NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF COMMERCE

DEPARTMENT OF BANKING

MSc BANKING AND FINANCIAL SERVICES-Part II

FINANCIAL ECONOMETRICS: CBA5206

DECEMBER 2007 EXAMINATION

DURATION: 3 HOURS

REQUIREMENTS:

- Statistical tables (to be provided)
- Electronic calculator (non programmable)
- Graph paper (to be provided)
- One-page list of formulae (to be stamped by Lecturer and given to students)

INSTRUCTIONS TO CANDIDATES

- This paper contains **SIX (6)** questions
- Candidates are advised to answer **FOUR (4)**questions

1. (a) Draw the flow diagram for the execution of a three phase simulation model. State the differences between a **B** and **C** activity. [5]

   (b) Discuss the methods that can be used when simulating a non-terminating system in a steady-state, to ensure that the initial bias is eliminated and the data satisfies the assumption of independence. Which method do you consider to be the most effective and why? [12]

   (c) Verification techniques in simulation include:

   i. structured walk-through,
   ii. diagnostic simulation runs,
   iii. comparison to a well understood problem,
   iv. trace analysis.

   Discuss how you would use each of these methods, and how they ensure that your model correctly represents the system you are trying to simulate. [8]

2. (a) Define research and distinguish between pure research and applied research. [3]

   (b) Outline the seven main stages that are encompassed by the research process stating the activities taking place at each stage. Hence comment of the importance of the preparatory phase. [9]

   (c) Focus Group Interview or Group Depth Interview is a loosely structured interview usually conducted by a trained moderator or interviewer on a small group of people (say 6 to 12) at the same time. Comment on the merits and demerits of this method in data/information collection. [13]

3. (a) Distinguish between Econometrics and Statistics, and also give areas of analysis in which they agree. [3]

   (b) Determine if the following process is stationary and/or invertible.

$$z_t - z_{t-1} = -0.4z_{t-1} + 0.1z_{t-2} + -0.8f_{t-1} - 0.3a_{t-1}.$$

   [5]

   (c) A stationary autoregressive model of order 1 had a mean of 10.0, an observation of 12 at time $t = 20$. The first three terms (ρ_1, ρ_2, ρ_3) of its ACF were $-0.650;\ 0.425;\ -0.255$. Calculate forecasts for $t = 21, 22$ and 23. [10]

   (d) Calculate the autocorrelation function of lag 1 for a stationary autoregressive process of order 3 using the Yule-Walker equations. Hence find ρ_1 given that $\phi_1 = 0.2;\ \phi_2 = -0.3$, and $\phi_3 = 0.0$. [7]

4. (a) The Octane number Y of refined petroleum is related to temperature X of the refining process, but it is also related to the particle size of the catalyst. An experiment with a small particle catalyst gave a fitted least squares line of

$$\hat{Y} = 9.36 + 0.155x,$$

with $n = 31$, $\text{var}(\hat{\beta}) = (0.0202)^2$ and $SSE = 2.04$.

An independent experiment with a large catalyst gave

$$\hat{Y} = 4.265 + 0.190x,$$

with $n = 11$, $\text{var}(\hat{\beta}) = (0.0193)^2$ and $SSE = 1.86$.

Test the hypothesis that the slopes are significantly different from zero using a 5% level of significance. [6]

(b) The data shown below were collected in an american psychology experiment to study if a wife's satisfaction with her marriage can be modelled as a function of her husband's income($000).

Income	Satisfaction	Income	Satisfaction
73	34	19	6
82	42	66	20
14	0	68	40
56	28	51	20
43	15	40	15
47	20	60	30
85	50	77	28
86	30	39	18
23	5	28	6
33	8	87	37

i. Draw a scatter diagram of satisfaction against income. [2]

ii. Assuming the simple linear regression model is an appropriate model relating satisfaction as a function of income, calculate the least squares estimates of the parameters of the model and fit the least squares regression line to the data. [4]

iii. Carry out an analysis of variance (ANOVA) at $\alpha = 0.05$ level of significance to test whether the slope is significantly different from zero. [8]

iv. From the ANOVA table in (c) compute the coefficient of determination ,R^2, and interpret it. [2]

v. Predict Mrs Apiah's satisfaction with her marriage if Mr Apiah's income is $84 thousand. Find the 95% confidence interval of the predicted value. [3]

5. ANOVA Bank is a new bank that is providing deposit facilities to different type of organisations. The deposit amount over the last month for four different types of organisations (Insurance company, Retail shop, Wholesaler and Charity organisation) was collected. Professor Mungo, a consultant with the bank, analysed the data using MINITAB and SPSS and obtained the following output. Using this output, answer the questions that follow.

One-way ANOVA: Deposit versus Organisation

Source	DF	SS	MS	F	P
Organisation	3	85.68	28.56	9.92	0.001
Error	12	34.56	2.88		
Total	15	120.24			

Descriptive Statistics Dependent Variable: Deposit

Organisation	Mean	Std.Dev	N
1	56.90	1.520	5
2	55.78	1.100	4
3	53.23	2.779	3
4	51.13	1.443	4
TOTAL	54.49	2.831	16

Test of Homogeneity of Variances
Deposit

Levence Statistics	df1	df2	Sig.
2.054	3	12	0.160

(a) Explain whether this experiment is modelled by a random effects or fixed effects model. [1]

(b) Write down the model for this design. [2]

(c) State the hypothesis being tested and make appropriate conclusions using the information from the MINITAB and SPSS output above. [5]

(d) Estimate the overall mean and treatment effects. [5]

(e) Find the 95% confidence interval for μ_3. [6]

(f) Using the Least Significant Difference (LSD) test the hypothesis that Organisation 1 (Insurance company) and Organisation 4 (Charity Organisation) have different mean deposits. [6]

6. (a) Consider the simplest form of a game called *craps*. In this game, a pair of dice is rolled. If on the first throw a 7 or 11 is rolled, a win is right away. If instead, a $2, 3$ or 12 is rolled, we lose right away. Any other total gives the player a second chance. In this part of the game, the player continues rolling the dice until he gets a 7 or a total of his first throw. If he gets a 7, he loses. If the player rolls the same total as first throw, he wins. Assuming the dice is fair, develop an experiment to determine the percentage of the time the player wins. Hence find the probability that the player wins in his fourth attempt (trial). [8]

   (b) The branch manager of New Era Bank wishes to develop a simulation model in order to help schedule jobs through the bank. He has evaluated the completion times for all the different types of jobs. For one particular job, the times to completion can be represented by the following exponential distribution:

$$F(x) = 1 - e^{-0.2x}, \qquad x > 0.$$

   Using the inverse transformation method, simulate four random values from the exponential distribution above using random values: 0.123; 0.680; 0.521 and 0.004. [10]

   (c) Given the Poison distribution

$$P(X = x) = e^{-2}\frac{2^x}{x!}, \qquad x = 0, 1, 2, ...$$

   Simulate 4 random numbers from the Poisson distribution using the random values: 0.824; 0.502; 0.004; and 0.153 [7]