of determination (R^2)
- c) Multicollinearity
- d) Heteroscedasticity
- e) Error term (u)

[5 marks each]

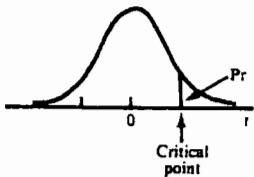
QUESTION 8

The input-output matrix for a two industry economy is expressed by the following table:

	INPUT TO		LEVEL OF OUTPUT
	INDUSTRY 1	INDUSTRY 2	
OUTPUT FROM			
INDUSTRY 1	300	800	2400
INDUSTRY 2	600	200	4000

- a) Determine the level of final demand which can be met by the two industries.
[5 marks]
- b) Determine the matrix of technology coefficients for the two industry economy.
[5 marks]
- c) If the level of final demand for the output of the two industries is 5000 units for industry 1 and 400 units for industry 2, at what level of output should the two industries operate?
[10 marks]

3. Student's t Critical Points



d.f. \ Pr	.25	.10	.05	.025	.010	.005	.001
1	1.000	3.078	6.314	12.706	31.821	43.657	318.31
2	.816	1.886	2.920	4.303	6.965	9.925	22.326
3	.765	1.638	2.353	3.182	4.541	5.841	10.213
4	.741	1.533	2.132	2.776	3.747	4.604	7.173
5	.727	1.476	2.015	2.571	3.365	4.032	5.893
6	.718	1.440	1.943	2.447	3.143	3.707	5.208
7	.711	1.415	1.895	2.365	2.998	3.499	4.785
8	.706	1.397	1.860	2.306	2.896	3.355	4.501
9	.703	1.383	1.833	2.262	2.821	3.250	4.297
10	.700	1.372	1.812	2.228	2.764	3.169	4.144
11	.697	1.363	1.796	2.201	2.718	3.106	4.025
12	.695	1.356	1.782	2.179	2.681	3.055	3.930
13	.694	1.350	1.771	2.160	2.650	3.012	3.852
14	.692	1.345	1.761	2.145	2.624	2.977	3.787
15	.691	1.341	1.753	2.131	2.602	2.947	3.733
16	.690	1.337	1.746	2.120	2.583	2.921	3.686
17	.689	1.333	1.740	2.110	2.567	2.898	3.646
18	.688	1.330	1.734	2.101	2.552	2.878	3.610
19	.688	1.328	1.729	2.093	2.539	2.861	3.579
20	.687	1.325	1.725	2.086	2.528	2.845	3.552
21	.686	1.323	1.721	2.080	2.518	2.831	3.527
22	.686	1.321	1.717	2.074	2.508	2.819	3.505
23	.685	1.319	1.714	2.069	2.500	2.807	3.485
24	.685	1.318	1.711	2.064	2.492	2.797	3.467
25	.684	1.316	1.708	2.060	2.485	2.787	3.450
26	.684	1.315	1.706	2.056	2.479	2.779	3.435
27	.684	1.314	1.703	2.052	2.473	2.771	3.421
28	.683	1.313	1.701	2.048	2.467	2.763	3.408
29	.683	1.311	1.699	2.045	2.462	2.756	3.396
30	.683	1.310	1.697	2.042	2.457	2.750	3.385
40	.681	1.303	1.684	2.021	2.423	2.704	3.307
60	.679	1.296	1.671	2.000	2.390	2.660	3.232
120	.677	1.289	1.658	1.980	2.358	2.617	3.160
∞	.674	1.282	1.645	1.960	2.326	2.576	3.090