DU MPhil Phd in Economics

Topic:- ECO MPHIL S2

1) A student is answering a multiple-choice examination. Suppose a question has m possible answers. The student knows the correct answer with probability p. If the student knows the correct answer, she picks it with probability 1; otherwise, she picks randomly from the choices with probability 1/m each. Given that the student picked the correct answer, the probability that she knew the correct answer is

[Question ID = 5996]

1. mp/[1 + (m − 1)p] [Option ID = 23978]
2. mp/[1 + (1 − p)m] [Option ID = 23979]
3. p/[1 + (m − 1)p] [Option ID = 23980]
4. p/[1 + (1 − p)m] [Option ID = 23981]

Correct Answer :-

- mp/[1 + (m − 1)p] [Option ID = 23978]

2) A doctor testing a diagnostic tool for a rare disease wants to minimise the chance that the test will find a patient to be healthy when she is in fact sick (the null hypothesis being that the patient is healthy). The doctor should minimise the probability of

[Question ID = 5997]

1. Type I error, which would denote a false positive [Option ID = 23982]
2. Type II error, which would denote a false positive [Option ID = 23983]
3. Type I error, which would denote a false negative [Option ID = 23984]
4. Type II error, which would denote a false negative [Option ID = 23985]

Correct Answer :-

- Type I error, which would denote a false negative [Option ID = 23984]

3) A and B play a best-of-seven table-tennis match, i.e., the first to win four games will win the match. The two players are equally likely to win any of the games in the match. The probability that the match will end in 6 games is

[Question ID = 5998]

1. less than the probability that it will end in 7 games

   [Option ID = 23986]
2. equal to the probability that it will end in 7 games

   [Option ID = 23987]
3. greater than the probability that it will end in 7 games

   [Option ID = 23988]
4. None of these

   [Option ID = 23989]

Correct Answer :-

- equal to the probability that it will end in 7 games

  [Option ID = 23987]

4) What is the probability that at least one 6 appears when 6 fair dice are rolled?

[Question ID = 5999]

1. $(5/6)^6$ [Option ID = 23990]
2. 1/6 [Option ID = 23991]
3. $1 - (5/6)^6$ [Option ID = 23992]
4. 5/6 [Option ID = 23993]

Correct Answer :-

- $1 - (5/6)^6$ [Option ID = 23992]

5) A family has two children. Each child is a girl with probability 1/2. If at least one child is a girl, then the probability that both children are girls is

[Question ID = 6000]

1. 1/2 [Option ID = 23994]
2. 1/3 [Option ID = 23995]
3. 3/4 [Option ID = 23996]
4. 2/3 [Option ID = 23997]

Correct Answer :-

- 1/3 [Option ID = 23995]

6) In a roll of two fair dice, X is the number on the first die and Y is the number on the second die. Which of the following statements is true?

[Question ID = 6001]

1. X^2 and Y are independent random variables

   [Option ID = 23998]
2. X − Y and X + Y are dependent random variables

   [Option ID = 23999]
3. X^2 and Y^2 are independent random variables

   [Option ID = 24000]
4. All of these

   [Option ID = 24001]

Correct Answer :-

- All of these

  [Option ID = 24001]

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7) You have a single draw from a Bernoulli distribution. The maximum likelihood estimate of the probability of success p is
[Question ID = 6002]

1. 0 [Option ID = 24002]
2. 1 [Option ID = 24003]
3. either 0 or 1 [Option ID = 24004]
4. strictly between 0 and 1 [Option ID = 24005]

Correct Answer :-

- either 0 or 1 [Option ID = 24004]

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8) If X and Y are independent random variables with uniform distributions on the interval [0, 1], and Z = min{X, Y}, then Pr[Z < 0.5] equals

[Question ID = 6003]

1. 0.25

   [Option ID = 24006]
2. 0.5

   [Option ID = 24007]
3. 0.625

   [Option ID = 24008]
4. 0.75

   [Option ID = 24009]

Correct Answer :-

- 0.75

  [Option ID = 24009]

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9) A student has the opportunity to take a test at most thrice. The student knows that each time he takes the test, his score is an independent random draw from the uniform distribution on the interval [0, 100]. After learning his score on a test, the student can either stop and accept it as his official score, or he can discard the result and retake the test. If the student rejects his score twice and takes the test a third time, that score will be his official score. If his objective is to maximise his expected official score, the student will decide to be retested after the very first test if and only if his score is less than
[Question ID = 6004]

1. 50 [Option ID = 24010]
2. 62.5 [Option ID = 24011]
3. 75 [Option ID = 24012]
4. 87.5 [Option ID = 24013]

Correct Answer :-

- 50 [Option ID = 24010]

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10) 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 ∪ F ?
[Question ID = 6005]

1. 5/8 [Option ID = 24014]
2. 1/2 [Option ID = 24015]
3. 3/4 [Option ID = 24016]
4. 3/8 [Option ID = 24017]

Correct Answer :-

- 3/8 [Option ID = 24017]

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

[Question ID = 6006]

1. 3p

   [Option ID = 24018]
2. p^2

   [Option ID = 24019]
3. $2p^2$

   [Option ID = 24020]
4. $3p^2$

   [Option ID = 24021]

Correct Answer :-

- $2p^2$

  [Option ID = 24020]

12) A coin toss has possible outcomes H and T with probabilities 3/4 and 1/4 respectively. A gambler observes a sequence of tosses of this coin until H occurs. If the first H occurs on the n-th toss, then the gambler's prize is 2^n. The expected value of the gambler's prize is

[Question ID = 6007]

1. 1 [Option ID = 24022]
2. 2 [Option ID = 24023]
3. 3 [Option ID = 24024]
4. 4 [Option ID = 24025]

Correct Answer :-

- 3 [Option ID = 24024]

13) Let w = W/P be the real wage rate, where W is the nominal wage rate and P is the aggregate price level. The demand function for labour is D(w) = 1 − w and the supply function of labour is S(w) = w. If N is the employment level, then f(N) is the aggregate output. If the nominal wage adjusts to clear the labour market, then the aggregate supply curve is given by

[Question ID = 6008]

1. Y = P f(N) [Option ID = 24026]
2. Y = f(N) [Option ID = 24027]
3. Y = P f(1/2) [Option ID = 24028]
4. Y = f(1/2) [Option ID = 24029]

Correct Answer :-

- Y = f(1/2) [Option ID = 24029]

14) Suppose a consumer lives for two periods and chooses consumptions C_1 and C_2 to maximize utility

$$u(C_t) = \frac{\sigma}{\sigma - 1}(C_t^{\frac{\sigma-1}{\sigma}} - 1)$$

Future consumption is discounted by ρ. The intertemporal elasticity of substitution in consumption between the two periods is

[Question ID = 6009]

1. $(\sigma - 1)/\sigma$

   [Option ID = 24030]
2. σ

   [Option ID = 24031]
3. 1

   [Option ID = 24032]
4. $\sigma/(\sigma - 1)$

   [Option ID = 24033]

Correct Answer :-

- σ

  [Option ID = 24031]

15) Suppose the economy-wide union sets wage for employed workers by $W = P^e(Z - \alpha u)$ with unemployment rate u and labor force of the economy L. The producer levies price over wage W with mark-up m as $P = (1 + m)W$. If each employed

worker produces one unit of output Y, then the aggregate supply function is

[Question ID = 6010]

1. $P = P^e(1+m)(Z-\alpha+\alpha Y/L)$

   [Option ID = 24034]
2. $P = -P^e(1+m)(Z-\alpha+\alpha Y/L)$

   [Option ID = 24035]
3. $P = -P^e(1+m)(Z-1+\alpha Y/L)$

   [Option ID = 24036]
4. $P = P^e(1+m)(Z-1+\alpha Y/L)$

   [Option ID = 24037]

Correct Answer :-

- $P = P^e(1+m)(Z-\alpha+\alpha Y/L)$

  [Option ID = 24034]

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16) Which of the following would make the LM curve flatter in the (Y, r) space?

[Question ID = 6011]

1. An increase in income sensitivity of money demand

   [Option ID = 24038]
2. An increase in interest sensitivity of planned investment

   [Option ID = 24039]
3. An increase in the marginal propensity to consume

   [Option ID = 24040]
4. An increase in the interest sensitivity of money demand

   [Option ID = 24041]

Correct Answer :-

- An increase in the interest sensitivity of money demand

  [Option ID = 24041]

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17) In the Mundell-Fleming model with fixed exchange rates and perfect capital mobility, an increase in government spending will lead to

[Question ID = 6012]

1. a deterioration in the trade balance [Option ID = 24042]
2. an improvement in the trade balance [Option ID = 24043]
3. no change in the trade balance [Option ID = 24044]
4. an increase in export without affecting imports [Option ID = 24045]

Correct Answer :-

- a deterioration in the trade balance [Option ID = 24042]

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18) Suppose that the mark-up over cost is 25% for a representative firm in an economy with labour being the single factor; and the wage-setting equation is $W = P(1-u)$ (where, u = the unemployment rate, P = Price and W = wage rate). Then the natural rate of unemployment is:

[Question ID = 6013]

1. 20%

   [Option ID = 24046]
2. 17%

   [Option ID = 24047]
3. 13%

   [Option ID = 24048]
4. 10%

   [Option ID = 24049]

Correct Answer :-

- 20%

  [Option ID = 24046]

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19) Assume that the aggregate production of an economy is $Y_t = \sqrt{K_t L_t}$ where $K_{t+1} = (1-\delta)K_t + S_t$, $S_t = sY_t$ and $L_t = L$ (i.e., the notation and meanings correspond to the setting for the Solow Model with constant population). Then, the savings rate s that maximizes the steady state level of *per capita* consumption equals

[Question ID = 6014]

1. δ/(1 + δ)

   [Option ID = 24050]
2. 1/2

   [Option ID = 24051]
3. 1/(1 + δ)

   [Option ID = 24052]
4. None of these

   [Option ID = 24053]

Correct Answer :-

- 1/2

  [Option ID = 24051]

20) A consumer lives for periods 1 and 2. Her lifetime utility function is

$U(c_1, c_2) = u(c_1) + u(c_2)/(1+\rho)$.

She earns w_1 and w_2 in the two periods, and her consumptions c_1 and c_2 satisfy a lifetime budget constraint

$c_1 + c_2/(1+r) = w_1 + w_2/(1+r)$

Let $u(c_t) = {c_t}^{1-\sigma}/(1-\sigma)$ for $t = 1, 2.$ If $r \geq \rho$, then

[Question ID = 6015]

1. $c_1 \geq c_2$

   [Option ID = 24054]
2. $c_1 \leq c_2$

   [Option ID = 24055]
3. $c_1 = c_2$

   [Option ID = 24056]
4. None of these

   [Option ID = 24057]

Correct Answer :-

- $c_1 \leq c_2$

  [Option ID = 24055]

21) Consider the Solow model with a positive savings rate, positive population growth rate, and positive rate of depreciation. Let k^* be the steady state capital-labour ratio.

Suppose k_1 and k_2 are capital-labour ratios such that $k_1 < k_2 < k^*$. Let g_1 and g_2 be the growth rates of per capita output at k_1 and k_2 respectively. Then

[Question ID = 6016]

1. $g_1 > g_2$

   [Option ID = 24058]
2. $g_1 = g_2$

   [Option ID = 24059]
3. $g_1 < g_2$

   [Option ID = 24060]
4. None of these

   [Option ID = 24061]

Correct Answer :-

- $g_1 > g_2$

  [Option ID = 24058]

22) Consider a small open economy with perfect capital mobility. If there is a positive productivity shock in the economy, then

[Question ID = 6017]

1. There will be net capital inflow [Option ID = 24062]
2. There will be net capital outflow [Option ID = 24063]
3. Net capital inflow is zero [Option ID = 24064]
4. Investment demand will fall [Option ID = 24065]

Correct Answer :-

- There will be net capital inflow [Option ID = 24062]

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23) Consider the game

$$\begin{array}{c} \\ U \\ M \\ D \end{array} \begin{array}{c} \begin{array}{ccc} L & M & R \end{array} \\ \begin{pmatrix} 2,0 & 3,3 & 0,0 \\ 1,-1 & 0,0 & 1,0 \\ 4,-4 & 2,2 & 1,1 \end{pmatrix} \end{array}$$

where the row player's payoff is given first, followed by the column player's payoff. Which of the following statement is false?

[Question ID = 6018]

1. Row player has a weakly dominated strategy

   [Option ID = 24066]
2. Column player has a strictly dominated strategy

   [Option ID = 24067]
3. There is a Nash equilibrium of this game in which both players play weakly dominated strategies

   [Option ID = 24068]
4. There is a Nash equilibrium of this game in which the column player plays a strictly dominated strategy

   [Option ID = 24069]

Correct Answer :-

- There is a Nash equilibrium of this game in which the column player plays a strictly dominated strategy

  [Option ID = 24069]

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24) Consider the game

$$\begin{array}{c} \\ U \\ D \end{array} \begin{array}{c} \begin{array}{cc} L & R \end{array} \\ \begin{pmatrix} x,x & z,y \\ y,z & y,y \end{pmatrix} \end{array}$$

where the row player's payoff is given first, followed by the column player's payoff. This game has only one Nash equilibrium when

[Question ID = 6019]

1. $x > y > z$

   [Option ID = 24070]
2. $x < y < z$

   [Option ID = 24071]
3. $y > z > x$

   [Option ID = 24072]
4. $y = z = x$

   [Option ID = 24073]

Correct Answer :-

- $y > z > x$

  [Option ID = 24072]

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25) Voters arrive at a social ranking of alternatives by consulting a 'holy book': the social ranking is the ranking found in this book. Which of Arrow's axioms defining an attractive preference aggregation method is violated by this method?

[Question ID = 6020]

1. Unrestricted domain [Option ID = 24074]
2. The Pareto principle [Option ID = 24075]
3. Independence of irrelevant alternatives [Option ID = 24076]
4. Non-dictatorship [Option ID = 24077]

Correct Answer :-

- The Pareto principle [Option ID = 24075]

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26) A monopolist firm first chooses an advertisement level θ at the cost $\theta^2/2$. Given θ, the firm faces the demand function $D(p) = \alpha + \theta - p$, where p is the price. The firm's cost function is $C(q) = cq$, where q is quantity. The firm sequentially chooses θ and q to maximize profit. Its maximized profit is

[Question ID = 6021]

1. $(\alpha - c)^2/2$

   [Option ID = 24078]
2. $(\alpha - c)^2/4$

[Option ID = 24079]

3. $(\alpha - \theta)^2$

[Option ID = 24080]

4. $(\alpha - c - \theta)^2/4$

[Option ID = 24081]

Correct Answer :-

- $(\alpha - c)^2/2$

[Option ID = 24078]

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27) Consider an exchange economy with two agents, 1 and 2, and two goods, X and Y. Each agent's consumption set is $\Re^2_+$. Given bundles (a,b) , $(c,d) \in \Re^2_+$ such that $(a,b) \geq (c,d)$ and $(a,b) \neq (c,d)$, agent 1 strictly prefers (a,b). (In any commodity bundle, the first entry is a quantity of X and the second one is a quantity of Y.)

Consider the following claims: In a competitive equilibrium for this economy,

I. Both prices must be positive, and

II. The sum of the allocations to 1 and 2 must equal the sum of their endowments

Which of the following statements is correct?

[Question ID = 6022]

1. I and II are true

[Option ID = 24082]

2. I and II are false

[Option ID = 24083]

3. I is true, but II is false

[Option ID = 24084]

4. I is false, but II is true

[Option ID = 24085]

Correct Answer :-

- I and II are true

[Option ID = 24082]

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28) Consider the following game. Player 1 moves first and chooses L or R. If she plays R, the game ends and the payoffs are (10, 0). If she plays L, then player 2 moves and chooses either L or R. If he plays R, the game ends and the payoffs are (0, 20). If he plays L, then player 1 moves and chooses either L or R. The game ends in both cases. If player 1 chooses L, then the payoffs are (30, 30). If she chooses R, then the payoffs are (40, 0). This game

[Question ID = 6023]

1. has a subgame perfect equilibrium in which 2 plays L

[Option ID = 24086]

2. has three subgame perfect equilibria

[Option ID = 24087]

3. has a unique Nash equilibrium outcome

[Option ID = 24088]

4. has a unique Nash equilibrium

[Option ID = 24089]

Correct Answer :-

- has a unique Nash equilibrium outcome

[Option ID = 24088]

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29) Duopolist firms 1 and 2 sell a homogeneous good in a market with demand function $Q = 100 - 2P$, where Q is the quantity demanded at price P. Firms 1 and 2 have constant marginal costs of 0 and 30 respectively. The firms simultaneously announce prices and consumers buy from the firm whose price is lower. If the firms choose the same price, all the consumers buy from firm 1. Firm 1's equilibrium price is

[Question ID = 6024]

1. 0

[Option ID = 24090]

2. 20

[Option ID = 24091]

3. 25

[Option ID = 24092]

4. 30

[Option ID = 24093]

Correct Answer :-

- 25

[Option ID = 24092]

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30) A monopolist can produce a good in two factories with individual cost functions $c_1(q_1) = 9q_1^2$ and $c_{2(}q_{2)} = 18q_2^2$ respectively, where q_1 and q_2 are the outputs in factories 1 and 2. Let $q = q_1 + q_2$ denote the monopolist's total output. The monopolist's cost function $c(q)$ is given by

[Question ID = 6025]

1. $6q^2$

[Option ID = 24094]

2. $9q^2$

[Option ID = 24095]

3. $\frac{27}{2}q^2$

[Option ID = 24096]

4. $18q^2$

[Option ID = 24097]

Correct Answer :-

- $6q^2$

[Option ID = 24094]

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31) A monopolist with unknown cost function faces the demand function $Q = 90 - 3P$. Which of the following choices of output cannot be a profit maximising choice?

[Question ID = 6026]

1. 20

[Option ID = 24098]

2. 30

[Option ID = 24099]

3. 40

[Option ID = 24100]

4. 50

[Option ID = 24101]

Correct Answer :-

- 50

[Option ID = 24101]

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32) Persons 1, 2 and 3 have to divide 12 indivisible chocolates among themselves. Each person's preference is strictly increasing in chocolates. The procedure for dividing the chocolates is as follows. Person 1 proposes a division. Each person votes either $Y\,(Yes)$ or $N\,(No)$. If at least two persons vote Y, then the proposal is implemented. If not, then Person 1 is eliminated from the voting and Person 2 makes a proposal. Now, only persons 2 and 3 can vote Y or N. If at least one of them votes Y, then Person 2's proposal is implemented. Otherwise, Person 3 makes a proposal, which will be implemented.

What division of chocolates will occur from a subgame perfect equilibrium of this game?

(Assume that a person votes N if voting Y and N are expected to result in the same number of chocolates for that person.)

[Question ID = 6027]

1. 1 gets 12, 2 gets 0, 3 gets 0

[Option ID = 24102]

2. 1 gets 4, 2 gets 4, 3 gets 4

[Option ID = 24103]

3. 1 gets 11, 2 gets 1, 3 gets 0

[Option ID = 24104]

4. 1 gets 11, 2 gets 0, 3 gets 1

[Option ID = 24105]

Correct Answer :-

- 1 gets 11, 2 gets 0, 3 gets 1

[Option ID = 24105]

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33) Persons 1, 2 and 3 have to divide 12 indivisible chocolates among themselves. Each person's preference is strictly increasing in chocolates. The procedure for dividing the chocolates is as follows. Person 1 proposes a division. Each person votes either Y (Yes) or N (No). If at least two persons vote Y, then the proposal is implemented. If not, then Person 1 is eliminated from the voting and Person 2 makes a proposal.

Now, only persons 2 and 3 can vote Y or N. If both the remaining voters, 2 and 3, vote Y, then Person 2's proposal is implemented. Otherwise, Person 3 makes a proposal, which will be implemented.

What division of chocolates will occur from a subgame perfect equilibrium of this game?

(Assume that a person votes N if voting Y and N are expected to result in the same number of chocolates for that person.)

[Question ID = 6028]

1. 1 gets 12, 2 gets 0, 3 gets 0

   [Option ID = 24106]
2. 1 gets 4, 2 gets 4, 3 gets 4

   [Option ID = 24107]
3. 1 gets 11, 2 gets 1, 3 gets 0

   [Option ID = 24108]
4. 1 gets 11, 2 gets 0, 3 gets 1

   [Option ID = 24109]

Correct Answer :-

- 1 gets 11, 2 gets 1, 3 gets 0

[Option ID = 24108]

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34) Consider a country with two citizens, 1 and 2. The government is considering a scheme that will cost 100. The government does not know the true benefits of the scheme to the citizens, say B_1 and B_2, and must decide whether to implement the scheme on the basis of their reported benefits, say R_1 and R_2. It will implement the scheme if and only if $R_1 + R_2 \geq 100$. If it is implemented, the government will impose tax $100 - R_2$ on person 1 and tax $100 - R_1$ on person 2. Each citizen's reported benefit seeks to maximize the difference between her true benefit (known only to her) and the tax that must be paid if and only if the scheme is implemented. The optimal choices of R_1 and R_2 must be such that

[Question ID = 6029]

1. $R_1 > B_1$ and $R_2 > B_2$

   [Option ID = 24110]
2. $R_1 = B_1$ and $R_2 = B_2$

   [Option ID = 24111]
3. $R_1 < B_1$ and $R_2 < B_2$

   [Option ID = 24112]
4. Nothing systematic can be said about R_1 and R_2

   [Option ID = 24113]

Correct Answer :-

- $R_1 = B_1$ and $R_2 = B_2$

[Option ID = 24111]

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35) The market for good X has the demand function $x = 100 - 15p$. There are ten price-taking firms, each having a cost function $c(q) = q^2$, where q is the firm's own output. There is no new entry. Prices and costs are in terms of rupees per unit. The equilibrium price in this market is

[Question ID = 6030]

1. Rs. 20

   [Option ID = 24114]
2. Rs. 15

   [Option ID = 24115]
3. Rs. 10

   [Option ID = 24116]
4. Rs. 5

   [Option ID = 24117]

Correct Answer :-

- Rs. 5

[Option ID = 24117]

36) A sequence of real numbers (x_n) converges to x.

Consider the following claims:

(I) The sequence (x_{n+1}/x_n) converges to 1.

(II) The sequence $(x_n + x_{n+1})$ converges to $2x$

[Question ID = 6031]

1. Only Statement I is correct

   [Option ID = 24118]
2. Only statement II is correct

   [Option ID = 24119]
3. Both the statements are correct

   [Option ID = 24120]
4. None of the statements is correct

   [Option ID = 24121]

Correct Answer :-

- Both the statements are correct

[Option ID = 24120]

37) Let $\Re$ be the set of real numbers and let D be the set of functions $d: \Re \times \Re \to \Re$ that satisfy the following properties for all $x, y, z \in \Re$:

- $d(x, y) \geq 0$
- $d(x, y) = 0$ **if and only if** $x = y$
- $d(x, y) = d(y, x)$
- $d(x, z) \leq d(x, y) + d(y, z)$

Which of the following is not a function in D?

[Question ID = 6032]

1. $d(x, y) = |x - y|$

   [Option ID = 24122]
2. $d(x, y) = \begin{cases} 0, & \text{if } x = y \\ 1, & \text{otherwise} \end{cases}$

   [Option ID = 24123]
3. $d(x, y) = \min\{|x - y|, 1\}$

   [Option ID = 24124]
4. $d(x, y) = \begin{cases} 0, & \text{if } |x - y| \leq 1 \\ 1, & \text{otherwise} \end{cases}$

   [Option ID = 24125]

Correct Answer :-

- $d(x, y) = \begin{cases} 0, & \text{if } |x - y| \leq 1 \\ 1, & \text{otherwise} \end{cases}$

[Option ID = 24125]

38) Let $\Re$ be the set of real numbers and let $f : \Re \to \Re$ be a concave function.

Which of the following statements is correct?

[Question ID = 6033]

1. $-f$ must be concave

   [Option ID = 24126]
2. $|f|$ must be concave

   [Option ID = 24127]
3. $f \circ f$ (the composition of f with itself) must be concave

   [Option ID = 24128]
4. $f + f$ must be concave

[Option ID = 24129]

Correct Answer :-

- $f + f$ must be concave

[Option ID = 24129]

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39) The maximum value of $f(x,y) = (xy)^{1/2}$, subject to $|x| \geq |y|$ and $|x| + |y| \leq 1$, is

[Question ID = 6034]

1. 0.25

[Option ID = 24130]

2. 0.5

[Option ID = 24131]

3. 1

[Option ID = 24132]

4. 2

[Option ID = 24133]

Correct Answer :-

- 0.5

[Option ID = 24131]

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40) What is the largest set of real numbers on which the function $f(x) = (x^2 - 3x)/(x + 1)$ is negative?

[Question ID = 6035]

1. (1, 3)

[Option ID = 24134]

2. (0, 3)

[Option ID = 24135]

3. $(-\infty,-1) \cup (-1,3)$

[Option ID = 24136]

4. $(-\infty,-1) \cup (0,\ 3)$

[Option ID = 24137]

Correct Answer :-

- $(-\infty,-1) \cup (0,\ 3)$

[Option ID = 24137]

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41) Consider the function $f(x,y) = \begin{cases} xy/(x^2+y^2), & if\ (x,y) \neq (0,0) \\ 0 \quad , & if\ (x,y) = (0,0) \end{cases}$

[Question ID = 6036]

1. f is differentiable at $(0,0)$ and its partial derivatives are both 0 at $(0,0)$

[Option ID = 24138]

2. f is not differentiable at $(0,0)$ and its partial derivatives are both 0 at $(0,0)$

[Option ID = 24139]

3. f is differentiable at $(0,0)$ and its partial derivatives are not both 0 at $(0,0)$

[Option ID = 24140]

4. f is not differentiable at $(0,0)$ and its partial derivatives do not exist at $(0,0)$

[Option ID = 24141]

Correct Answer :-

- f is not differentiable at $(0,0)$ and its partial derivatives are both 0 at $(0,0)$

[Option ID = 24139]

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42) The coefficient of x^2 in $(1 + 3x + 3x^2 + x^3)^4$ is

[Question ID = 6037]

1. 36

[Option ID = 24142]

2. 66

[Option ID = 24143]

3. 16

[Option ID = 24144]

4. 86

[Option ID = 24145]

Correct Answer :-

- 66

[Option ID = 24143]

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43) Consider the set $A = \{(x,y) \in \Re^2 | x = 1, y \geq 1\} \cup \{(x,y) \in \Re^2 | x > 1\}$

[Question ID = 6038]

1. A is open in $\Re^2$

[Option ID = 24146]

2. A is closed in $\Re^2$

[Option ID = 24147]

3. A is open and closed in $\Re^2$

[Option ID = 24148]

4. A is neither open, nor closed in $\Re^2$

[Option ID = 24149]

Correct Answer :-

- A is neither open, nor closed in $\Re^2$

[Option ID = 24149]

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44) If $f: \Re \to \Re$ is a continuous function and E is a closed subset of $\Re$, then the set $\{x \in \Re | f(x) \in E\}$ is

[Question ID = 6039]

1. Open

[Option ID = 24150]

2. Closed

[Option ID = 24151]

3. Neither open, nor closed

[Option ID = 24152]

4. Open and closed

[Option ID = 24153]

Correct Answer :-

- Closed

[Option ID = 24151]

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45) For the function $f: \Re \to \Re$, given by $f(x) = x^4 - 4x^3 + 6x^2 - 4x + 1$, the point $x = 1$ is

[Question ID = 6040]

1. A local minimum

[Option ID = 24154]

2. A local maximum

[Option ID = 24155]

3. A point of inflection

[Option ID = 24156]

4. None of these

[Option ID = 24157]

Correct Answer :-

- A point of inflection

[Option ID = 24156]

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46) Consider the function f mapping points of the plane into the plane, defined by $f(x,y) = (x - y, x + y)$

The range of this function is

[Question ID = 6041]

1. The 45 degree line

[Option ID = 24158]

2. A ray through the origin but not the 45 degree line

[Option ID = 24159]

3. The entire plane

[Option ID = 24160]

4. The first and third quadrants

[Option ID = 24161]

Correct Answer :-

- The entire plane

[Option ID = 24160]

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47) Suppose $\{v_1, v_2, \ldots, v_n\}$ is a set of linearly dependent vectors, none of them being the zero vector. Suppose $c_1, c_2, \ldots, c_n$ are scalars, not all zero, such that $\sum_{i=1}^{n} c_i v_i = 0$. Then the minimum number of non-zero scalars is

[Question ID = 6042]

1. 1

[Option ID = 24162]

2. 2

[Option ID = 24163]

3. $n-1$

[Option ID = 24164]

4. Cannot be determined

[Option ID = 24165]

Correct Answer :-

- 2

[Option ID = 24163]

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48) Suppose $f: (-\infty, 0) \cup (0, \infty) \to \Re$ **satisfies** $f(xy) = f(x) + f(y)$ **for all** $x, y \in (-\infty, 0) \cup (0, \infty)$.

Consider the statements:

$f(1) = f(-1) = 0$ $\quad (A)$

$f(x) = f(-x)$ **for every** $x \in \Re \setminus \{0\}$ $\quad (B)$

[Question ID = 6043]

1. (A) is true and (B) is false

[Option ID = 24166]

2. (A) is false and (B) is true

[Option ID = 24167]

3. Both are true

[Option ID = 24168]

4. Both are false

[Option ID = 24169]

Correct Answer :-

- Both are true

[Option ID = 24168]

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49) Consider the function $f: \Re \to \Re$ **defined by** $f(x) = x^3 - 6x^2 + 11x - 6$.

Of the functions g_1, g_2, g_3**, defined as follows,** $g_1(x) = x - 2$, $g_2(x) = x - 3$, $g_3(x) = x - 4$ **, the functions that divide** $f(x)$ **without a remainder are**

[Question ID = 6044]

1. Only g_1

[Option ID = 24170]

2. Only g_1 and g_2

[Option ID = 24171]

3. Only g_2

[Option ID = 24172]

4. g_1, g_2 and g_3

[Option ID = 24173]

Correct Answer :-

- Only g_1 and g_2

[Option ID = 24171]

50) If B is an $n \times n$ real matrix and B^T is the transpose of B, then

[Question ID = 6045]

1. $B^T B$ is negative definite

   [Option ID = 24174]
2. $B^T B$ is positive definite

   [Option ID = 24175]
3. $B^T B$ is negative semidefinite

   [Option ID = 24176]
4. $B^T B$ is positive semidefinite

   [Option ID = 24177]

Correct Answer :-

- $B^T B$ is positive semidefinite

[Option ID = 24177]