2019
FUNDAMENTALS OF BUSINESS MATHEMATICS

Full marks : 100   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 26 questions. All questions are compulsory.*
iii) *Marks are indicated against each question.*
iv) *Internal choice has been provided in some questions.*
N.B: Check that all pages of the question paper is complete as indicated on the top left side.

1. Define equivalence relation.   **1**

2. Write one property of determinants.   **1**

3. Define compound partnership.   **1**

4. Define banker's discount.   **1**

5. What is meant by a yield?   **1**

6. What is stamp duty?   **1**

7. Using set operations, find the HCF of three numbers 8, 12 and 20.   **4**

8. Of the 50 boarders of a hostel, 25 drinks milk, 20 drinks tea and 15 drinks neither milk nor tea. How many of them drink both?   **4**

9. Prove that $\begin{vmatrix} 0 & -2 & -3 \\ 2 & 0 & -5 \\ 3 & 5 & 0 \end{vmatrix} = 0$ by using properties of determinants.   **4**

10. Find A and B if: $A+3B = \begin{bmatrix} 2 & 3 \\ 5 & 6 \end{bmatrix}$ and $2A+5B = \begin{bmatrix} 1 & 3 \\ 1 & 0 \end{bmatrix}$ **4**

11. Find the matrix A if $AX = -2Y + 4Z$, where $X = \begin{bmatrix} 2 & 4 \\ -6 & -8 \end{bmatrix}$, $Y = \begin{bmatrix} 3 & 6 \end{bmatrix}$ and $Z = \begin{bmatrix} 6 & 7 \end{bmatrix}$ **4**

12. A, B and C started a business; A puts in ` 70,000,  B ` 80,000 and C ` 90,000. At the end of 4 months A left and 4 months  more C also left, both taking their capitals with them, but  the profits were not divided till the end of the year, when C left, D joined with  ` 95,000. If at the end of the year D gets ` 3,800 as profit, find what A, B and C will receive?   **4**

13. **a.** Mr.Atoka offers ` 305 cash for a cycle (old) and Mr. Hituka offers ` 327 for the same cycle to be paid after 18 months. Which is the better offer and by how much money being reconed at 6% per annum simple interest?

                                        Or   **4**

     b. The true discount of ` 1,147.50 due after some time is ` 22.50 at 3% per annum. When is the sum due?

14. **a.** How much 4% stock at 120 can be purchased by investing ` 48,000? What will be the income?

                                        Or   **4**

     b. What amount of stock can be obtained by investing ` 30,800 in 5% stock at 120, brokerage being 1/5 % and stamp duty 3%?

15. **a**. A person sell ` 8,000, 5% stock at 98 and invest the proceed in 6% stock at 105. Find the change in his income.

                                        Or   **4**

     b. Company A pay 6% dividend on share of ` 100 each, while company B pays 3.5% 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 shareholder. What difference does it make to one investing ` 80,500?

16. **a**. Write any four applications of linear programming.

                                        Or   **4**

     b. Write any four advantages of linear programming.

17. **a**. In what ratio should the two types of rice costing ` 8 per kg and ` 15 per kg be mixed so as to gain 20% by selling the mixture at ` 12 per kg?

                                        Or   **4**

     b. In what ratio should three varieties of wheat costing ` 12 per kg , ` 16 per kg and ` 20 per kg be mixed so that the mixture cost ` 17 per kg?

18. **a.** Let A={-2,-1,0,1,3,5} and B={-2,0,7,10,28}and the function $f : A \rightarrow B$ is defined by $f(x) = x^2 + x - 2, x \in A$. Find the range of f. Is f an onto function?

                                        Or   **5**

b. If $f(x) = \dfrac{2x+1}{2x^2+1}$ and $\phi(x) = 2f(2x)$, then show that $\phi(2.5) = \dfrac{22}{51}$ and also find $\phi\left(\dfrac{1}{2}\right)$.

19. **a.** Prove that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc + ab + bc + ca$,

by using properties of determinants.

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Or   **5**
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b. Solve by Cramer's rule $\begin{array}{c} 2x_1 - 4x_2 + 3x_3 = 3 \\ 4x_1 - 6x_2 + 5x_3 = 1 \\ -2x_1 + x_2 - x_3 = 1 \end{array}$

20. **a.** A, B and C are partners in a partnership firm. A gives ` 3,000 more than B and B gives ` 2,000 more than C. A's contribution was ` 10,000. But A had contributed only for 3 months; B for 6 months and C for 8 months. The profit made by the firm was ` 5,600. Find their respective shares if the profit was to be distributed on the basis of their capital contributions.

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Or   **5**
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b. A, B and C start a business, A putting ` 2,000 and they agree to share the profits pro-rata: A withdraws his capital after 3 months, B after 5 months and C after 6 months. At the end of the year A got as his share of $\frac{1}{3}^{rd}$ of the total profits and B received $\frac{1}{4}^{th}$ and C the remaining balance. Find the contribution of B and C in the business.

21. **a.** A dealer bought goods of the following amounts on the stated date, two months being allowed in each case for payments:
    ` 2,500 on March 10$^{th}$, ` 2,680 on April 25th, ` 4,300 on May 4th and
    ` 3,000 on June 22$^{nd}$. He paid ` 7,000 on June 20th. On what date would the balance amount be an equitable settlement of his account?

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Or   **5**
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b. Mr.K has accepted the following bills:
    ` 4,500 drawn on 1st September, 2000 at 3 months after date
    ` 7,000 drawn on 3rd October, 2000 at 2 months after date
    ` 3,250 drawn on 11th November, 2000 at 1 month after date
    ` 8,000 drawn on 17th November, 2000 at 4 months after date.
    He wants to retire the bills under rebate at 10% per annum on 15th October, 2000. What funds does he require for the purpose?

22. **a**. In a class of 330 students, the following number of students were found studying different subjects:
Economics 200, Mathematics 150, Statistics 90, Economics and Mathematics 60, Economics and Statistics 50, Mathematics and Statistics 45, Economics, Mathematics and Statistics 35.
Find the number of students
i) Who has enrolled in Mathematics alone?
ii) Who has enrolled in Statistics alone?
iii) Who has not offered any of the 3 subjects?
iv) Who has enrolled only in one subject?

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Or   6
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   b. 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 the three games. How many students
i) did not play any game?
ii) played only one game?
iii) played two games?

23. **a**. In a certain country, there are 20 head post offices and 2,000 sub- post offices. Each office has 1 cashier, 1 head clerk, 2 clerk. Each head post office in addition has 1 accountant, 1 clerk,1 peon. The monthly salary of each of them is as follows: head clerk ` 8,000, accountant ` 7,000, cashier ` 5,000, clerk ` 4,000 and peon ` 3,000; using matrix algebra, find
 i) the total number of posts of each kind in all the offices taken together.
ii) the total monthly salary bill of each kind of office separately.
iii) the total monthly salary bill of all the offices taken together.

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Or   6
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   b. Three fruit sellers X, Y and Z go to a wholesale market to buy the following articles:
 X buys 8 dozens of mangoes, 10 dozens of apples and 5 dozens of bananas, Y buys 9 dozens of mangoes, 9 dozens of apples and 7 dozens of bananas and Z buys 12 dozens of mangoes, 5 dozens of apples and 5 dozens of bananas. A mango costs ` 5, an apple costs ` 6 and a banana cost 50 paisa. Calculate each individual bill buy using matrix application.

24. **a**. Find the equilibrium prices and quantities of two commodities market models (use matrix inversion method)
$xd_1 = -3P + 20Q - 300$ and
$xd_2 = 20P + 10Q - 300$
$xs_1 = 4P - Q + 246$ and
$xs_2 = -2P - Q + 140$
Where P and Q are price and quantity respectively.

Or   **6**

b. A firm produces two products P_1 and P_2 passing through two machines M_1 and M_2 before completion. M_1 can produce either 10 units of P_1 or 15 units of P_2 per hour. M_2 can produce 15 units of either product per hour. Find daily production of P_1 and P_2 if time available is 12 hours of machine M_1 and 10 hours of machine M_2 per day, using matrix inversion.

25. **a.** Find the maximum as well as minimum value of the objective function.
Maximize $Z = 300x_1 + 400x_2$
Subject to the constraints
$5x_1 + 4x_2 \le 200$
$3x_1 + 5x_2 \le 150$
$5x_1 + 4x_2 \ge 100$
$x_1, x_2 \ge 0$

Or   **6**

b. Solve graphically the following LPP
Minimize $Z = 20x_1 + 40x_2$
Subject to the constraints
$36x_1 + 6x_2 \ge 108$
$3x_1 + 12x_2 \ge 36$
$20x_1 + 10x_2 \ge 100$ and
$x_1, x_2 \ge 0$

26. **a**. Two grades A and B of oil are mixed in the proportion of 3:2. After 25% of this has being sold from stock, a sufficient quantity of A is mixed with the remainder to raise the proportion to 5:3. If the stock is now 600 liters, what was the quantity of the original mixture and how much of grade A was added to make the new mixture?

Or   **6**

b. A businessman openly declare to retail his goods at a profit of 5%, but he adulterates them by adding $1/5^{th}$ of their weight of an inferior article which costs him $3/4^{th}$ of the price of the better. How much percent profit does he make? Also in what proportion must he mix the two kinds so as to gain 10%?

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