(2)

$$U_{ij} = \begin{array}{c|ccccc} & A_1 & A_2 & A_3 & A_4 & A_5 \\ \hline q_1 & 0 & 1 & 1 & 0 & 1 \\ q_2 & 1 & 1 & 1 & 0 & 1 \\ q_3 & 1 & 0 & 0 & 1 & 1 \\ q_4 & 0 & 0 & 1 & 0 & 0 \\ q_5 & 1 & 1 & 1 & 0 & 0 \end{array}$$

$$freq_{ij} = \begin{array}{c|ccc|c} & S_1 & S_2 & S_3 & \\ \hline q_1 & 10 & 20 & 0 & 30 \\ q_2 & 5 & 0 & 10 & 15 \\ q_3 & 0 & 35 & 5 & 40 \\ q_4 & 0 & 10 & 0 & 10 \\ q_5 & 0 & 15 & 0 & 15 \end{array}$$

$$aff_{ij} = \begin{array}{c|ccccc} & A_1 & A_2 & A_3 & A_4 & A_5 \\ \hline A_1 & 70 & 30 & 30 & 40 & 55 \\ A_2 & 30 & 60 & 60 & 0 & 45 \\ A_3 & 30 & 60 & 70 & 0 & 45 \\ A_4 & 40 & 0 & 0 & 40 & 40 \\ A_5 & 55 & 45 & 45 & 40 & 85 \end{array}$$

BEA:

input: aff_{ij}

o/p : ca_{ij}

$$c_{ij} = \begin{array}{c|cc} & A_1 & A_2 \\ \hline A_1 & 70 & 30 \\ A_2 & 30 & 60 \\ A_3 & 30 & 60 \\ A_4 & 40 & 0 \\ A_5 & 55 & 45 \end{array}$$

Next Attribute A_3:

$$cont(A_0, A_3, A_1) = 2[Bond(A_0, A_3) + Bond(A_1, A_3) - Bond(A_0, A_1)]$$
$$= 2[0 + 8475 - 0]$$
$$= 16950$$

$$cont(A_1, A_3, A_2) = 2[Bond(A_1, A_3) + Bond(A_2, A_3) - Bond(A_1, A_2)]$$
$$= 2[8475 + 10,725 - 8175]$$
$$= 22050 \quad \text{maximum}$$

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$$cont(A_2, A_3, A_4) = 2[Bond(A_2, A_3) + \underbrace{Bond(A_4, A_3)}_{0} - \underbrace{Bond(A_2, A_4)}_{0}]$$

$$= 2[10,725 + \underbrace{3000}_{0} - \underbrace{3000}_{0}]$$

$$= \underline{21,450}$$

Now,

$$CA_{ij} = \begin{array}{c|ccc} & A_1 & A_3 & A_2 \\ \hline A_1 & 70 & 30 & 30 \\ A_2 & 30 & 60 & 60 \\ A_3 & 30 & 70 & 60 \\ A_4 & 40 & 0 & 0 \\ A_5 & 55 & 45 & 45 \end{array}$$

Next Attribute is A_4

$$contribution(A_0, A_4, A_1) = 2[Bond(A_0, A_4) + Bond(A_1, A_4) - Bond(A_0, A_1)]$$

$$= 2[0 + 6600 - 0]$$

$$= \underline{13,200}$$

$$cont(A_1, A_4, A_3) = 2[Bond(A_1, A_4) + Bond(A_3, A_4) - Bond(A_1, A_3)]$$

$$= 2[6600 + 3000 - 8475]$$

$$= \underline{2250}$$

$$cont(A_3, A_4, A_2) = 2[Bond(A_3, A_4) + Bond(A_2, A_4) - Bond(A_3, A_2)]$$

$$= 2[3000 + 3000 - 10,725]$$

$$= \underline{-9450}$$

$$cont(A_2, A_4, A_5) = 2[Bond(A_2, A_4) + Bond(A_4, A_5) - Bond(A_2, A_5)]$$

$$= 2[3000 + \underbrace{7200}_{0} - \underbrace{10,875}_{0}]$$

$$= \cancel{-1350}$$

$$= 6000$$ changed

ii) Now

$$\begin{array}{c|c} & \begin{array}{cccc} A_4 & A_1 & A_3 & A_2 \end{array} \\ \begin{array}{c} A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \end{array} & \begin{bmatrix} 40 & 70 & 30 & 30 \\ 0 & 30 & 60 & 60 \\ 0 & 30 & 70 & 60 \\ 40 & 40 & 0 & 0 \\ 40 & 55 & 45 & 45 \end{bmatrix} \end{array}$$

next attribute is A_5

$cont(A_0, A_5, A_4) = 2[Bond(A_0, A_5) + Bond(A_4, A_5) - Bond(A_0, A_4)]$

$= 2[\underset{0}{\cancel{11325}} + 7200 - \underset{0}{\cancel{3000}}]$

$= 2[\cancel{15525}]$

$= \cancel{31050} = 14,400$ changed

$cont(A_4, A_5, A_1) = 2[Bond(A_4, A_5) + Bond(A_1, A_5) - Bond(A_4, A_1)]$

$= 2[7200 + 12825 - 6600]$

$= 26,850$

$cont(A_1, A_5, A_3) = 2[Bond(A_1, A_5) + Bond(A_3, A_5) - Bond(A_1, A_3)]$

$= 2[12825 + 11325 - 8475]$

$= 31,350$

$cont(A_3, A_5, A_2) = 2[Bond(A_3, A_5) + Bond(A_5, A_2) - Bond(A_3, A_2)]$

$= 2[11,325 + 10,875 - 10725]$

< 31350

$cont(A_2, A_5, A_6) = 2[Bond(A_2, A_5) + Bond(A_6, A_5) - Bond(A_2, A_6)]$

$= 2[10,875 + 0 - 0]$

$< 31,350$

Now

$$
\begin{array}{c}
 \\ A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5
\end{array}
\begin{array}{c}
\begin{array}{ccccc} A_4 & A_1 & A_5 & A_3 & A_2 \end{array} \\
\begin{bmatrix}
40 & 70 & 55 & 30 & 30 \\
0 & 30 & 45 & 60 & 60 \\
0 & 30 & 45 & 70 & 60 \\
40 & 40 & 40 & 0 & 0 \\
40 & 55 & 85 & 45 & 45
\end{bmatrix}
\end{array}
$$

Interchanging rows:

$$
Ca_{ij} =
\begin{array}{c}
 \\ A_4 \\ A_1 \\ A_5 \\ A_3 \\ A_2
\end{array}
\begin{array}{c}
\begin{array}{ccccc} A_4 & A_1 & A_5 & A_3 & A_2 \end{array} \\
\begin{bmatrix}
40 & 40 & 40 & 0 & 0 \\
40 & 70 & 55 & 30 & 30 \\
40 & 55 & 85 & 45 & 45 \\
0 & 30 & 45 & 70 & 60 \\
0 & 30 & 45 & 60 & 60
\end{bmatrix}
\end{array}
$$

Partitioning:-

$TA = \{A_4\}$, $TB = \{A_1, A_5, A_3, A_2\}$

$TQ = \{\}$

$BQ = \{q_1, q_2, q_4, q_5\}$

$OQ = \{q_3\}$

	TA	TB
q_1	0	1
q_2	0	1
q_3	1	1
q_4	0	1
q_5	0	1

$CTQ = 0$

$CBQ = 70$

$COQ = 40$

$\therefore Z = CTQ * CBQ - COQ^2$

$= -40^2$

$TA = \{A_4, A_1\}$

$TB = \{A_5, A_3, A_2\}$

$TQ = \{\}$

$BQ = \{q_1, q_4\}$

$OQ = \{q_2, q_3, q_5\}$

$CTQ = 0$

$CBQ = 30 + 10 = 40$

$COQ = 70$

$Z = CTQ * CBQ - COQ^2$

$= -70^2$

	TA	BA
q_1	0	1
q_2	1	1
q_3	1	1
q_4	0	1
q_5	1	1

$TA = \{A_4, A_1, A_5\}$

$TB = \{A_3, A_2\}$

$TQ = \{q_3\}$

$BQ = \{q_4\}$

$OQ = \{q_1, q_2, q_5\}$

$CTQ = 40$

~~77~~

$CBQ = 10$

$COQ = 60$

$\therefore Z = CTQ * CBQ - COQ^2$

$= 40 \times 10 - 60^2$

$= -3200$

	TA	TB
q_1	1	1
q_2	1	1
q_3	1	0
q_4	0	1
q_5	1	1

$TA = \{A_4, A_1, A_5, A_3\}$

$TB = \{A_2\}$

$TQ = \{q_3, q_4\}$

$TB = \{\}$

$OQ - \{q_1, q_2, q_5\}$

	TA	TB
q_1	1	1
q_2	1	1
q_3	1	0
q_4	1	0
q_5	1	1

$Z = CTQ * CBQ - COQ^2$

$= 0 - 60^2$

$= -60^2$

since all z values are negative, vertical fragmentation is not possible