2022
FUNDAMENTALS OF BUSINESS MATHEMATICS

Full marks : 80   Time : 3 hours

General instructions:
i)   *Approximately 15 minutes is allotted to read the question paper and revise the answers.*
ii)   *The question paper consists of 32 questions.*
iii)   *Marks are indicated against each question.*
iv)   *General choice has been provided in some questions.*
N.B: Check to ensure that all pages of the question paper is complete as indicated on the top left side.

1.   What is meant by subset?   **1**

2.   What is non singular matrix?   **1**

3.   Write the formula for finding A^{-1} **1**

4.   Who is a sleeping partner?   **1**

5.   What is meant by feasible region?   **1**

    Answer **any nine (9)** from the following questions: **9x4=36**

6.   Given a relation $R = \{(1,2),(2,3)\}$ on the set of natural numbers, add a minimum number of ordered pairs so that the enlarged relation is reflexive, symmetric and transitive.

7.   Write the four characteristics of a function.

8.   Using properties of determinant, prove that
$$\begin{vmatrix} \sqrt{21} + \sqrt{2} & \sqrt{5} & \sqrt{3} \\ 2 + \sqrt{42} & \sqrt{10} & \sqrt{6} \\ 3 + \sqrt{63} & \sqrt{7} & 3 \end{vmatrix} = 0$$

9.   If $A = \begin{bmatrix} 5 & 7 \\ 6 & 9 \\ 8 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 2 \\ 0 & 5 \\ 5 & 0 \end{bmatrix}$ *and* $C = \begin{bmatrix} 3 & 5 \\ 1 & 1 \\ 2 & 9 \end{bmatrix}$ find the matrix X such that *A-3B+X=C*

10. A shopkeeper has in stock 40 dozen notebooks, 30 dozen pens and 12 dozen pencils. If the selling prices are ₹20 per notebook, ₹10 per pen and ₹5 per pencil, find the total amount the shopkeeper will get after selling all the items in the stock (Apply Matrix Rule).

11. If a banker's gain on a bill due 4 months hence at 9% per annum is ₹75, find the true discount and the amount of bill.

12. What is the actual rate of interest which a banker gets for the money when he discount a bill legally due in 15 months at 5% per annum?

13. A trader supplies goods and receives cash as follows. On which date the balance in a lump sum should be paid so that there may be no loss to either party?

Goods supplied in 1941	Cash received in 1941
10th Feb. - ₹100	12th March - ₹50
18th March - ₹200	07th May - ₹100
08th May - ₹500	10th June - ₹200

14. Mr. Maharaj borrowed ₹5,000 on 15th January, 1985. He paid back ₹1,500 after 1 month, ₹1,600 after 3 months, ₹2,000 after 4 months and ₹500 after 5 months. Find the rate of interest.

15. How much 4% stock at 120 can be purchased by investing ₹48,000. What will be the income?

16. A man invests ₹6,750 partly in 4% stock at 90 and partly in 5% stock at 105. If his total income is ₹310, find how much he invests in each.

17. In a liquid mixture, 20% is water, and in another mixture, water is 25%. These two mixture are mixed in the ratio of 5:3. Find the percentage of water in the final mixture.

18. A shopkeeper mixes 20kg of vegetable ghee with 30kg of pure ghee and sells the mixture at ₹140 per kg and gains 10% thereby. Find the cost per Kg of pure ghee if the vegetable ghee costs him at ₹100 per kg.

Answer **any three (3)** from the following questions: **3x5=15**

19. Solve by Crammer's Rule
$$x - 3y + z = -1$$
$$2x + y - 4z = -1$$
$$6x - 7y + 8z = 7$$

20. A company produces 3 products every day. Their total production on a certain day is 45 tons. It is found that the production of third product exceeds the production of the first product by 8 tons while the total production of first and third products is twice the production of second product. Determine the production level of each product using Cramer's Rule.

21. Company A pays 6% dividend on share of ₹100 each, while company B pays 3½% dividend on share of ₹10 each. If the market values of the shares in A and B are ₹120 and ₹7.20 respectively per share, determine which of these gives a better return to the share holder. What difference does it make to one investing ₹80,500?

22. A man sold 5% stock of ₹8,000 at 110 and purchased 6% stock with sale proceeds. As a result, his early income increased by ₹40. What was the market price of 6% stock?

23. A dealer mixes sugar costing ₹19 per kg, ₹20 per kg and ₹25 per kg and sells the mixture at ₹20 and thereby losses 5% on sales price. In what proportion are they mixed?

24. A grocer sells one kind of pulse at ₹21 per kg and gains 5% and another at ₹22.50 per kg and losses 10%. How should they be mixed so that the mixture may be sold at ₹24.2 per kg at a profit of 10%?

Answer **any four (4)** from following questions: **4x6=24**

25. Out of 300 students in a college, 30 students speak all the 3 languages English, Nagamese and Hindi, 60 speak English and Nagamese, 90 speak Nagamese and Hindi, 75 speak English and Hindi, 36 speak English only, 15 speak Nagamese only and 24 speak Hindi only. How many students do not speak any of the 3 languages?

26. Out of 500 students in a school, 250 played cricket, 220 played football and 180 played volleyball, of the total 160 played both cricket and football,140 played cricket and volleyball, 110 played football and volleyball, 75 played all three games. How many students (i) did not play any game (ii) played only one game (iii) played only two games?

27. Find a matrix Q such that

$$Q \begin{bmatrix} 1 & -2 & 3 \\ 0 & 2 & -1 \\ -4 & 5 & 2 \end{bmatrix} = \begin{bmatrix} 1 & -2 & 3 \\ -4 & 5 & 2 \\ 0 & 2 & -1 \end{bmatrix}$$

28. Mr. Rao invested a total of ₹1,500 in 3 different savings accounts with annual rates of 5%,2% and 1%. The total amount yield from this investment is ₹38. If he invested equal amounts in the 5% and 1% accounts, how much amount would be yield from each investment? Use matrix algebra.

29. A, B, C and D formed a partnership and contributed ₹40,000, ₹36,000, ₹24,000 and ₹25,000 respectively.They agree to set aside 10% of profit in a year as reserve and distribute $66\frac{2}{3}$% of the balance equally among them. The remaining profit is divided as interest on respective capitals. If A receives in all ₹9,600 more than C in a year, find also share of profit earned in that year, find also the share of profit distributed to A and B in that year.

30. A, B and C are partners in a Business. A contributes $\frac{1}{3}^{rd}$ of the whole capital while B's share is twice that of C. At the end of 4 months, A withdraws half of his capital but refunds it at the end of next 4 months when B withdraws half of his capital. If C gets ₹4,800 out of the profits, then ascertain the share of the profits to which A and B are entitled.

31. Consider two different types of foodstuffs F_1 and F_2 assume that these food stuffs contain vitamin V_1, V_2 and V_3 respectively. Minimum daily requirements of these vitamins are 2mg of V_1, 3mg of V_2 and 6mg of V_3. Assume that these foodstuff F_1 contains 1mg of V_1, 3mg of V_2 and 4mg of V_3 whereas foodstuffs F2 contains 2mg of V_1, 1mg of V_2 and 3mg of V_3 cost of 1 unit of foodstuff F_1 is ₹4 and that of F_2 is ₹2. Find the minimum cost diet that would supply the body at least the minimum requirement of each vitamin.

32. The ABC company has been a producer of picture tubes for television sets and certain printed circuits for radios. The company has just expanded into full scale production and marketing of AM and AM-FM radios. It has built a new plant that can operate 48 hours per week. Productions of an AM radio in the new plant will require 2 hours and production of AM-FM radio will require 3 hours. Each AM radio will contribute ₹40 to profit while an AM-FM radio will contributes ₹80 to profits. The marketing department, after extensive research, has determined that a maximum of 15 AM radio and 10AM-FM radios can be sold each week.
  (i)   Formulate a linear programming model to determine the optimum production mix of AM-FM radios that will maximize profits.
  (ii) Solve the above problem using graphic method.

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