Delhi School of Economics
Department of Economics

Entrance Examination for M. A. Economics
Option A (Series 01)
June 25, 2005

Time. 3 hours   Maximum marks. 100

General instructions. Please read the following instructions carefully.

• Check that you have a bubble-sheet accompanying this examination booklet. Do not break the seal on this booklet until instructed to do so by the invigilator.

• Immediately on receipt of this booklet, fill in your Name and Roll Number on the small slip attached to this booklet. Do not write this information anywhere else on this booklet.

• **Following the instructions on the bubble-sheet,** fill in the required information in Boxes 1, 2, 4, 5 and 6 on the bubble-sheet. The invigilator will sign in Box 3.

• This examination has two parts, 1 and 2. Part 1 is to be answered on the bubble-sheet, while Part 2 is to be answered in the blank space provided on this booklet itself.

• When you finish, hand in this booklet **and** the bubble-sheet to the invigilator.

• Do not disturb your neighbours at any time. **Anyone engaging in illegal examination practices will be immediately evicted and that person's candidature will be cancelled.**

Do not write below this line.
This space is for official use only.

Marks tally

Question	Marks
1	
2	
3	
4	
Total	

Fictitious Roll Number

Part 1

Instructions.

- Check that this booklet has pages 1 through 26. Also check that the bottom of each page is marked with *EEE 2005 A 01*.
- This part of the examination consists of 30 multiple-choice questions. Each question is followed by four possible answers, one of which is correct. Indicate the correct answer on the bubble-sheet, **not** on this booklet.
- **Each correct choice will earn you 2 marks. However, you will lose 1 mark for each incorrect choice. If you shade none of the bubbles or more than one bubble, you will get 0 for that question.**
- Use pages 21 through 26 of this booklet, marked **Rough work** to do your calculations, drawings, etc. Your "Rough work" will **not** be read or checked.
- This part of the examination will be checked by a machine. **Therefore, it is very important that you follow the instructions on the bubble-sheet.**

You may begin now. Good luck!

Answer 1, 2, 3 and 4 using the following information. *Consider a competitive exchange economy with two agents (1 and 2) and two goods (X and Y). Agent 1's endowment of (X, Y) is $(100, 100)$ and Agent 2's endowment of (X, Y) is $(50, 0)$. An allocation for Agent i is denoted (x_i, y_i), where x_i is his allocation of X and y_i is his allocation of Y. Agent 1's objective is to choose (x_1, y_1) to maximize his utility $\min\{x_1, y_1\}$. Agent 2's objective is to choose (x_2, y_2) to maximize his utility $x_2 + y_2$.*

1. An example of a competitive equilibrium allocation for this economy is
    (a) $(x_1, y_1) = (100, 50)$ and $(x_2, y_2) = (50, 50)$
    (b) $(x_1, y_1) = (125, 100)$ and $(x_2, y_2) = (25, 0)$
    (c) $(x_1, y_1) = (50, 50)$ and $(x_2, y_2) = (100, 50)$
    (d) $(x_1, y_1) = (100, 100)$ and $(x_2, y_2) = (50, 0)$

2. An example of a Pareto efficient allocation for this economy is
    (a) $(x_1, y_1) = (50, 50)$ and $(x_2, y_2) = (100, 50)$
    (b) $(x_1, y_1) = (125, 100)$ and $(x_2, y_2) = (25, 0)$
    (c) $(x_1, y_1) = (125, 75)$ and $(x_2, y_2) = (25, 25)$
    (d) $(x_1, y_1) = (50, 100)$ and $(x_2, y_2) = (100, 0)$

3. An example of a pair of competitive equilibrium prices (p_1, p_2) for this economy is

    (a) $(1, 0)$

    (b) $(0, 1)$

    (c) $(1/3, 2/3)$

    (d) $(2/3, 1/3)$

4. Suppose the government imposes a lump-sum tax of Rs. 50 on agent 1 and transfers the tax receipts as a lump-sum subsidy of Rs. 50 to agent 2. After this wealth transfer, an example of a competitive equilibrium for this economy is: prices $(p_1, p_2) = (1/2, 1/2)$ and allocation

    (a) $(x_1, y_1) = (100, 100)$ and $(x_2, y_2) = (50, 0)$

    (b) $(x_1, y_1) = (50, 50)$ and $(x_2, y_2) = (100, 50)$

    (c) $(x_1, y_1) = (0, 100)$ and $(x_2, y_2) = (150, 0)$

    (d) $(x_1, y_1) = (100, 0)$ and $(x_2, y_2) = (50, 100)$

Answer 5, 6, 7 and 8 using the following information. *Consider a Society consists of individuals. These individuals may belong to various sets called Clubs and/or Tribes. The collections of Clubs and Tribes satisfy the following rules:*

    • *The entire Society is a Club.*

    • *The empty subset of Society is also a Club.*

    • *Given a collection of Clubs, the set of individuals who belong to at least one of these Clubs is also a Club.*

    • *Given any two Clubs, the set of individuals who belong to both Clubs is also a Club.*

    • *A set of individuals is called a Tribe if and only if the set of individuals not in it constitute a Club.*

5. The union of two Tribes is necessarily

    (a) a Club

    (b) a Tribe

    (c) not a Club

    (d) not a Tribe

6. The intersection of a collection of Tribes is necessarily

    (a) not a Club

    (b) not a Tribe

    (c) a Club

    (d) a Tribe

7. Which of the following statements is necessarily true?

(a) A set of individuals cannot be a Tribe and a Club.

(b) There are at least two sets of individuals that are both a Club and a Tribe.

(c) The union of a Club and a Tribe is a Tribe.

(d) The intersection of a Club and a Tribe is a Club.

8. Suppose we are given a Club and a Tribe. Then, the set of individuals who belong to the given Club but not to the given Tribe necessarily constitute

(a) a Club

(b) a Tribe

(c) neither a Club, nor a Tribe

(d) a Club and a Tribe

Answer 9, 10, 11 and 12 using the following information. *Consider a Cournot duopoly with inverse market demand function $p = a - b(q_1 + q_2)$, where $a > 4$ and $b > 0$ are given constants, p is the market price and q_i is firm i's output. Suppose Firm 1's cost function is $C_1(q_1) = q_1$ and Firm 2's cost function is $C_2(q_2) = 2q_2$.*

9. In Cournot equilibrium, the outputs are

(a) $q_1 = a/3b$ and $q_2 = (a - 3)/3b$

(b) $q_1 = (a - 3)/3b$ and $q_2 = a/3b$

(c) $q_1 = 2a/3b$ and $q_2 = (2a - 3)/3b$

(d) $q_1 = (2a - 3)a/3b$ and $q_2 = 2a/3b$

10. If the market expands, as measured by an increase in parameter a, then

(a) The market share of the more efficient firm increases.

(b) The market share of the more efficient firm decreases.

(c) The market share of the more efficient firm is unchanged.

(d) The market share of the more efficient firm may increase or decrease.

11. Suppose, instead of choosing outputs simultaneously, Firm 1 chooses q_1 first and Firm 2 chooses q_2 after seeing q_1. As a result of this change, compared to the Cournot outcome,

(a) q_1 will decrease and q_2 will increase

(b) q_1 and q_2 will increase

(c) q_1 will increase and q_2 will decrease

(d) q_1 and q_2 will decrease

12. Suppose Firm 1 takes-over Firm 2 to become a monopolist. The new firm will

(a) produce 2/3 of the output in Plant 1 and 1/3 of the output in Plant 2.

(b) produce 1/3 of the output in Plant 1 and 2/3 of the output in Plant 2.

(c) divide the output equally between the two plants.

(d) produce nothing in Plant 2.

13. A number of mathematicians in the middle of the 20th century contributed to a series of books published in the name of a fictitious mathematician called Bourbaki. Suppose a sociological critic of science asserts "There exists a book by Bourbaki such that every chapter in that book contains a theorem whose validity depends on the reader's gender." If this assertion is false, which of the following assertions must be true?

(a) Every book by Bourbaki contains a chapter such that the validity of some theorem in that chapter is independent of the reader's gender.

(b) Every chapter in every book by Bourbaki contains a theorem whose validity is independent of the reader's gender.

(c) There exists a book by Bourbaki such that every chapter in it contains a theorem whose validity is independent of the reader's gender.

(d) Every book by Bourbaki contains a chapter such that the validity of all the theorems in it is independent of the reader's gender.

14. Consider Robinson Crusoe who has to allocate 24 hours between lying on the beach and climbing trees to gather coconuts. If L is the time spent lying on the beach and C is the number of coconuts Crusoe gathers, then Crusoe's utility is $\min\{L, C\}$. If Crusoe spends $x \leq 8$ hours climbing trees, then he earns x coconuts. If he spends $x > 8$ hours climbing trees, then he earns $8 + 3(x - 8)/2$ coconuts. How many hours should Crusoe spend climbing trees?

(a) 17.4

(b) 12

(c) 11.2

(d) 8

15. Consider Ms. Bijlee whose utility function is $\min\{E, W\}$, where E is her electricity consumption and W is her consumption of widgets. Suppose Ms. Bijlee's income is 10 and the prices of widgets and electricity are 1. In order to curb Ms. Bijlee's electricity consumption, the electricity company decides to impose a surcharge of Re. 1 on every unit of electricity consumed in excess of 4 units. What is the resulting reduction in Ms. Bijlee's electricity consumption?

(a) 1/4

(b) 1/5

(c) 1/3

(d) 1/6

16. Suppose four fair coins are tossed simultaneously. Suppose E is the event "the number of Heads strictly exceeds the number of Tails" and F is the event "the number of Tails strictly exceeds the number of Heads". What is the probability of the event $E \cup F$?

 (a) 5/8

 (b) 1/2

 (c) 3/4

 (d) 3/8

17. Suppose two dice are tossed simultaneously. What is the probability that the total number of spots on the upper faces of the two dice is not divisible by 2, 3 or 5?

 (a) 1/3

 (b) 2/9

 (c) 4/9

 (d) 7/16

18. A blood test to detect the presence of a certain disease successfully detects the disease in 99 out of every 100 patients who actually have the disease. But it falsely indicates the presence of the disease in 1 out of every 100 healthy persons. 1 percent of the population has the disease. The test is administered to a randomly selected person. What is the probability that she has the disease given that her test result is positive?

 (a) 2/3

 (b) 1/2

 (c) 3/4

 (d) 3/5

19. Suppose X and Y are independent random variables with standard Normal distributions. The probability of $X < -1$ is some $p \in (0, 1)$. What is the probability of the event: $X^2 > 1$ and $Y^3 < -1$?

 (a) $3p$

 (b) p^2

 (c) $2p^2$

 (d) $3p^2$

20. There are three identical boxes, each with two drawers. Box A contains a gold coin in each drawer. Box B contains a silver coin in each drawer. Box C contains a gold coin in one drawer and a silver coin in another drawer. A box is chosen, a drawer opened and a gold coin is found. What is the probability that the chosen box is A?

 (a) 2/3

(b) 1/3

(c) 1/2

(d) 3/4

21. Provided $c \neq 0$, the expression

$$\frac{\sum_{i=1}^{n}(c - x_i) - \sum_{i=1}^{n}(cy_i - x_i)}{c}$$

is identical to

    (a) $1 - n\bar{y}$

    (b) $n - n\bar{y}$

    (c) $n + n\bar{y}$

    (d) $1 + n\bar{y}$

22. If X, Y and Z are uncorrelated statistical variables with standard deviations 5, 12 and 9 respectively, and $U = X + Y$ and $V = Y + Z$, then the correlation coefficient between U and V is

    (a) 12/65

    (b) 144/288

    (c) 48/65

    (d) 144/169

23. A random variable has outcomes Success and Failure with probabilities 3/4 and 1/4 respectively. A gambler observes the sequence of outcomes of this variable and receives a prize of 2^n if n is the first time that Success occurs. What is the expected value of the gambler's prize?

    (a) 1

    (b) 2

    (c) 3

    (d) 4

24. The LM curve will shift to the

    (a) left if the price level falls and the quantity of money is held constant.

    (b) left if the price level is held constant and the quantity of money rises.

    (c) right if the price level falls and/or the quantity of money rises.

    (d) right if the price level rises and the quantity of money is held constant.

25. An increase in the price level will

    (a) decrease the real money supply and shift the aggregate demand curve.

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(b) change the slope of the aggregate demand curve at each income level.

(c) increase the real money supply and shift the aggregate demand curve.

(d) None of the above choices is correct.

26. The Life-Cycle-Permanent-Income hypothesis says that the marginal propensity to consume out of a permanent increase in income is close to _____ and close to _____ for a temporary increase in income

    (a) zero; one

    (b) one; zero

    (c) one; one

    (d) half; half

27. Keynes argued that monetary policy was ineffective during the Great Depression because

    (a) IS curve was vertical and stuck at a low level of income.

    (b) both the IS and the LM curves were vertical.

    (c) IS curve was continuously shifting, while the LM curve was vertical.

    (d) None of the above choices is correct.

28. In the Baumol-Tobin model of money demand, the income elasticity of money demand is _____ and the interest elasticity is _____.

    (a) $1; -1$

    (b) $1; 0$

    (c) $1/2; -1/2$

    (d) $0; 1$

29. The money multiplier is _____ in the reserve-deposit ratio and _____ in the cash-deposit ratio.

    (a) increasing; decreasing

    (b) decreasing; decreasing

    (c) decreasing; increasing

    (d) increasing; increasing

30. The desired stock of capital is _____ in the marginal product of capital and _____ in the expected future price of capital.

    (a) increasing; increasing

    (b) decreasing; increasing

    (c) increasing; decreasing

    (d) decreasing; decreasing

Part 2

Instructions. *This part of the examination consists of 4 questions.* **Each question is worth 10 marks; so budget approximately 18 minutes for each question.** *Answer each question in the space provided after that question.* **Do not** *use the space for Rough Work to write your answers; the Rough Work will not be read. Appropriate partial credit will be given for sub-parts of a question.*

Question 1. *Answer either (A) or (B).*

(A) Suppose population A is normally distributed with variance 25 and population B is normally distributed with variance 36. Suppose a sample from population A has mean $\bar{x}_A = 50$ and a sample from population B has mean $\bar{x}_B = 75$.

(a) What is the variance associated with the distribution of differences between means for samples of size 49?

(b) What is the variance associated with the distribution of differences between any two observations from population A?

(c) How will you test for the equality of the population means if the sample size from population A is 36 and from B is 49. Procedure and statistic only are required.

(B) Determine for each of the following statements whether it is true or false. In either case, briefly explain why it is so.

(a) Consider sampling at random from a normal population with unknown mean μ and unknown variance σ^2. A 95% confidence interval for μ based on a sample of size 20 will necessarily be shorter than a 95% confidence interval for μ based on a sample of size 10.

(b) The proportion of area beyond a specific value of t is more than the proportion of area beyond the corresponding value of z.

(c) In any hypothesis testing situation, the probability of making a type I error and the probability of making a type II error add to 1.

(d) If X is normally distributed with mean $\mu = 30$ and standard deviation $\sigma = 1$, and if $\bar{X}$ is the sample mean obtained from a random sample of size 16 of the variable X, then $\text{Prob}(\bar{X} \leq 29) = \text{Prob}(Z \leq -1)$ where Z is a standard normal variable.

(e) The slope of a regression relationship by itself, says nothing about the strength of the relationship of X and Y.

Question 2. *If labour demand depends on the marginal product of labour and labour supply on the real wage rate, what is the effect on output of an increase in the supply of money?*

Question 3. *Answer either (A) or (B).*

(A) Consider a country divided into a Rural market and an Urban market. A profit-maximizing telecom firm produces telecom services (voice and other data transmission) to meet the demands of both market segments. The telecom regulator (e.g., TRAI) has fixed the prices of such services and requires the firm to meet the entire Rural and Urban demands for these services at the set prices. Given the set prices, the Urban demand is 4 units of service and the Rural demand is 3 units.

Let U and R denote the firm's service outputs for the Urban and Rural markets respectively. Telecom services are produced using a fixed input x (e.g., network) and a variable input y (e.g., labour, spectrum, lease-line charges). The fixed input is common for both markets, but the firm can employ different amounts of the variable input for the two markets, say y_u for the Urban market and y_r for the Rural market. The relationship between the inputs and the output is $U = \sqrt{xy_u}$ for the Urban market and $R = \sqrt{xy_r}$ for the Rural market.

(a) Consider an old firm (e.g., BSNL) that has a given amount x of the fixed input. Derive this firm's cost function.

(b) Consider a new firm (e.g., Reliance) that is planning to enter the telecom business and is free to choose x and the variable input. Derive this firm's cost function.

(c) Given that the new firm must obey the regulator, what x will the firm choose?

(d) Does the answer to (c) change if the demand for telecom services is uniformly 3.5 units across both market segments? If so, what is the new value of x?

(B) Suppose there are three profit-maximizing firms who produce a homogeneous good at zero cost. The inverse demand function for this good is $p = 1 - q$, where p is the price and q is the total output produced by these firms. Suppose the firms choose their outputs sequentially, with Firm 1 choosing q_1 first, Firm 2 choosing q_2 next (having seen q_1) and Firm 3 chooses last (having seen q_1 and q_2).

If these firms behave rationally (i.e., act so as to maximize own profit) given their information and anticipate rational behaviour by their rivals, then what will be the outputs chosen by the firms?

(Hint: This is Stackelberg with an extra sequential follower thrown in!)

Answer.

Question 4. *Answer either (A) or (B).*

(A) Consider a differentiable function $f : \Re^2 \to \Re$ and a positive integer k. Show that: $f(tx) = t^k f(x)$ for every $x \in \Re^2$ and every $t > 0$ if and only if

$$x_1 \frac{\partial f}{\partial x_1}(x) + x_2 \frac{\partial f}{\partial x_2}(x) = k f(x)$$

for every $x \in \Re^2$.

(B) Suppose there are two dates: today and tomorrow. The state of the world tomorrow may be State 1, State 2 or State 3. Tomorrow's state is unknown today, i.e., State 1, State 2 and State 3 are the possible outcomes of a random variable.

Suppose Securities 1, 2 and 3 are traded today on financial markets. Security i is described by a vector $a^i = (a_{i1}, a_{i2}, a_{i3})$, where a_{ij} refers to the price tomorrow of Security i if State j occurs. Suppose the traded securities are $a^1 = (1,1,1)$, $a^2 = (1,3,-1)$ and $a^3 = (-2,-1,a_{33})$. A portfolio of the traded securities refers to a vector $x = (x_1, x_2, x_3)$, where x_i is the amount of Security i in the portfolio. (Note: Negative values of x_i are allowed as these are interpreted as "short sales".)

(a) Consider a mutual fund manager whose objective is to find a portfolio of the traded securities whose market value tomorrow will be **exactly** b_1, b_2 and b_3 in States 1, 2 and 3 respectively. For what values of a_{33} will it be the case that, for every $b = (b_1, b_2, b_3)$, there exists a portfolio (x_1, x_2, x_3) such that $b = x_1 a^1 + x_2 a^2 + x_3 a^3$.

(b) Suppose $a_{33} = 0$ and the prices today of Securities 1, 2 and 3 are 4, 1 and 5 respectively. Suppose a bank offers to the fund manager a new security that will tomorrow pay 3 in State 1, 1 in State 2 and 4 in State 3. What should be the price of the new security if the fund manager is to be prevented from making a profit by simply trading on the (old and new) securities markets?

Answer.