International Journal of Engineering, Science and Mathematics
Vol. 7Issue 4, April2018,
ISSN: 2320-0294 Impact Factor: 6.765
Journal Homepage: http://www.ijesm.co.in, Email: ijesmj@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A

ON THE CONSTRUCTION OF CONFERENCE MATRICES OF ORDER 30

P.K.Manjhi*
Arjun Kumar**

Abstract

In this paper we forward a method of construction of conference matrices of orders 30 by suitable combination of adjacency matrices of suitable coherent configuration.

Keywords:

Coherent Configuration;
Conference matrix;
Symmetric Conference matrix.

Author correspondence:

Dr. P. K. Manjhi, Assistant Professor,University Depaetment of Mathematics,Vinoba Bhave University,Hazaribag,

1. Introduction:

A *weighing matrix* M of order m and weight w is an $m \times m$ matrix with entries $(0,\pm 1)$ such that $MM^T = wI_m$ .where M^T is transpose of M and I_m is identity matrix of order m.A weighing matrix of order m and weight w is denoted by $M(m,w)$.A M(m,m) is a hadamardmatrix.A M(m,m-1),m even with zeros on the diagonal such that $MM^T = (m-1)I_m$ is conference matrix.If $m \equiv 2(\bmod 4)$ such that $M = M^T$ is symmetric conference matrix.(vide[3]).

Exaple: $$M(6,5) = \begin{bmatrix} 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & -1 & -1 & 1 \\ 1 & 1 & 0 & 1 & -1 & -1 \\ 1 & -1 & 1 & 0 & 1 & -1 \\ 1 & -1 & -1 & 1 & 0 & 1 \\ 1 & 1 & -1 & -1 & 1 & 0 \end{bmatrix}$$

A conference matrix of order m with entries 0,+1 and -1 is called symmetric conference matrix if $MM^T = M^T M = mI_m$ where M^T is transpose of M and I_m is the identity matrix.

*Assistant Professor, University Department of Mathematics, Vinoba Bhave University, Jharkhand, India.
**Research Scholar, University Department of Mathematics, Vinoba Bhave University, Jharkhand, India.

.Example: $M = \begin{bmatrix} 0 & 1 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & -1 & -1 & 1 \\ 1 & 1 & 0 & 1 & -1 & -1 \\ 1 & -1 & 1 & 0 & 1 & -1 \\ 1 & -1 & -1 & 1 & 0 & 1 \\ 1 & 1 & -1 & -1 & 1 & 0 \end{bmatrix}$ (Vide [5] and [6])

A coherent configuration on a finite set X is a set $C = \{C_1 ..., C_m\}$ of partition of $X \times X$ satisfying the following four conditions:

(i) Thereexist a subset I of {1,2,3...m} such that $\bigcup_{i \in I} C_i = ((x,x) : x \in X)$

(ii) $C_i \in C \Rightarrow C_i^{-1} \in C$

(iii) There exist an integer P_{ij}^k for $1 \le i, j, k \le m$ such that for any $(\alpha, \beta) \in C_k$ $P_{ij}^k = |\{\gamma : (\alpha, \gamma) \in C_i \text{ and } (\gamma, \beta)\}|$. P_{ij}^k independent of the choice of $(\alpha, \beta) \in C_k$.

Coherent configuration is also defiend by adjacency matrices of classes of C .If $\{M_1,..., M_m\}$ are adjacency matrices of $C_1,..., C_m$ respectively then the axioms takes the following from

(i) $M_1 + ... + M_m = j$

(ii) There exist a sub set of $\{M_1,..., M_m\}$ with sum I=identity matrix;

(iii) Each element of the set $\{M_1,..., M_m\}$ is closed under transposition;

(iv) $M_i M_j = \sum_{i=1}^{m} P_{ij}^k$ where P_{ij}^k are non-negative integers.

(Vide[7])

2. **MAIN WORK:**

In [3],[4] and [5] methods of construction of conference matrices of order 6, 10, 14, 18 and 26 are given,in this paper we forward method of construction of two different symmetric conference matriceseach of order 30 by suitable linear combination of coherent configurations:

2.1. CONSTRUCTION OF SYMMETRIC CONFERENCE MATRICES OF ORDER 30

Consider $X = \{1,2,3,...,30\}$ and a partition $C = \{C_1, C_2, C_3, C_4, C_5, C_6\}$ of $X \times X$ where

$C_1 = \{(i,i) : i = 1\}, C_2 = \{(1,i) : i = 2,3,4,...,30\}, C_3 = \{(i,1)) : i = 2,3,4,...,30\}, C_4 = \{(i,i) : i = 2,3,4,...,30\},$

$C_5 = \{\{(2,i): i = 3,4,5,6,7,8,9,10,11,12,13,14,15,16\} \cup \{(3,i): i = 2,4,5,8,9,10,15,17,18,22,26,27,28,30\}$
$\cup \{(4,i): i = 2,3,5,6,9,14,16,17,21,23,24,27,28,29\} \cup \{(5,i): i = 2,3,4,6,7,13,15,20,22,23,25,28,29,30\}$
$\cup \{(6,i): i = 2,4,5,7,8,12,14,19,21,22,24,26,29,30\} \cup \{(7,i): i = 2,5,6,8,9,11,13,18,20,21,24,25,27,30\}$
$\cup \{(8,i): i = 2,3,6,7,9,10,12,17,19,20,24,25,26,28\} \cup \{(9,i): i = 2,3,4,7,8,11,16,18,19,23,25,26,27,29\}$
$\cup \{(10,i): i = 2,3,8,11,12,15,16,18,20,21,22,24,28,29\} \cup \{(11,i): i = 2,7,9,10,12,13,16,19,21,22,23,27,28,30\}$
$\cup \{(12,i): i = 2,6,8,10,11,13,14,17,20,22,23,26,27,29\} \cup \{(13,i): i = 2,5,7,11,12,14,15,17,18,21,23,25,26,28\}$
$\cup \{(14,i): i = 2,4,6,12,1315,16,17,18,19,22,24,25,27\} \cup \{(15,i): i = 2,3,5,10,13,14,16,18,19,20,23,24,26,30\}$
$\cup \{(16,i): i = 2,4,9,10,11,14,15,17,19,20,21,25,29,30\} \cup \{(17,i): i = 3,4,8,12,13,14,16,20,21,25,26,27,28,30\}$
$\cup \{(18,i): i = 3,7,9,10,13,14,15,21,22,24,25,26,27,29\} \cup \{(19,i): i = 6,8,9,11,14,15,16,22,23,24,25,26,28,30\}$
$\cup \{(20,i): i = 5,7,8,10,12,15,16,17,23,24,25,27,29,30\} \cup \{(21,i): i = 4,6,7,10,11,13,16,17,18,24,26,28,29,30\}$
$\cup \{(22,i): i = 3,5,6,10,11,12,14,18,19,25,27,28,29,30\} \cup \{(23,i): i = 4,5,9,11,12,13,15,19,20,24,26,27,28,29\}$
$\cup \{(24,i): i = 4,6,7,8,10,14,15,18,19,20,21,23,27,28\} \cup \{(25,i): i = 5,7,8,9,13,14,16,17,18,19,20,22,28,29\}$
$\cup \{(26.i): i = 3,6,8,9,12,13,15,17,18,19,21,23,29,30\} \cup \{(27,i): i = 3,4,7,9,11,12,14,17,18,20,22,23,24,30\}$
$\cup \{(28,i): i = 3,4,5,8,10,11,13,17,19,21,22,23,24,25\} \cup \{(29,i): i = 4,5,6,9,10,12,16,18,20,21,22,23,25,26\}$
$\cup \{(30,i): i = 3,5,6,7,11,15,16,17,19,20,21,22,26,27\}\}.$

$C_6 = \{\{(2,i): i = 17,18,19,20,21,22,23,24,25,26,27,28,29,30\}$
$\cup \{(3,i): i = 6,7,11,12,13,14,16,19,20,21,23,24,25,29\} \cup \{(4,i): i = 7,8,10,11,12,13,15,18,19,20,22,25,26,30\}$
$\cup \{(5,i): i = 8,9,10,11,12,14,16,17,18,19,21,24,26,27,\} \cup \{(6,i): i = 3,9,10,11,13,15,16,17,18,20,23,25,27,28\}$
$\cup \{(7,i): i = 3,4,10,12,14,15,16,17,19,22,23,26,28,29\} \cup \{(8,i): i = 4,5,11,13,14,15,16,18,21,22,23,27,29,30\}$
$\cup \{(9,i): i = 5,6,10,12,13,14,15,17,20,21,22,24,28,30\} \cup \{(10,i): i = 4,5,6,7,9,13,14,17,19,23,25,26,27,30\}$
$\cup \{(11,i): i = 3,4,5,6,8,14,15,17,18,20,24,25,26,29\} \cup \{(12,i): i = 3,4,5,7,9,15,16,18,19,21,24,25,28,30\}$
$\cup \{(13,i): i = 3,4,6,8,9,10,16,19,20,22,24,27,29,30\} \cup \{(14,i): i = 3,5,7,8,9,10,11,20,21,23,26,28,29,30\}$
$\cup \{(15,i): i = 4,6,7,8,9,11,12,17,21,22,25,27,28,29\} \cup \{(16,i): i = 3,5,6,7,8,12,13,18,22,23,24,26,27,28,\}$
$\cup \{(17,i): i = 2,5,6,7,9,10,11,15,18,19,22,23,24,29\} \cup \{(18,i): i = 2,4,5,6,8,11,12,16,17,19,20,23,28,30\}$
$\cup \{(19,i): i = 2,3,4,5,7,10,12,13,17,18,20,21,27,29\} \cup \{(20,i): i = 2,3,4,6,9,11,13,14,18,19,21,22,26,28,\}$
$\cup \{(21,i): i = 2,3,5,8,9,12,14,15,19,20,22,23,25,27\} \cup \{(22,i): i = 2,4,7,8,9,13,15,16,17,20,21,23,24,26,\}$
$\cup \{(23,i): i = 2,3,6,7,8,10,14,16,17,18,21,22,25,30\} \cup \{(24,i): i = 2,3,5,9,11,12,13,16,17,22,25,26,29,30\}$
$\cup \{(25,i): i = 2,3,4,6,10,11,12,15,21,23,24,26,27,30\} \cup \{(26.i): i = 2,4,5,7,10,11,14,16,20,22,24,25,27,28,\}$
$\cup \{(27,i): i = 2,5,6,8,10,13,15,16,19,21,25,26,28,29\} \cup \{(28,i): i = 2,6,7,9,12,14,15,16,18,20,26,27,29,30\}$
$\cup \{(29,i): i = 2,3,7,8,11,13,14,15,17,19,24,27,28,30\} \cup \{(30,i): i = 2,4,8,9,10,12,13,14,18,23,24,25,28,29\}\}.$

Then adjacency matrices M_1, M_2, M_3, M_4, M_5 *and* M_6 of C_1, C_2, C_3, C_4, C_5, *and* C_6 respectively .Then by the properties of matrix multiplication we can obtain the following results:

$(1) M_1 + M_2 + M_3 + M_4 + M_5 + M_6 = J_{30}$

$(2) M_1 + M_4 = I_{30}$ $(3) M_1^{'} = M_1, M_2^{'} = M_2, M_3^{'} = M_2, M_4^{'} = M_4, M_5^{'} = M_5, M_6^{'} = M_6.$

(4)

$(i)\quad M_1^2 = M_1, M_1M_2 = M_2, M_1M_3 = 0, M_1M_4 = 0, M_1M_5 = 0, M_1M_6 = 0.$

$(ii)\quad M_2^2 = 0, M_2M_3 = 29M_{1,} M_2M_4 = M_2, M_2M_5 = 14M_2, M_2M_6 = 14M_2$

$(iii)\quad M_3^2 = 0, M_3M_4 = 0, M_3M_5 = 0, M_3M_6 = 0$

$(iv)\quad M_4^2 = M_4, M_4M_5 = M_5, M_4M_6 = M_6$

$(v)\quad M_5^2 = 14.M_4 + 6M_5 + 7M_6, M_5M_6 = 7(M_5 + M_6)$

$(vi)\quad M_6^2 = 14M_4 + 7M_5 + 6M_6$

Hence product of any two adjacency matrices is some linear combinations of adjacency matrices.Thus the set $C = \{C_1, C_2, C_3, C_4, C_5, C_6\}$ is a C.C.

Consider the matrix $M = 0.M_1 + 1.M_2 + 1.M_3 + 0.M_4 + 1.M_5 + (-1)M_6$

$$M = \begin{bmatrix}
0&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1&1\\
1&0&1&1&1&1&1&1&1&1&1&1&1&1&1&1&-&-&-&-&-&-&-&-&-&-&-&-&-&-\\
1&1&0&1&1&-&-&1&1&1&-&-&-&-&1&-&1&1&-&-&-&1&-&-&-&1&1&1&-&1\\
1&1&1&0&1&1&-&-&1&-&-&-&-&1&-&1&1&-&-&-&1&-&1&1&-&-&1&1&1&-\\
1&1&1&1&0&1&1&-&-&-&-&-&1&-&1&-&-&-&-&1&-&1&1&-&1&-&-&1&1&1\\
1&1&-&1&1&0&1&1&-&-&-&1&-&1&-&-&-&-&1&-&1&1&-&1&-&1&-&-&1&1\\
1&1&-&-&1&1&0&1&1&-&1&-&1&-&-&-&-&1&-&1&1&-&-&1&1&-&1&-&-&1\\
1&1&1&-&-&1&1&0&1&1&-&1&-&-&-&-&1&-&1&1&-&-&-&1&1&1&-&1&-&-\\
1&1&1&1&-&-&1&1&0&-&1&-&-&-&-&1&-&1&1&-&-&-&1&-&1&1&1&-&1&-\\
1&1&1&-&-&-&-&1&-&0&1&1&-&-&1&1&-&1&-&1&1&1&-&1&-&-&-&1&1&-\\
1&1&-&-&-&-&1&-&1&1&0&1&1&-&-&1&-&-&1&-&1&1&1&-&-&-&1&1&-&1\\
1&1&-&-&-&1&-&1&-&1&1&0&1&1&-&-&1&-&-&1&-&1&1&-&-&1&1&-&1&-\\
1&1&-&-&1&-&1&-&-&-&1&1&0&1&1&-&1&1&-&-&1&-&1&-&1&1&-&1&-&-\\
1&1&-&1&-&1&-&-&-&-&-&1&1&0&1&1&1&1&1&-&-&1&-&1&1&-&1&-&-&-\\
1&1&1&-&1&-&-&-&-&1&-&-&1&1&0&1&-&1&1&1&-&-&1&1&-&1&-&-&-&1\\
1&1&-&1&-&-&-&-&1&1&1&-&-&1&1&0&1&-&1&1&1&-&-&-&1&-&-&-&1&1\\
1&-&1&1&-&-&-&1&-&-&-&1&1&1&-&1&0&-&-&1&1&-&-&-&1&1&1&1&-&1\\
1&-&1&-&-&-&1&-&1&1&-&-&1&1&1&-&-&0&-&-&1&1&-&1&1&1&1&-&1&-\\
1&-&-&-&-&1&-&1&1&-&1&-&-&1&1&1&-&-&0&-&-&1&1&1&1&1&-&1&-&1\\
1&-&-&-&1&-&1&1&-&1&-&1&-&-&1&1&1&-&-&0&-&-&1&1&1&-&1&-&1&1\\
1&-&-&1&-&1&1&-&-&1&1&-&1&-&-&1&1&1&-&-&0&-&-&1&-&1&-&1&1&1\\
1&-&1&-&1&1&-&-&-&1&1&1&-&1&-&-&-&1&1&-&-&0&-&-&1&-&1&1&1&1\\
1&-&-&1&1&-&-&-&1&-&1&1&1&-&1&-&-&-&1&1&-&-&0&1&-&1&1&1&1&-\\
1&-&-&1&-&1&1&1&-&1&-&-&-&1&1&-&-&1&1&1&1&-&1&0&-&-&1&1&-&-\\
1&-&-&-&1&-&1&1&1&-&-&-&1&1&-&1&1&1&1&1&-&1&-&-&0&-&-&1&1&-\\
1&-&1&-&-&1&-&1&1&-&-&1&1&-&1&-&1&1&1&-&1&-&1&-&-&0&-&-&1&1\\
1&-&1&1&-&-&1&-&1&-&1&1&-&1&-&-&1&1&-&1&-&1&1&1&-&-&0&-&-&1\\
1&-&1&1&1&-&-&1&-&1&1&-&1&-&-&-&1&-&1&-&1&1&1&1&1&-&-&0&-&-\\
1&-&-&1&1&1&-&-&1&1&-&1&-&-&-&1&-&1&-&1&1&1&1&-&1&1&-&-&0&-\\
1&-&1&-&1&1&1&-&-&-&1&-&-&-&1&1&1&-&1&1&1&1&-&-&-&1&1&-&-&0
\end{bmatrix}$$

[- is written in place of -1]

$$\Rightarrow MM^T = M^T M = 29 I_{30} = (30-1) I_{30}.$$

Which show that M is a symmetric conference matrix of order 30.

2.2. CONSTRUCTION OF ANOTHER SYMMETRIC CONFERENCE MATRIX OF ORDERS 30:

Consider $X = \{1,2,3,...,30\}$ and a partition $C = \{C_1, C_2, C_3, C_4, C_5, C_6\}$ of $X \times X$ where

$C_1 = \{(i,i) : i = 1\}, C_2 = \{(1,i) : i = 2,3,4,...,30\}, C_3 = \{(i,1)) : i = 2,3,4,...,30\}, C_4 = \{(i,i) : i = 2,3,4,...,30\},$

$C_5 = \{\{(2,i) : i = 3,4,5,6,7,8,9,10,11,12,13,14,15,16\} \cup \{(3,i) : i = 2,4,5,8,9,10,15,17,18,22,26,27,28,30\}$

$\cup \{(4,i) : i = 2,3,5,6,9,14,16,17,21,23,24,27,28,29\} \cup \{(5,i) : i = 2,3,4,6,7,13,15,20,22,23,25,28,29,30\}$

$\cup \{(6,i) : i = 2,4,5,7,8,12,14,19,21,22,24,26,29,30\} \cup \{(7,i) : i = 2,5,6,8,9,11,13,18,20,21,24,25,27,30\}$

$\cup \{(8,i) : i = 2,3,6,7,9,10,12,17,19,20,24,25,26,28\} \cup \{(9,i) : i = 2,3,4,7,8,11,16,18,19,23,25,26,27,29\}$

$\cup \{(10,i) : i = 2,3,8,11,12,15,16,18,20,21,22,24,28,29\} \cup \{(11,i) : i = 2,7,9,10,12,13,16,19,21,22,23,27,28,30\}$

$\cup \{(12,i) : i = 2,6,8,10,11,13,14,17,20,22,23,26,27,29\} \cup \{(13,i) : i = 2,5,7,11,12,14,15,17,18,21,23,25,26,28\}$

$\cup \{(14,i) : i = 2,4,6,12,1315,16,17,18,19,22,24,25,27\} \cup \{(15,i) : i = 2,3,5,10,13,14,16,18,19,20,23,24,26,30\}$

$\cup \{(16,i) : i = 2,4,9,10,11,14,15,17,19,20,21,25,29,30\} \cup \{(17,i) : i = 3,4,8,12,13,14,16,20,21,25,26,27,28,30\}$

$\cup \{(18,i) : i = 3,7,9,10,13,14,15,21,22,24,25,26,27,29\} \cup \{(19,i) : i = 6,8,9,11,14,15,16,22,23,24,25,26,28,30\}$

$\cup \{(20,i) : i = 5,7,8,10,12,15,16,17,23,24,25,27,29,30\} \cup \{(21,i) : i = 4,6,7,10,11,13,16,17,18,24,26,28,29,30\}$

$\cup \{(22,i) : i = 3,5,6,10,11,12,14,18,19,25,27,28,29,30\} \cup \{(23,i) : i = 4,5,9,11,12,13,15,19,20,24,26,27,28,29\}$

$\cup \{(24,i) : i = 4,6,7,8,10,14,15,18,19,20,21,23,27,28\} \cup \{(25,i) : i = 5,7,8,9,13,14,16,17,18,19,20,22,28,29\}$

$\cup \{(26.i) : i = 3,6,8,9,12,13,15,17,18,19,21,23,29,30\} \cup \{(27,i) : i = 3,4,7,9,11,12,14,17,18,20,22,23,24,30\}$

$\cup \{(28,i) : i = 3,4,5,8,10,11,13,17,19,21,22,23,24,25\} \cup \{(29,i) : i = 4,5,6,9,10,12,16,18,20,21,22,23,25,26\}$

$\cup \{(30,i) : i = 3,5,6,7,11,15,16,17,19,20,21,22,26,27\}\}.$

$C_6 = \{\{(2,i) : i = 17,18,19,20,21,22,23,24,25,26,27,28,29,30\}$

$\cup \{(3,i) : i = 6,7,11,12,13,14,16,19,20,21,23,24,25,29\} \cup \{(4,i) : i = 7,8,10,11,12,13,15,18,19,20,22,25,26,30\}$

$\cup \{(5,i) : i = 8,9,10,11,12,14,16,17,18,19,21,24,26,27,\} \cup \{(6,i) : i = 3,9,10,11,13,15,16,17,18,20,23,25,27,28\}$

$\cup \{(7,i) : i = 3,4,10,12,14,15,16,17,19,22,23,26,28,29\} \cup \{(8,i) : i = 4,5,11,13,14,15,16,18,21,22,23,27,29,30\}$

$\cup \{(9,i) : i = 5,6,10,12,13,14,15,17,20,21,22,24,28,30\} \cup \{(10,i) : i = 4,5,6,7,9,13,14,17,19,23,25,26,27,30\}$

$\cup \{(11,i) : i = 3,4,5,6,8,14,15,17,18,20,24,25,26,29\} \cup \{(12,i) : i = 3,4,5,7,9,15,16,18,19,21,24,25,28,30\}$

$\cup \{(13,i) : i = 3,4,6,8,9,10,16,19,20,22,24,27,29,30\} \cup \{(14,i) : i = 3,5,7,8,9,10,11,20,21,23,26,28,29,30\}$

$\cup \{(15,i) : i = 4,6,7,8,9,11,12,17,21,22,25,27,28,29\} \cup \{(16,i) : i = 3,5,6,7,8,12,13,18,22,23,24,26,27,28,\}$

$\cup \{(17,i) : i = 2,5,6,7,9,10,11,15,18,19,22,23,24,29\} \cup \{(18,i) : i = 2,4,5,6,8,11,12,16,17,19,20,23,28,30\}$

$\cup \{(19,i) : i = 2,3,4,5,7,10,12,13,17,18,20,21,27,29\} \cup \{(20,i) : i = 2,3,4,6,9,11,13,14,18,19,21,22,26,28,\}$

$\cup \{(21,i) : i = 2,3,5,8,9,12,14,15,19,20,22,23,25,27\} \cup \{(22,i) : i = 2,4,7,8,9,13,15,16,17,20,21,23,24,26,\}$

$\cup \{(23,i) : i = 2,3,6,7,8,10,14,16,17,18,21,22,25,30\} \cup \{(24,i) : i = 2,3,5,9,11,12,13,16,17,22,25,26,29,30\}$

$\cup \{(25,i) : i = 2,3,4,6,10,11,12,15,21,23,24,26,27,30\} \cup \{(26.i) : i = 2,4,5,7,10,11,14,16,20,22,24,25,27,28,\}$

$\cup \{(27,i) : i = 2,5,6,8,10,13,15,16,19,21,25,26,28,29\} \cup \{(28,i) : i = 2,6,7,9,12,14,15,16,18,20,26,27,29,30\}$

$\cup \{(29,i) : i = 2,3,7,8,11,13,14,15,17,19,24,27,28,30\} \cup \{(30,i) : i = 2,4,8,9,10,12,13,14,18,23,24,25,28,29\}\}.$

Then adjacency matrices M_1, M_2, M_3, M_4, M_5 and M_6 of $C_1, C_2, C_3, C_4, C_5, and\, C_6$ respectively.

Then by the elementary properties of matrices we can find the following results:

$(1) M_1 + M_2 + M_3 + M_4 + M_5 + M_6 = J_{30}$

$(2) M_1 + M_4 = I_{30}$

$(3) M_1^{'} = M_1, M_2^{'} = M_2, M_3^{'} = M_2, M_4^{'} = M_4, M_5^{'} = M_5, M_6^{'} = M_6.$

(4)

$(i)\ \ M_1^2 = M_1, M_1M_2 = M_2, M_1M_3 = 0, M_1M_4 = 0, M_1M_5 = 0, M_1M_6 = 0.$

$(ii)\ \ M_2^2 = 0, M_2M_3 = 29M_{1,} M_2M_4 = M_2, M_2M_5 = 14M_2, M_2M_6 = 14M_2$

$(iii)\ \ M_3^2 = 0, M_3M_4 = 0, M_3M_5 = 0, M_3M_6 = 0$

$(iv)\ \ M_4^2 = M_4, M_4M_5 = M_5, M_4M_6 = M_6$

$(v)\ \ M_5^2 = 14.M_4 + 6M_5 + 7M_6, M_5M_6 = 7(M_5 + M_6)$

$(vi)\ \ M_6^2 = 14M_4 + 7M_5 + .6M_6$

Hence product of any two adjacency matrices is some linear combinations of adjacency matrices.Thusthe set $C = \{C_1, C_2, C_3, C_4, C_5, C_6\}$ is a C.C.

Consider the matrix $M = 0.M_1 + 1.M_2 + 1.M_3 + 0.M_4 + 1.M_5 + (-1)M_6$

$$
= \begin{bmatrix}
0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & - & - & - & - & - & - & - & - & - & - & - & - & - & - \\
1 & 1 & 0 & 1 & - & 1 & 1 & - & 1 & - & - & 1 & 1 & - & - & - & 1 & - & - & 1 & - & 1 & 1 & - & 1 & 1 & - & 1 & - & - \\
1 & 1 & 1 & 0 & 1 & - & 1 & 1 & - & - & 1 & 1 & - & - & - & - & - & - & 1 & - & 1 & 1 & 1 & - & - & 1 & 1 & - & 1 & - \\
1 & 1 & - & 1 & 0 & 1 & - & 1 & 1 & 1 & 1 & - & - & - & - & - & - & 1 & - & 1 & 1 & 1 & - & - & - & - & 1 & 1 & - & 1 \\
1 & 1 & 1 & - & 1 & 0 & 1 & - & 1 & 1 & - & - & - & - & - & 1 & 1 & - & 1 & 1 & 1 & - & - & 1 & - & - & - & 1 & 1 & - \\
1 & 1 & 1 & 1 & - & 1 & 0 & 1 & - & - & - & - & - & - & 1 & 1 & - & 1 & 1 & 1 & - & - & 1 & - & 1 & - & - & - & 1 & 1 \\
1 & 1 & - & 1 & 1 & - & 1 & 0 & 1 & - & - & - & - & 1 & 1 & - & 1 & 1 & 1 & - & - & 1 & - & 1 & - & 1 & - & - & - & 1 \\
1 & 1 & 1 & - & 1 & 1 & - & 1 & 0 & - & - & - & 1 & 1 & - & - & 1 & 1 & - & - & 1 & - & 1 & 1 & 1 & - & 1 & - & - & - \\
1 & 1 & - & - & 1 & 1 & - & - & - & 0 & 1 & - & 1 & 1 & 0 & 1 & - & - & - & 1 & - & 1 & 1 & 1 & - & 1 & - & - & 1 & 1 \\
1 & 1 & - & 1 & 1 & - & - & - & - & 1 & 0 & 1 & - & 1 & 1 & - & 1 & - & - & - & 1 & - & 1 & - & 1 & - & - & 1 & 1 & 1 \\
1 & 1 & 1 & 1 & - & - & - & - & - & - & 1 & 0 & 1 & - & 1 & 1 & 1 & 1 & - & - & - & 1 & - & 1 & - & - & 1 & 1 & 1 & - \\
1 & 1 & 1 & - & - & - & - & - & 1 & 1 & - & 1 & 0 & 1 & - & 1 & - & 1 & 1 & - & - & - & 1 & - & - & 1 & 1 & 1 & - & 1 \\
1 & 1 & - & - & - & - & - & 1 & 1 & 1 & 1 & - & 1 & 0 & 1 & - & 1 & - & 1 & 1 & - & - & - & - & 1 & 1 & 1 & - & 1 & - \\
1 & 1 & - & - & - & - & 1 & 1 & - & - & 1 & 1 & - & 1 & 0 & 1 & - & 1 & - & 1 & 1 & - & - & 1 & 1 & 1 & - & 1 & - & - \\
1 & 1 & - & - & - & 1 & 1 & - & - & 1 & - & 1 & 1 & - & 1 & 0 & - & - & 1 & - & 1 & 1 & - & 1 & 1 & - & 1 & - & - & 1 \\
1 & - & 1 & - & - & 1 & - & 1 & 1 & - & 1 & 1 & - & 1 & - & - & 0 & - & 1 & - & - & 1 & - & 1 & 1 & - & - & 1 & 1 & 1 \\
1 & - & - & - & 1 & - & 1 & 1 & 1 & - & - & 1 & 1 & - & 1 & - & - & 0 & - & 1 & - & - & 1 & 1 & - & - & 1 & 1 & 1 & 1 \\
1 & - & - & 1 & - & 1 & 1 & 1 & - & - & - & - & 1 & 1 & - & 1 & 1 & - & 0 & - & 1 & - & - & - & - & 1 & 1 & 1 & 1 & 1 \\
1 & - & 1 & - & 1 & 1 & 1 & - & - & 1 & - & - & - & 1 & 1 & - & - & 1 & - & 0 & - & 1 & - & - & 1 & 1 & 1 & 1 & 1 & - \\
1 & - & - & 1 & 1 & 1 & - & - & 1 & - & 1 & - & - & - & 1 & 1 & - & - & 1 & - & 0 & - & 1 & 1 & 1 & 1 & 1 & 1 & - & - \\
1 & - & 1 & 1 & 1 & - & - & 1 & - & 1 & - & 1 & - & - & - & 1 & 1 & - & - & 1 & - & 0 & - & 1 & 1 & 1 & 1 & - & - & 1 \\
1 & - & 1 & 1 & - & - & 1 & - & 1 & 1 & 1 & - & 1 & - & - & - & - & 1 & - & - & 1 & - & 0 & 1 & 1 & 1 & - & - & 1 & 1 \\
1 & - & - & - & - & 1 & - & 1 & 1 & 1 & - & 1 & - & - & 1 & 1 & 1 & 1 & - & - & 1 & 1 & 1 & 0 & - & 1 & - & - & 1 & - \\
1 & - & 1 & - & - & - & 1 & - & 1 & - & 1 & - & - & 1 & 1 & 1 & 1 & - & - & 1 & 1 & 1 & 1 & - & 0 & - & 1 & - & - & 1 \\
1 & - & 1 & 1 & - & - & - & 1 & - & 1 & - & - & 1 & 1 & 1 & - & - & - & 1 & 1 & 1 & 1 & 1 & 1 & - & 0 & - & 1 & - & - \\
1 & - & - & 1 & 1 & - & - & - & 1 & - & - & 1 & 1 & 1 & - & 1 & - & 1 & 1 & 1 & 1 & 1 & - & - & 1 & - & 0 & - & 1 & - \\
1 & - & 1 & - & 1 & 1 & - & - & - & - & 1 & 1 & 1 & - & 1 & - & 1 & 1 & 1 & 1 & 1 & - & - & - & - & 1 & - & 0 & - & 1 \\
1 & - & - & 1 & - & 1 & 1 & - & - & 1 & 1 & 1 & - & 1 & - & - & 1 & 1 & 1 & 1 & - & - & 1 & 1 & - & - & 1 & - & 0 & - \\
1 & - & - & - & 1 & - & 1 & 1 & - & 1 & 1 & - & 1 & - & - & 1 & 1 & 1 & 1 & - & - & 1 & 1 & - & 1 & - & - & 1 & - & 0
\end{bmatrix}
$$

[- is written in place of -1]

$\Rightarrow MM^T = M^T M = 29I_{30} = (30-1)I_{30}$. Which show that M is another symmetric conference matrix of order 30.

3. ACKNOWLEDGMENT

The second author is indebted to UGC NATIONAL FELLOWSHIP FOR OTHER BACKWARD CLASSES(OBC) New Delhi,India,for financial support.

REFERENCES:

[1] Balon,N.A.&Seberry,A review and new symmetric conference matrices. Informatsionnno-upravliaiushchiesystemy,no.4,71(2014),pp2-7.

[2] BelevitchV.,Conference networks and Hadamard matrices,Ann.Soc.Sci.Brux.T.82(1968),13-32.

[3] Manjhi P. K. and Kumar A.,''On the Construction of Weighing matrices from Coherent Configuration,"International Journal of Mathematics Trends and Technology(IJMTT)-Volume 48 ,pp.281-287,5August 2017.

[4] Manjhi P. K. and Kumar A.,''On the Construction of Conference matrices of orders 10 and 14 from Coherent Configuration,"International Journal of Mathematics Trends and Technology(IJMTT)-Volume 49 ,pp.195-199,5August 2017.

[5] Manjhi P. K. and Kumar A.,''On the Construction of Conference matrices of orders 18 and 26 from Coherent Configuration,"International Journal of Engineering,Science and Mathematics(IJESM)-Volume 6 ,pp.131-143,October 2017.

[6] Seberry J. and Whiteman A.L,New Hadamard matrices and conference matrices obtained vaiMathonsconstruction,Graphs combin.4(1988),355-377.

[7] Singh M.K and Manjhi P.K."Generalized Directed Association Scheme and its Multiplicative form".International journal of mathematical science and Engineering Applications(IJMSEA),Vol.No.iii,pp,99-113,may2012