RA-3506
First Year B. B. A. (Sem. I) Examination
March / April - 2017
Quantitative Methods - I

Time : Hours [Total Marks : 50]

Instructions :

(1) Fill up strictly the details of sign on your answer book.
Name of the Examination:
First Year B. B. A. (Sem. 1)
Name of the Subject:
Quantitative Methods - I

(2) Use of simple calculator is allowed.
(3) Indicate your options clearly.
(4) Figures to the right indicate full marks.

1 Answer the following 10

1 Find the value of x if \[ \left| \frac{(x - 5)^2}{3(x + 5)} \right| = 6 \]

2 If \( A = \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix} \) then find \( AA' \).

3 What is the use of Linear Programming Problem?

4 Find the IBFS for following Transportation Problem by North-West Corner Rule

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Q</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>R</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Supply</td>
<td>17</td>
<td>23</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

5 Find IBFS for following Assignment Problem.

\[ \begin{bmatrix} 2 & 4 & 5 \\ 10 & 8 & 7 \\ 5 & 3 & 9 \end{bmatrix} \]
2

a) Solve the following system of equation by matrix inversion method.
   \[ 2X + 3Y + 3Z = 17 \]
   \[ 3X - 2Y + 4Z = 11 \]
   \[ 4X + 5Y - 3Z = 5 \]

b) \[ \begin{bmatrix} 5 & 2 & 3 \\ 4 & 1 & 0 \\ 1 & 2 & 4 \end{bmatrix} \text{ and } \begin{bmatrix} 3 & 2 & 9 \\ 4 & 3 & 4 \\ 7 & 2 & 0 \end{bmatrix} \]
   then find \( 3A + 2B \)

A company is manufacturing Pen Drive, Hard Drive, Head Phones and Mouse of three
different types in following quantity. The cost price of individual item in
rupees is also given below. Find total cost of the company with respect to three types using matrix.

<table>
<thead>
<tr>
<th>Pen Drive</th>
<th>Hard Drive</th>
<th>Head Phone</th>
<th>Mouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pen Drive</th>
<th>Cost(Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen Drive</td>
<td>150</td>
</tr>
<tr>
<td>Hard Drive</td>
<td>2000</td>
</tr>
<tr>
<td>Head Phone</td>
<td>1200</td>
</tr>
<tr>
<td>Mouse</td>
<td>400</td>
</tr>
</tbody>
</table>

OR

2

a) Solve the following system of equation by matrix inversion method.
   \[ 2X + 3Y + 4Z = 9 \]
   \[ 3X - 5Y + 7Z = 5 \]
   \[ 4X + 6Y - 7Z = 3 \]

b) \[ \begin{bmatrix} 2 & 5 & 7 \\ 2 & -1 & 0 \\ 3 & 4 & 8 \end{bmatrix} \text{ and } \begin{bmatrix} 1 & 4 & 9 \\ 3 & -2 & 4 \\ -5 & 6 & 8 \end{bmatrix} \]
   then prove that
   (i) \((AB)^T = B^T A^T\) and (ii) \((A + B)^T = A^T + B^T\)

c) A company produces two types of mobile A and B. For the production of these two mobiles,
two machines are used. For producing one unit of mobile A, first machine is used for 2 hours
and second machine is used for 7 hours and producing one unit of mobile B first machine is
used for 3 hours and second machine is used for 8 hours. If the total time available on these
two machines is respectively 280 hours and 830 hours, find the number of units of mobile A
and B that should be produced using matrix method.

3

a) Solve the following system of equation by Cramer’s Rule.
   \[ X + Y + Z = 6 \]
   \[ X - Y + Z = 2 \]
   \[ 2X + Y - Z = 1 \]

b) Prove that \( \begin{bmatrix} a & a & a \\ a & b & b \\ b & c \end{bmatrix} = a \begin{bmatrix} b-c \end{bmatrix} - \begin{bmatrix} a-b \end{bmatrix} \)

c) A manufacturer has two machines A and B. He manufactures two products P and Q on these
machines. For manufacturing one unit of product P, he has to use machine A for 4 hours and
machine B for 8 hours and for manufacturing one unit of product Q he has to use machine A
for 5 hours and machine B for 4 hours. On each unit of P he earns Rs. 14 and on each unit of
Q he earns Rs. 20. Using graphical method find how many units of P and Q should be
manufactured to get maximum profit if each machine cannot be used for more than 2000 hours.

OR

2

[Contd...]
3  
a) Solve the following system of equation by Cramer’s Rule.
   \[ 2Y - 3Z = 0 \]
   \[ X + 3Y = -4 \]
   \[ 3X + 4Y = 3 \]

b) Solve the equation for \( x \) without expanding the determinant
\[
\begin{vmatrix}
   x & 4 & 4 \\
   4 & x & 4 \\
   4 & 4 & x \\
\end{vmatrix} = 0
\]

3  
c) Solve the following Linear Programming Problem using graphical method.
   Minimize \( Z = 30X + 50Y \)
   Subject to \[ 3X + Y \geq 15 \]
   Constraints \[ X + 2Y \geq 12 \]
   \[ 3X + 2Y \geq 24 \]
   With Non-negative restriction \( X, Y \geq 0 \)

7  
4  
a) There are three sources which store a given product. These sources supply the products to four dealers. The capacities of the sources and the demands are given below. \( S_1 = 150, S_2 = 40, S_3 = 80 \) and \( D_1 = 90, D_2 = 70, D_3 = 50, D_4 = 60 \). The cost of transporting the product from various sources to various dealers is shown in the table below. Find out the optimum solution for transporting the product at a minimum cost.

\[
\begin{array}{|c|c|c|c|c|}
\hline
 & D_1 & D_2 & D_3 & D_4 \\
\hline
S_1 & 27 & 23 & 31 & 69 \\
S_2 & 10 & 45 & 40 & 32 \\
S_3 & 30 & 54 & 35 & 57 \\
\hline
\end{array}
\]

7  
b) Five persons are to be assigned five works. The following matrix shows the time each person will take to complete different works. Assign works to persons so that the total time is minimum.

\[
\begin{array}{|c|c|c|c|c|}
\hline
 & I & II & III & IV & V \\
\hline
A & 15 & 25 & 50 & 75 & 40 \\
B & 20 & 35 & 75 & 90 & 40 \\
C & 40 & 60 & 100 & 100 & 60 \\
D & 25 & 25 & 40 & 50 & 30 \\
E & 50 & 50 & 75 & 125 & 50 \\
\hline
\end{array}
\]

7  
4  
a) Obtain optimum solution for the following Transportation Problem.

\[
\begin{array}{|c|c|c|c|c|c|}
\hline
 & I & II & III & IV & Supply \\
\hline
A & 15 & 10 & 17 & 18 & 2 \\
B & 16 & 13 & 12 & 13 & 6 \\
C & 12 & 17 & 20 & 11 & 7 \\
\hline
Demand & 3 & 3 & 4 & 5 & \\
\hline
\end{array}
\]

RA-3506] 3  
[Contd...]
b) Solve the following Assignment Problem to maximize sales

<table>
<thead>
<tr>
<th>District</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>32</td>
<td>38</td>
<td>40</td>
<td>28</td>
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<td>II</td>
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<tr>
<td>III</td>
<td>41</td>
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<td>37</td>
</tr>
<tr>
<td>IV</td>
<td>22</td>
<td>38</td>
<td>41</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>V</td>
<td>29</td>
<td>33</td>
<td>40</td>
<td>35</td>
<td>39</td>
</tr>
</tbody>
</table>