Delhi School of Economics
Department of Economics

Entrance Examination for M.A. Economics, June 28, 2008
Option A
Series 02

Time: 3 hours **Maximum marks: 100**

General Instructions: Please read carefully.

- Do not break the seal on this booklet until instructed to do so by the invigilator. Anyone breaking the seal prematurely will be evicted from the examination hall and his/her candidature will be cancelled.
- Immediately after you receive this booklet, fill in your Name and Roll Number in the designated space below.
- Check that you have a bubble-sheet accompanying this examination booklet. All questions are to be answered on the bubble sheet only, and the entire examination will be checked by a machine. **Therefore, it is very important that you follow the instructions on the bubble-sheet.**
- **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.
  - In Box 4, enter your roll number as a 4-digit number, e.g. 0123.
  - In Box 5, enter the category under which you wish to be considered, viz. SC (Scheduled Caste), ST (Scheduled Tribe), OBC (Other Backward Caste), PH (Physically Handicapped), AF (dependent of Armed Forces personnel killed or disabled in action), or Sports. All other candidates should enter GEN (General category).
  - In Box 6, enter 02 as your series number.
- Keep your admission ticket easily accessible for verification by the invigilators.
- For rough work (calculations, drawing etc.), use only the blank pages at the end of this booklet. The rough work will not be read or checked.
- When you finish, hand in this booklet **and** the bubble-sheet to the invigilator.
- Do not disturb or talk to your neighbours at any time. **Anyone engaging in illegal examination practices will be immediately evicted and that person's candidature will be cancelled.**
- Only after the invigilator announces the start of the examination, break the seal on this booklet and follow the instructions on Page 2.

Full Name _____

Roll Number _____

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PART I: One-mark questions

Instructions:

- First check that this booklet has pages numbered 1 through 24. Also check that the bottom of every page is marked AS02. Bring any missing pages to the attention of the invigilator.
- This part of the examination consists of 20 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 1 mark. *However, you will lose 1/3 mark for each incorrect choice.* If you shade none of the bubbles, or more than one bubble, you will get 0 for that question.
- You may begin now. Good luck.

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1. In the context of *ideal* price index numbers, consider the following statements:
   S1: The index number should be invariant to the choice of base, i.e. $P_{rs} * P_{sr} = 1$.
   S2: An index that satisfies the circularity condition $P_{rs} * P_{st} = P_{rt}$, $r \neq t$, need not satisfy S1.
   S3: If all prices change in the same proportion λ, then the index should equal λ.
   S4: If we change the units of measurement of the prices, but not those of the quantity weights, that should not affect the index.

   Given these statements, which of the following is true?
   (a) S1 and S2
   (b) S2 and S4
   (c) S1, S2, and S3
   (d) S1 and S3

2. Suppose that the probability that any particle emitted by a radioactive material will penetrate a given shield is .01. If ten particles are emitted, what is the probability that exactly one of the particles will penetrate the shield?

   (a) $(.01)(0.99)^9$
   (b) $(0.1)(0.99)^9$
   (c) 0.1
   (d) 1/9

3. Consider a symmetric 90% confidence interval for the population mean of a normal distribution with unknown variance, constructed using a random sample of 400 observations. Which of the following changes, ceteris paribus, would shorten the length of the confidence interval by the greatest amount?
   (a) The confidence level is changed to 99%.
   (b) The sample mean is half its original value.
   (c) The sample size is four times its original value.
   (d) The sample standard deviation is one third its original value.

4. Let A and B be any two events, each of which has a positive probability of occurring. Consider the following statements:

I. If A and B are independent, they must be mutually exclusive.
II. If A and B are mutually exclusive, they must be independent.
III. If A and B are independent, they cannot be mutually exclusive.
IV. If A and B are mutually exclusive, they cannot be independent.

Which of the above statements are true?
(a) I and IV.
(b) II and III.
(c) III and IV.
(d) None of the statements are true.

5. Consider a random variable X which can take on only nonzero integer values from −20 to +20, and whose probability distribution is symmetric around 0. Suppose the function $f(x)$, called the *probability mass function* of X, gives the probability that $X = x$, $\forall\, x = -20, \ldots, -1, 1, \ldots, 20$. Now consider the random variable $Y = X^2$. Which of the following would be an appropriate definition for $g(y)$, the probability mass function for Y?

(a) $g(y) = f(\sqrt{y})$ $\forall\, y = 1, 4, \ldots, 400$ and $g(y) = 0$ otherwise.
(b) $g(y) = [f(\sqrt{y})]^2$ $\forall\, y = 1, 4, \ldots, 400$ and $g(y) = 0$ otherwise.
(c) $g(y) = 2f(\sqrt{y})$ $\forall\, y = 1, 4, \ldots, 400$ and $g(y) = 0$ otherwise.
(d) $g(y) = \sqrt{f(\sqrt{y})}$ $\forall\, y = 1, 4, \ldots, 400$ and $g(y) = 0$ otherwise.

6. A consumer has a utility function $U(x, y) = 10(x^2 + 4xy + 4y^2) + 20$. Which one of the following statements must be true?
(a) The goods are imperfect substitutes
(b) The goods are perfect substitutes
(c) The goods are perfect complements
(d) None of the above.

7. Suppose a consumer has a utility function $U = \min\{x+y, 2y\}$. He maximizes his utility subject to his budget constraint and consumes $(x^*, y^*) = (3, 3)$. Which one of the following statements must be true?
(a) price of good x is necessarily equal to price of good y
(b) price of good x is double the price of good y
(c) price of good x is less than or equal to price of good y
(d) none of the above.

8. Suppose a monopolist sells his product in two separate markets. After the product is sold in one market, there is no possibility of it being resold in the other market. Which one of the following statements must be true?
(a) Prices in both markets must be equal when the marginal cost of output is constant.
(b) Price must be higher in the market with higher price elasticity of demand.
(c) Price must be higher in the market with lower price elasticity of demand.
(d) None of the above.

9. Consider a firm producing a single good with the cost function

$$C(x) = \begin{cases} 5, & \text{if } x = 0 \\ 10 + 10x, & \text{if } x > 0 \end{cases}$$

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This firm's sunk cost and fixed cost are respectively
(a) 10 and 10
(b) 10 and 0
(c) 0 and 10
(d) 5 and 10

10. The elasticity of substitution of the production function $f(x, y) = cx^a y^b$ is
(a) c/ab
(b) ab/c
(c) $a + b$
(d) 1

11. In the standard IS-LM framework if you introduce endogenous money supply such that money supply depends positively on the nominal rate of interest, the corresponding LM curve
(a) becomes steeper
(b) becomes flatter
(c) becomes horizontal
(d) remains unchanged

12. Consider a simple Keynesian model where equilibrium output is determined by aggregate demand. Investment is autonomous and a constant proportion of the income is saved. In this framework an increase in the savings propensity has the following effect:
(a) it leads to higher level of output in the new equilibrium
(b) it leads to lower level of output in the equilibrium
(c) the level of output in the new equilibrium remains unchanged
(d) the level of output in the new equilibrium may increase or decrease depending on the degree of increase in the savings propensity.

13. In the Solow model of growth, an increase in the savings propensity has the following impact:
(a) it leads to a higher steady state rate of growth
(b) it leads to a lower steady state rate of growth
(c) the steady state rate of growth remains unchanged
(d) the steady state rate of growth may increase or decrease depending on the degree of increase in the savings propensity.

14. If covered interest parity prevails between two countries,
(a) nominal interest rates of the two countries must be equal.
(b) expected currency depreciation must equal the interest rate differential.
(c) expected currency depreciation must equal the interest rate differential plus the risk premium.
(d) interest rate differential must equal the risk premium.

15. Which of the following constitute the "impossible trinity" which cannot be simultaneously ensured in an open economy?
1. Fixed exchange rate
2. Balance in the balance of payments
3. Free international capital mobility
4. Independent monetary policy
(a) 1, 2 and 3
(b) 1, 2 and 4
(c) 1, 3 and 4
(d) 2, 3 and 4

16. Consider the following two functions mapping points on the plane back to points on the plane.

(i) $f(x_1, x_2) = (x_1 + 1, x_2 + 1)$ and

(ii) $g(x_1, x_2) = (x_2, x_1)$.

Which of the above functions is a linear function?

(a) Both functions are linear.
(b) Neither function is linear.
(c) f is a linear function, g is not linear.
(d) g is a linear function, f is not linear.

17. Consider the equation $x^y + y^z + z^x = k$, defined for all positive values of x and y, and where k is a given positive constant. The partial derivative $\partial z / \partial x$ then equals

(a) $-(xz^{x-1} + y^z \ln y)/(yx^{y-1} + z^x \ln z)$
(b) $-(yx^{y-1} + z^x \ln z)/(xz^{x-1} + y^z \ln y)$
(c) $-(zy^{z-1} + x^y \ln x)/(xz^{x-1} + y^z \ln y)$
(d) $-(zy^{z-1} + z^z \ln z)/(xz^{x-1} + z^x \ln z)$

18. The derivative of the function defined by $f(x) = \sin^2 x + \cos^2 x$ is

(a) an increasing function of x
(b) an oscillating function of x
(c) a constant
(d) a decreasing function of x

19. Consider an n x n real matrix A with $n > 4$. Interchanging the positions of two columns

(a) will change the sign of det A
(b) will not change the sign of det A
(c) may or may not change the sign of det A, depending on the value of n
(d) may or may not change the sign of det A, depending on the positions of the two columns

20. Suppose we have a chair with n legs and it stands with all its legs touching the floor, regardless of the floor quality, i.e., evenness, smoothness, etc. Then, n is

(a) 2
(b) 3
(c) 4
(d) 5

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Part II: Two-mark questions

- This part of the examination consists of 40 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 2/3 mark for each incorrect choice.* If you shade none of the bubbles, or more than one bubble, you will get 0 for that question.

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21. The frequency distribution of variable X (monthly family expenditure in Rs. '000) for 100 households is as follows:

X	10 – 15	5 – 9.9999	2 – 4.9999	Below 2
No. of households	10	15	45	30

The median monthly family expenditure is in the range:
(a) Rs 2000 to 3000
(b) Rs 3000 to 4000
(c) Rs 4000 to 5000
(d) Rs 5000 to 6000

22. The frequency distribution of variable Y, the number of heads when two damaged coins are tossed, is:

Y	0	1	2
F(y)	0.3	0.45	0.25

To two decimal places, the mean and variance of Y (in that order) are:
(a) 0.95 and 0.50
(b) 0.50 and 0.95
(c) 0.95 and 0.55
(d) 0.95 and 0.45

23. For variables X and Y we have the data: $\Sigma XY = 350$, $\Sigma X = 50$, $\Sigma Y = 60$, $\overline{X} = 5$, $\sigma_X^2 = 4$, and $\sigma_Y^2 = 9$. Which of the following holds?
(a) A one unit change in X is associated with a 1.25 unit change in Y, and a one unit change in Y is associated with a 0.6 unit change in X.
(b) A one unit change in X is associated with a 0.6 unit change in Y, and a one unit change in Y is associated with a 1.25 unit change in X.
(c) The covariance between X and Y exceeds $\overline{Y}$
(d) The regression of Y on X passes through the origin.

24. The life of a cycle tyre is normally distributed with mean 350 days and variance 64. It is true that:
(a) The probability that the life of the tyre will be less than 336.84 days is greater than 5%
(b) The probability that the life of the tyre will be greater than 363.16 days is greater than 5%
(c) The probability that the life of the tyre will be between 336.84 and 363.16 days is 90%
(d) The probability that the life of the tyre will be less than 334.32 days is greater than 3%

25. In a random sample of 400 mangoes selected from a large consignment, 30 were found rotten. The null hypothesis is that the proportion π of rotten mangoes in the consignment is 10%. It is true that:
   (a) Given H_A: $\pi \neq 0.1$, we can't reject the null at the 1% level of significance, and the probability of error type I of this test is 0.005
   (b) Given H_A: $\pi < 0.1$, we reject the null at the 5% level of significance, and the probability of error type I of this test is 0.05
   (c) Given H_A: $\pi \neq 0.1$, we reject the null at the 10% level of significance, and the probability of error type I of this test is 0.1
   (d) If H_A: $\pi > 0.1$, the power of the associated test is higher than if H_A: $\pi < 0.1$

26. In a sample of 1000 mangoes, the mean weight of a mango is 210 g, and the standard deviation 9.5 g. In another sample of 1200 mangoes, the mean is 180 g and the standard deviation 11.5 g. Assume that the respective populations from which these samples are drawn have the same variances. Given the null hypothesis H_0: $\mu_1 - \mu_2 = 0$, where μ_1 and μ_2 are the population means, it is true that:
   (a) If H_A: $\mu_1 - \mu_2 \neq 0$, we reject the null hypothesis at the 15%, 13%, 12% and 8% levels of significance.
   (b) If H_A: $\mu_1 - \mu_2 \neq 0$, we do not reject the null hypothesis at the 1% level of significance.
   (c) The appropriate estimator for testing whether the samples are from essentially the same population is $\mu_1 - \mu_2$.
   (d) If H_A: $\mu_1 - \mu_2 \neq 0$, and we conduct a test at the 7% level of significance, the probability of error type I of this test is 0.035.

27. Data on India's exports of Jute and Tea for the years 2000-2003 are as follows:

	2000	2001	2002	2003
Jute				
Quantity ('000 t)	871	706	724	627
Price (Rs '00000/1000 t)	202	320	311	302
Tea				
Quantity ('000 t)	199	179	214	288
Price (Rs '00000/1000 t)	577	767	884	799

Which of the following are true?
   (a) The chain-base price indices with 2000 as base year are $\overline{P}_{01} = 146.3$, $\overline{P}_{02} = 152.2$, and $\overline{P}_{03} = 144.9$
   (b) The chain-base price indices with 2000 as base year are $\overline{P}_{01} = 148.3$, $\overline{P}_{02} = 152.2$, and $\overline{P}_{03} = 146.9$
   (c) The chain-base price indices with 2000 as base year are $\overline{P}_{01} = 148.3$, $\overline{P}_{02} = 154.2$, and $\overline{P}_{03} = 144.9$
   (d) The chain-base price indices with 2000 as base year are $\overline{P}_{01} = 148.3$, $\overline{P}_{02} = 156.2$, and $\overline{P}_{03} = 146.9$

28. Suppose that 80% of all statisticians are shy, whereas only 15% of all economists are shy. Suppose also that 90% of the people at a large gathering are economists and the other

10% are statisticians. If you meet a shy person at random at the gathering, what is the probability that the person is a statistician?
(a) 8/9
(b) 0.8
(c) .08
(d) 80/215

29. Each cell of the following table provides the probability of the joint occurrence of the corresponding pair of values of the random variables X and Y.

$X\downarrow$ $Y\rightarrow$	1	2	3	4
1	.1	0	.1	0
2	.3	0	.1	.2
3	0	.1	0	.1

Consider the following statements about X and Y :
I. $Pr(Y = 2) > Pr(X = 1)$
II. $Pr(Y = 1|X = 2) = Pr(Y = 1|X = 1)$
III. The events $X = 3$ and $Y = 3$ are mutually exclusive.
IV. X and Y are independent.
Which of the above statements are true?
(a) only I and II.
(b) only II and III.
(c) only III and IV.
(d) only II, III and IV.

30. A survey of asset ownership in poor households in rural UP and Bihar found that 40% of the households own a radio, 15% own a television and 60% own a bicycle. It also found that 5% of the households own both a radio and a television, 26% own both a radio and a bicycle, 5% own both a television and a bicycle, and 1% own all three. If a randomly selected poor household in these areas is found to own exactly one of these three assets, what is the probability that it is a bicycle?
(a) 20/23
(b) 17/23
(c) 15/23
(d) 12/23

31. Consider an exchange economy with two persons and two goods. Person 1's utility function is $u_1(x, y) = x + y$ and person 2's utility function is $u_2(x, y) = e^{x^2+y^2+2xy}$. Person 1's endowment is (1, 0) and person 2's endowment is (0, 1). Denote person 1's allocation by (x_1, y_1) and person 2's allocation by (x_2, y_2). The set of efficient allocations $((x_1, y_1), (x_2, y_2))$ is such that
(a) $(x_2, y_2) = (1 - x_1, 1 - y_1)$ for all $x_1, x_2 \in [0, 1]$
(b) $(x_2, y_2) = (1 - x_1, 1 - y_1)$ for all $x_1, x_2 \in (0, 1)$
(c) $(x_1, y_1) = (1/2, 1/2) = (x_2, y_2)$
(d) $(x_1, y_1) = (e^a, e^b)$ and $(x_2, y_2) = (1 - e^a, 1 - e^b)$ for all $a, b \in (-\infty, 0)$

32. Consider an exchange economy with persons 1 and 2 and goods x and y. Person 1's utility function is $u_1(x, y) = x^2y^2$ and person 2's utility function is $u_2(x, y) = e^{x+y}$. The total endowment of the economy is (2, 1). The allocation $(x_1, y_1) = (1, 1)$ and $(x_2, y_2) = (1, 0)$ is
(a) Pareto inefficient
(b) Pareto efficient or inefficient depending on the endowments of the two persons
(c) Pareto efficient or inefficient depending on the state of the world
(d) Pareto efficient

33. Consider the situation of the preceding question. If person 1's endowment is (1, 1) and 2's endowment is (1, 0), then the following allocation is a competitive equilibrium:
(a) $(x_1, y_1) = (3/2, 1/2)$ and $(x_2, y_2) = (1/2, 1/2)$
(b) $(x_1, y_1) = (1, 1)$ and $(x_2, y_2) = (1, 0)$
(c) $(x_1, y_1) = (2, 0)$ and $(x_2, y_2) = (0, 1)$
(d) $(x_1, y_1) = (2, 1)$ and $(x_2, y_2) = (0, 0)$

34. Consider the situation of the preceding question. Which of the following is an equilibrium price vector?
(a) $(p_1, p_2) = (1, 0)$
(b) $(p_1, p_2) = (0, 1)$
(c) $(p_1, p_2) = (1, 1)$
(d) none of the above

35. Consider an exchange economy with the same two agents and utility functions as the last three questions, but now the endowments of the two persons are (0, 1) and (2, 0). Which of the following pre-trade lump-sum transfers of wealth will lead to allocations $(x_1, y_1) = (1, 1)$ and $(x_2, y_2) = (1, 0)$ and prices $(p_1, p_2) = (1, 1)$ being a competitive equilibrium?
(a) subsidies of 1 to both persons
(b) taxes of 1 on both persons
(c) a subsidy of 1 to person 1 and a tax of 1 on person 2
(d) a subsidy of 1 to person 2 and a tax of 1 on person 1

36. There are 3 items of choice, x, y z, and Ms. A has 4 possible choice situations: in 3 of them, she is asked to choose one or more items from the 3 possible pairs of items $\{x, y\}$, $\{y, z\}$ and $\{x, z\}$. She chooses the items x, y, and z respectively in these 3 situations. In the 4th situation she must choose one or more items from the set $\{x, y, z\}$; we are not told directly what her choice is. Which of the following is correct?
(a) Ms A's choices violate the weak axiom of revealed preference.
(b) Ms A's choices are consistent with the weak axiom of revealed preference.
(c) We can't say (a) or (b) because we don't know her choice from the set $\{x, y, z\}$.
(d) We can't say (a) or (b), even though we can deduce her choice from the set $\{x, y, z\}$.

Questions 37-39 use the following information: *A chemical factory produces a chemical K and an effluent E which it dumps in a river. A downstream fishery produces fish F and its costs are affected by the level of effluent in the river. The two firms are competitive and face unit prices $P_K = 10$ and $P_F = 20$ for the chemical and the fish respectively. The cost function of the chemical factory is $C(K,E) = K^2[(5-E)^2 + 1]$. The cost function of the fishery is $\tilde{C}(F,E) = F^2E^2$.*

37. If the chemical factory chooses levels of chemical and effluent to maximize profits, and the fishery chooses the level of fish to maximize profits, the chosen levels of the chemical, effluent and fish (i.e. K,E,F) are respectively
(a) 5, 0, 5/8
(b) 3, 0, 2/5
(c) 5, 5, 2/5
(d) 5, 5, 5/8

38. Suppose the socially optimal levels of the chemical, effluent and fish, denoted by $\overline{K}, \overline{E}, \overline{F}$ respectively, are the levels that maximize the joint profit of an integrated firm consisting of the chemical factory and the fishery. Then $\overline{E}$ is equal to

(a) $5\overline{K}^2/(\overline{K}^2 - \overline{F}^2)$

(b) $5\overline{F}^2/(\overline{K}^2 + \overline{F}^2)$

(c) $5\overline{F}^2/(\overline{K}^2 - \overline{F}^2)$

(d) $5\overline{K}^2/(\overline{K}^2 + \overline{F}^2)$

39. Suppose a government knows the firms' production functions and their output prices, and can costlessly monitor the amount of effluent released by the chemical factory. If it sets a tax t per unit of effluent produced by the chemical factory, the level of this tax that will result in the socially optimal effluent level $\overline{E}$ is equal to

(a) $t = 10\overline{K}\overline{F}^2/(\overline{K}^2 + \overline{F}^2)$

(b) $t = 10\overline{K}^2\overline{F}^2/(\overline{K}^2 - \overline{F}^2)$

(c) $t = 10\overline{K}^2\overline{F}^2/(\overline{K}^2 + \overline{F}^2)$

(d) $t = 5\overline{K}\overline{F}^2/(\overline{K}^2 + \overline{F}^2)$

40. Consider a firm with one output and two possible choices of capital stock, say 1 and 2. The associated cost functions are $C(x, 1) = 2 + 2x$ and $C(x, 2) = 4 + x$. Before choosing its capital stock, the firm's cost function is

(a) $C^*(x) = \begin{cases} 2+2x, \text{ if } x \in [0,2] \\ 4+x, \text{ if } x > 2 \end{cases}$

(b) $C^*(x) = 2 + 2x$

(c) $C^*(x) = 4 + x$

(d) $C^*(x) = \begin{cases} 4+x, \text{ if } x \in [0,2] \\ 2+2x, \text{ if } x > 2 \end{cases}$

Questions 41 to 46 are related and share a common information set. The complete set of information is revealed gradually as you move from one question to the next.

Consider a macro-economy where the aggregate output in the short run is given by: $Y = AL^{\alpha}(\overline{K})^{1-\alpha}$, *where*

L *is the total employment of labour;*

$\overline{K}$ *is the total capital stock (which is fixed in the short run);*

and $A > 0$ *and* $0 < \alpha < 1$ *are parameters of the system.*

Let P and W denote the aggregate price level and the money wage rate respectively. Assume that the producers in the economy maximize profit in a perfectly competitive set up.

41. The corresponding demand for labour schedule as a function of the real wage rate is given by:

(a) $L^d = \left(\dfrac{Y}{A(\overline{K})^{1-\alpha}}\right)^{\frac{1}{\alpha}}$

(b) $L^d = \overline{K}(A\alpha)^{\frac{1}{1-\alpha}}\left(\frac{W}{P}\right)^{\frac{1}{\alpha-1}}$

(c) $L^d = \left(\frac{1}{A\alpha(\overline{K})^{1-\alpha}}\right)^{\frac{1}{\alpha}}\left(\frac{W}{P}\right)^{\frac{1}{1-\alpha}}$

(d) None of the above

42. If there is a one-shot increase in the stock of capital $(\overline{K})$, the demand for labour schedule, as derived above,
(a) shifts up
(b) shifts down
(c) does not shift
(d) the information available so far is not adequate to answer this question

Suppose the above economy is characterized by a single household which takes the aggregate price level and the money wage rate as given and decides on its consumption and labour supply by maximizing its utility subject to its budget constraint. The household has a total endowment of $\overline{L}$ units of labour time, of which it supplies L^s units to the market at the money wage rate W, and enjoys the rest as leisure. Its utility depends on its consumption and leisure in the following way: $U = (C)^\beta + \left(\overline{L} - L^s\right)^\beta$; $0 < \beta < 1$. The only source of income of the household is the wage income and it spends its entire wage earning in buying consumption goods at the price P.

43. The corresponding supply of labour schedule as a function of the real wage rate is given by:

(a) $L^s = \left(\frac{\overline{L}\left(\frac{W}{P}\right)^{\frac{\beta}{1-\beta}}}{1+\left(\frac{W}{P}\right)^{\frac{\beta}{1-\beta}}}\right)$

(b) $L^s = \frac{\overline{L}}{1+\left(\frac{W}{P}\right)^{\frac{\beta}{1-\beta}}}$

(c) $L^s = \left(\frac{\left(\frac{W}{P}\right)^{\beta}}{\overline{L}+\left(\frac{W}{P}\right)^{\beta}}\right)$

(d) None of the above

44. If there is an exogenous increase in the total endowment of labour time ($\overline{L}$), the supply of labour schedule, as derived above,

(a) shifts up
(b) shifts down
(c) does not shift
(d) the information available so far is not adequate to answer this question

45. Let $\alpha = \frac{1}{2}$; $\beta = \frac{2}{3}$; $\overline{K} = 10$; $\overline{L} = 10$; $A = 4$. Given these parameter values, the unique non-negative equilibrium value of real wage rate that clears the labour market is given by:

(a) $\frac{W}{P} = \left[\frac{1}{2\sqrt{2}}\right]^{1/2}$

(b) $\frac{W}{P} = \left[\frac{1+\sqrt{2}}{2}\right]^{1/2}$

(c) $\frac{W}{P} = \left[2-2\sqrt{2}\right]^{1/2}$

(d) $\frac{W}{P} = \left[2+2\sqrt{2}\right]^{1/2}$

46. Given the labour demand and the labour supply schedule as derived above, the aggregate supply curve (output supplied as a function of the aggregate price level) is
(a) upward sloping
(b) downward sloping
(c) vertical
(d) horizontal

Questions 47 to 50 are related and share a common information set. The complete set of information is given below. Attempt all of them together.

Consider a closed economy where the general price level is exogenously fixed at $\overline{P}$. *The goods market clearing condition is given by:* $Y = C + I + G$, *where the consumption demand (C) is a function of the disposable income* $(Y - T)$ *such that* $C = c.(Y - T), 0 < c < 1$; *the investment demand (I) is a function of the real rate of interest (r) such that* $I = \overline{I} - d.r$, $d > 0$; *total tax revenue in the economy (T) is a function of the aggregate real income such that* $T = \tau.Y$, $0 < \tau < 1$; *and the government expenditure (G) is autonomous such that* $G = \overline{G}$. *The money market clearing condition is given by:* $\frac{M}{\overline{P}} = L$, *where supply of money (M) is exogenous such that* $M = \overline{M}$; *and the demand for real balances (L) is a function of the real income (Y) and the nominal interest rate (i) such that* $L = a.Y - b.i$, $a, b > 0$. *Finally, the nominal interest rate is the sum of the real rate of interest and the expected rate of inflation* (π^e) *such that* $i = r + \pi^e$.

Assume that the economy starts from an equilibrium situation where both the goods market and the money market clear.

47. In *ceteris paribus*, a unit increase in government expenditure has the following impact on the equilibrium income level:

(a) it **increases** by $\frac{1}{b[1-c(1-\tau)]+ad}$ units

(b) it **decreases** by $\frac{1}{b[1-c(1-\tau)]+ad}$ units

(c) it **increases** by $\frac{b}{b[1-c(1-\tau)]+ad}$ units

(d) it **decreases** by $\frac{b}{b[1-c(1-\tau)]+ad}$ units

48. In *ceteris paribus*, a unit increase in the expected rate of inflation has the following impact on the equilibrium value of the real interest rate:

(a) it **increases** by $\frac{[1-c(1-\tau)]}{b[1-c(1-\tau)]+ad}$ units

(b) it **decreases** by $\frac{a}{a[1-c(1-\tau)]+ad}$ units

(c) it **increases** by $\frac{b[1-c(1-\tau)]}{b[1-c(1-\tau)]+ad}$ units

(d) it **decreases** by $\frac{b[1-c(1-\tau)]}{b[1-c(1-\tau)]+ad}$ units

49. In *ceteris paribus*, a unit increase in the general price level has the following impact on the equilibrium value of the real interest rate:

(a) it **increases** by $\frac{\left[\overline{M}/(\overline{P})^2\right]}{b[1-c(1-\tau)]+ad}$ units

(b) it **decreases** by $\frac{\left[\overline{M}/(\overline{P})^2\right]}{b[1-c(1-\tau)]+ad}$ units

(c) it **increases** by $\frac{[1-c(1-\tau)]\left[\overline{M}/(\overline{P})^2\right]}{b[1-c(1-\tau)]+ad}$ units

(d) it **decreases** by $\frac{[1-c(1-\tau)]\left[\overline{M}/(\overline{P})^2\right]}{b[1-c(1-\tau)]+ad}$ units

50. Suppose we now allow the general price level to be flexible. Given the above characteristics of the macro-economy, the corresponding aggregate demand curve (output demanded as a function of the general price level) is
(a) upward sloping
(b) downward sloping
(c) vertical
(d) horizontal

51. Fix an m x n matrix A and an m-vector b. A condition that ensures the existence of a solution (an n-vector x) of the equation $Ax = b$ is
(a) det $A \neq 0$
(b) $m = n$
(c) the columns of A are linearly independent
(d) the rows of A are linearly independent

52. The real-valued function $f(x) = x^3$ is
(a) strictly convex
(b) strictly concave
(c) neither strictly concave nor strictly convex
(d) convex but not strictly convex

53. Consider the equation $Ax = 0$ where A is an n x n matrix such that $a_{ii} \neq 0$ for every $i \in \{1,....,n\}$ and $a_{ij} = 0$ whenever $i > j$. This equation has
(a) n distinct solutions
(b) an $n - 1$ dimensional vector space of solutions
(c) exactly one solution
(d) an n dimensional vector space of solutions.

54. There is a pile of 17 matchsticks on a table. Players 1 and 2 take turns in removing matchsticks from the pile, starting with Player 1. On each turn, a player has to remove a number of sticks that equals the square of a positive integer, such that the number of matchsticks that remain on the table equals some non-negative integer. The player who cannot do so, when it is his/her turn, loses. Which of the following statements is true?
(a) If Player 2 plays appropriately, he can win regardless of how 1 actually plays.
(b) If Player 1 plays appropriately, she can win regardless of how 2 actually plays.
(c) Both players have a chance to win, if they play correctly.
(d) The outcome of the game cannot be predicted on the basis of the data given.

55. If A is a set of real numbers, let g_A be the function such that $g_A(x) = 1$ if $x \in A$, and $g_A(x) = 0$ if $x \notin A$. With this notation, consider the infinite sequence of functions f_n, where $f_n(x) = n\, g_{[0,1/n]}(x)$ (i.e., n multiplied by $g_{[0,1/n]}(x)$) for all real numbers x and for each $n = 1, 2, 3 \ldots$. Then
(a) For every x, the sequence of numbers $(f_n(x))_{n=1}^{\infty}$ has a limit in the space of real numbers.
(b) $\lim_{n\to\infty} f_n(x)$ does not exist, for any x.
(c) When $\lim_{n\to\infty} f_n(x)$ exists, the actual limit depends on the x in question.
(d) $\lim_{n\to\infty} f_n(x)$ exists for all but a finite set of real numbers x.

56. Continuing with the sequence of functions above, we consider the sequence of real numbers $(\int f_n)_{n=1}^{\infty}$ (that is, the sequence of their integrals). This sequence of integrals is
(a) an increasing sequence
(b) a decreasing sequence
(c) a constant sequence
(d) an oscillating sequence

57. For each positive integer $a = 1, 2, 3, \ldots$, let S_a be the set of points lying on the curve $y = (1/x^a)$, for all positive real numbers x. Then the intersection of these sets over all a, (that is, $\bigcap_{a=1}^{\infty} S_a$) is
(a) a set with infinitely many points
(b) a set having a single point
(c) a set having exactly 2 points
(d) a set having more than 2, but a finite number of points

58. Which of the following two numbers is larger: e^{π} or π^{e}?
(a) e^{π}
(b) π^{e}
(c) they are equal
(d) it depends on the value of e

59. The function $f(x)=\begin{cases}\sin(1/x), & \text{if } x>0\\ a, & \text{if } x=0\end{cases}$
(a) is continuous or discontinuous at $x = 0$, depending on the value a
(b) is continuous at $x = 0$
(c) is discontinuous at $x = 0$
(d) is upper hemicontinuous at $x = 0$

60. Suppose v_1, v_2 and v_3 are three vectors in 3-dimensional space, and are linearly dependent. Then the vectors $v_1 + v_2$, $v_2 + v_3$, and $v_1 + v_3$
(a) are linearly independent
(b) may be linearly dependent
(c) are linearly dependent
(d) are linearly independent, except when one of the vectors is zero.

The remaining pages of this booklet are for your rough work, which will not be checked.

After you finish, hand in this booklet along with your bubble sheet to the invigilators before you leave the examination hall.

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