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## **THE Use of Kohonen Network for the Classification of Years by Levels of Rainfall in Ninava Province Hutheyfa H. Taha**

### **Abstract:**

The process of classification of data usually put conditions or limitations which are often illogical and incorrect,so in this research is a classification process has been conducted depending on the style of artificial neural network , specially kohonen network , which also called self organizing maps.

The results of classification are blind without interference from the researcher in the development of any restriction or condition and this

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تاريخ التسليم 2011/3/7 تاريخ القبول 2011/9/29

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is what is characterized kohonen network being one of the networks that train themselves without any superviision. Valuable Results were obtained in good appropriate time and the results of this method is to build Kohonen algorithm for the classification of years depending on the level of rain, and it is striking to obtain the results of classification using the above algorithm in a very short time.

: 1-1

(positive) (input) (unsupervised) (target) (negative)  
[7],[9]. (down) (up)  
: 2-1

: 3-1

1960

Rijksuniversiteit

1996

Dr.M.Turhan (Tury)

1997

2001

2003

2007

Qja

Polla

: 4-1

(Teuvo Kohonen) ( )

(target)

(target)

[4],[3].

(cluster)

(unsupervised)

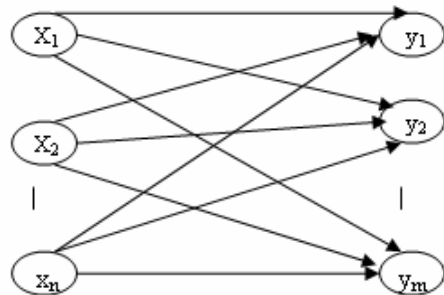
(cluster)

[8],[6]. (target)

(input)

[5],[1]:

(output)



input

output

:(1)

Borland.c)

C++

(3.1

(Object

Oriented Programming (O.O.P.)

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(Years)

(1)

.(1)

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6-1

[10]:

(1)....

2=

( )

(1)

(1)

(65)

(4096)

4034

65

[1]:

Optimal number of cluster=Fix(log<sub>2</sub> no.(input))  
.....(2)

(2)..... (( )<sub>2</sub> ) = (2)

: 1999-1935

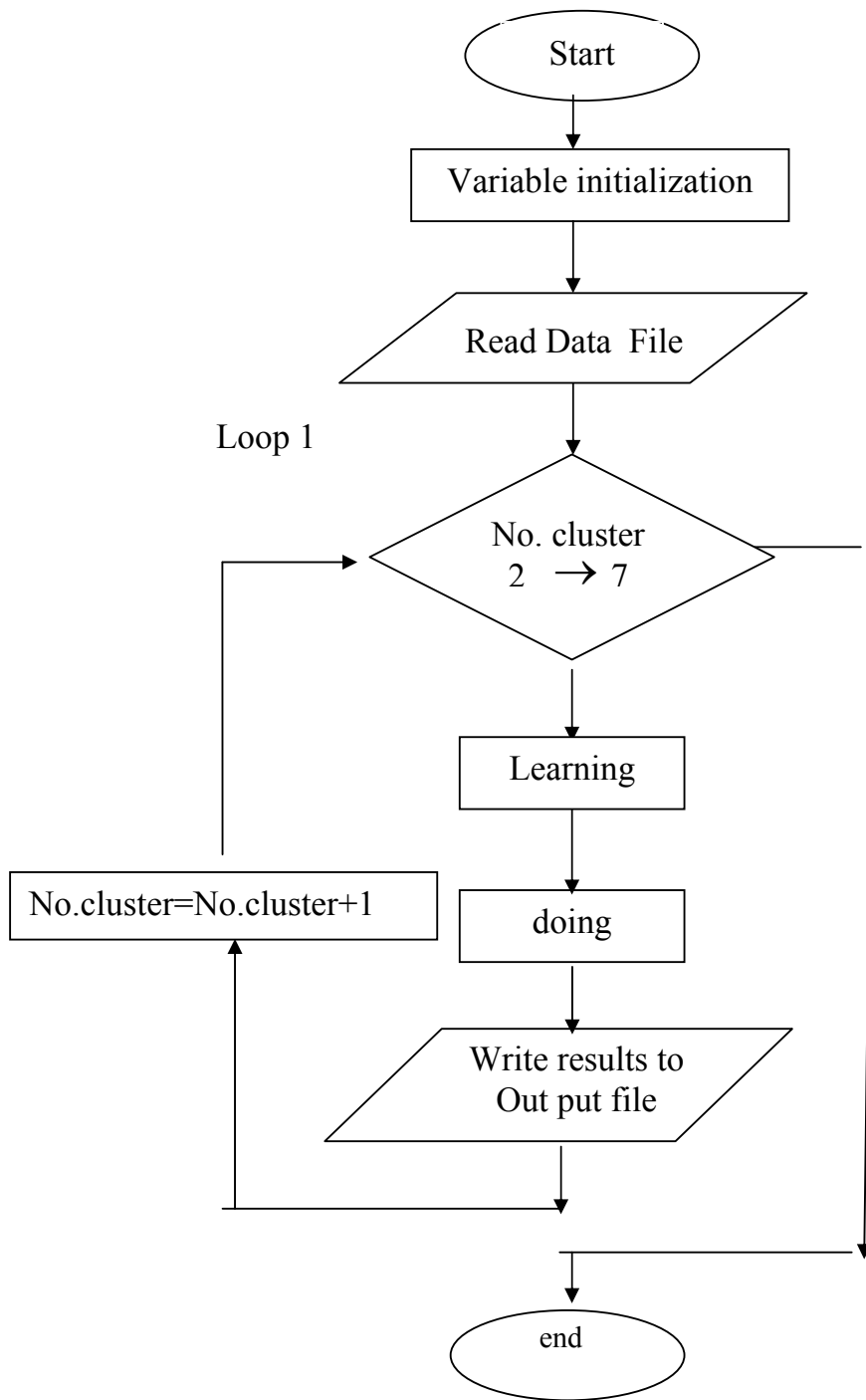
(log<sub>2</sub>(65)) =  
(6.93) =  
7=

2

: 7-1

(2)

:



(2)

:

variable initialization :

:

(No.Data=65) -1

. 1999-1935

(No. variable=12) -2

(Error=0.001) -3

(Max.No.Cluster=7) -4

(Alph=0.8) -5

(R=4) -6

Rain

Read Data File :

txt

.65\*12

(Loop1):

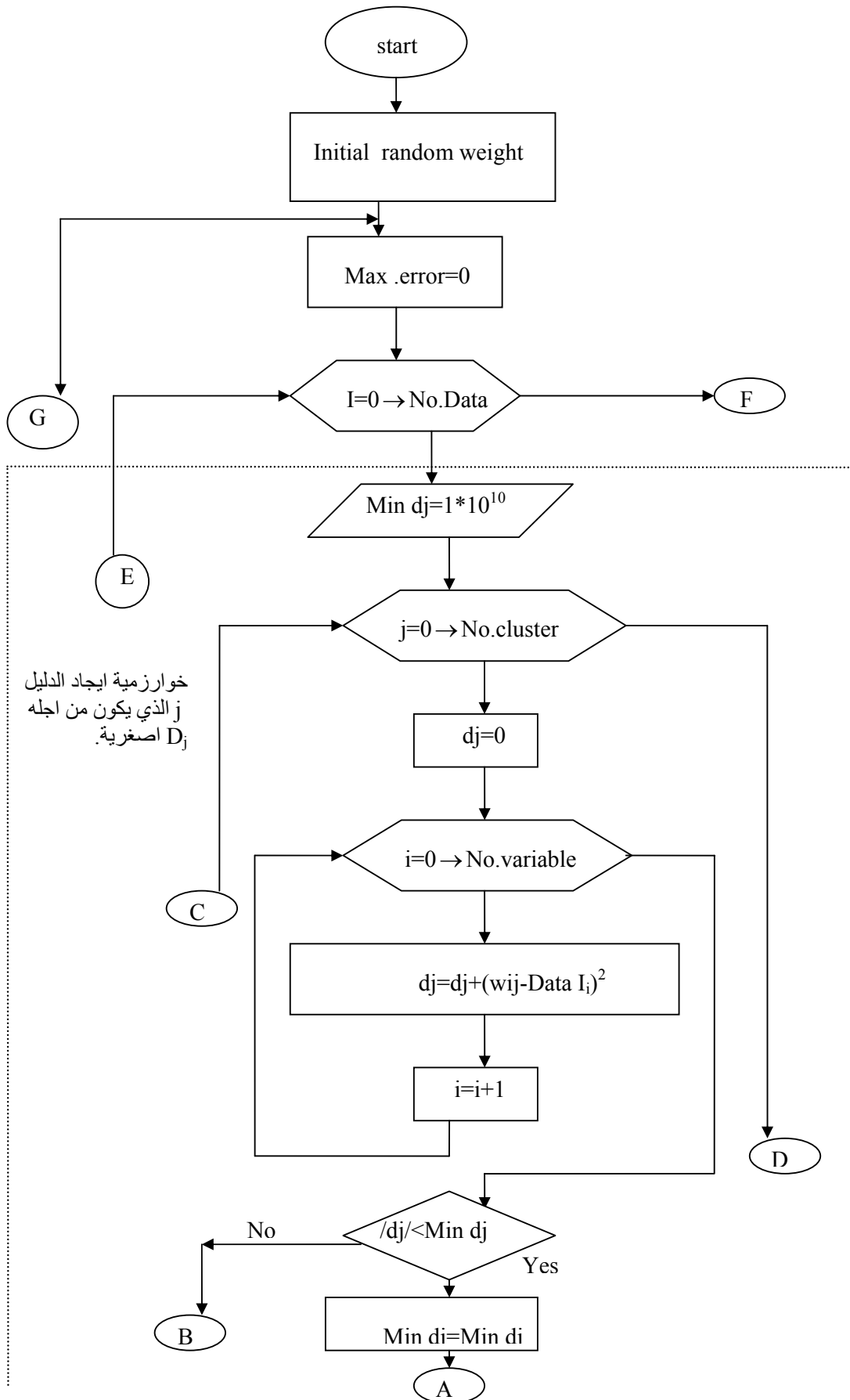
. (2)

7

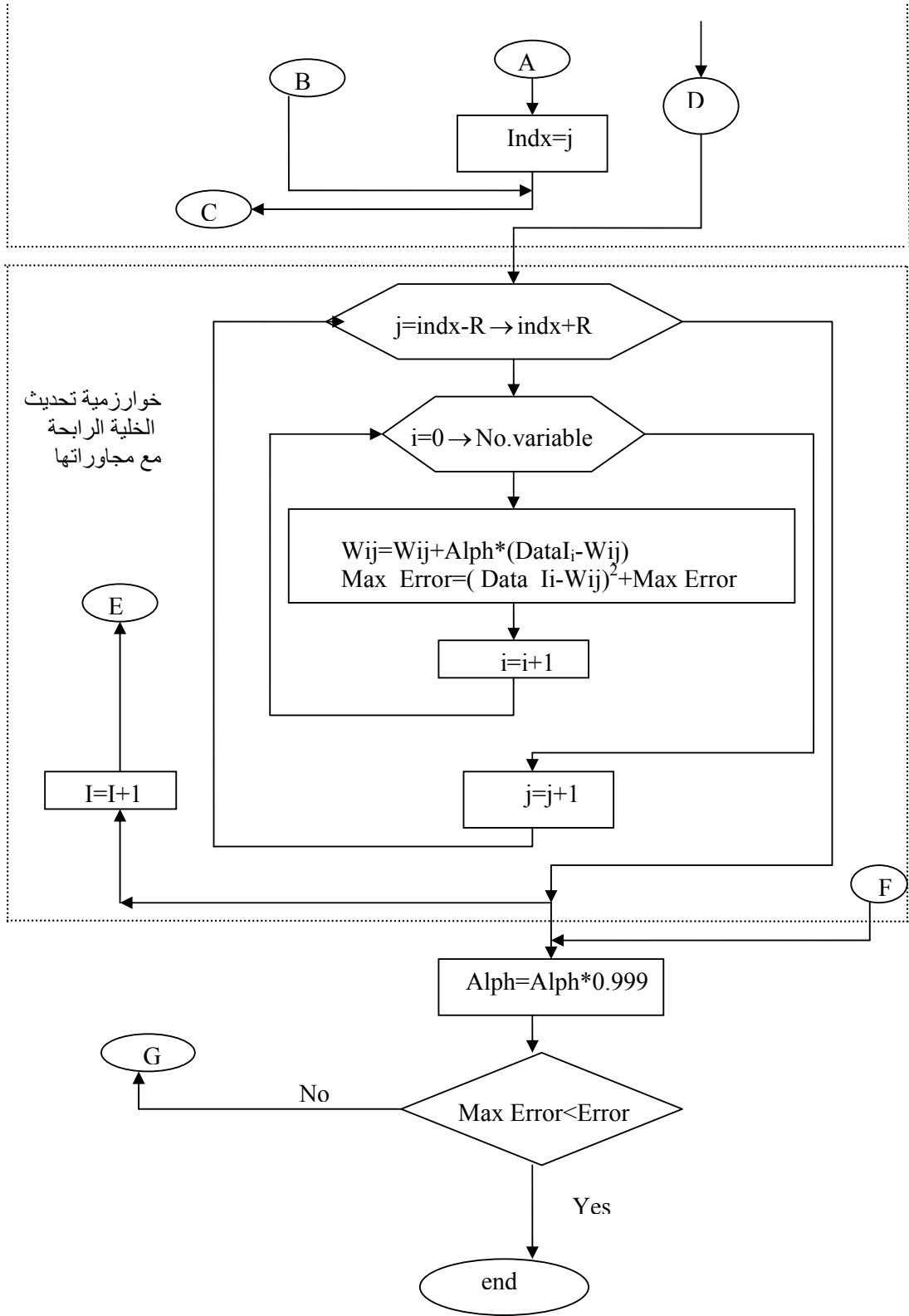
Learning :

: 1-7-1

:







:(3)

(- 7\*12 : . 1,1)

. 10 3 :  
Max Error Max Error < Error

. 9 4 :

$$D_{I_j} = \sum_j (w_{ij} - Data I_i)^2$$

Dj j :  
. indx  
indx :

$$W_{ij} = W_{ij} + \alpha(Data I_i - W_{ij})$$

. 6 3 :

:  $\alpha$  :

$$\alpha = \alpha \times 0.999$$

. R :

. :

:

doing :

.

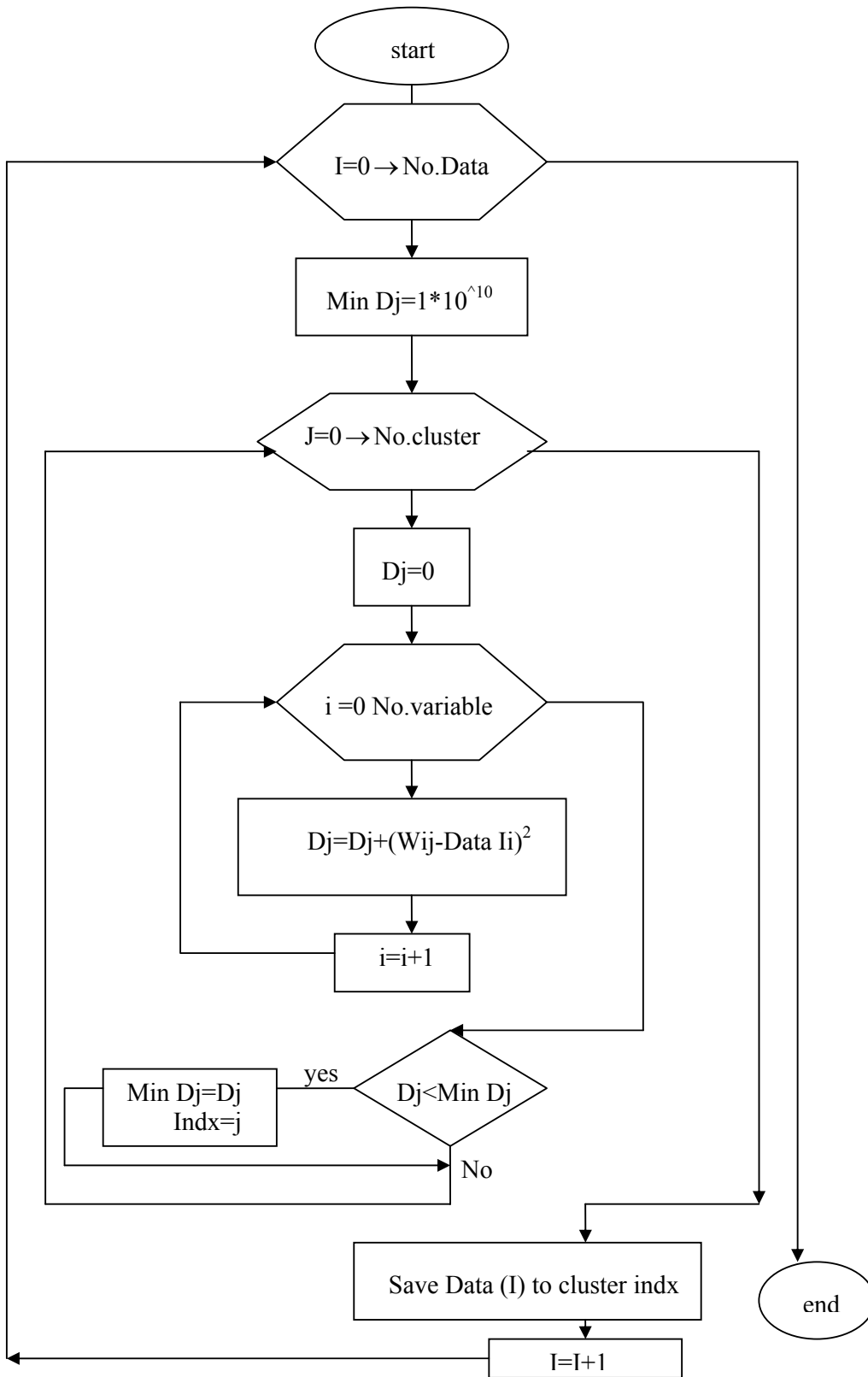
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:(4)

:

write result to out put file :

txt

:

result.txt

-1

No.iteration

-2

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.

-3

include

-4

.

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5 1

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------( 2 Clusters )-----

No. of iteration = 385

C( 0){ 67.24 46.45 53.19 35.53 14.84 0.61 0.16 0.07 0.64 13.50 50.47 48.30 }

Include -> 1935 , 1936 , 1937 , 1938 , 1940 , 1942 , 1944 , 1945 ,  
1947 , 1950 , 1951 , 1956 , 1958 , 1959 , 1960 , 1961 ,  
1962 , 1964 , 1965 , 1966 , 1967 , 1968 , 1969 , 1970 ,  
1971 , 1973 , 1977 , 1978 , 1979 , 1981 , 1982 , 1983 ,  
1984 , 1985 , 1986 , 1987 , 1989 , 1990 , 1994 , 1995 ,  
1997 , 1998 , 1999 , ( 43 )

C( 1){ 65.05 89.75 95.77 75.39 30.19 1.54 0.10 0.00 0.56 7.22 32.27 88.59 }

Include -> 1939 , 1941 , 1943 , 1946 , 1948 , 1949 , 1952 , 1953 ,  
1954 , 1955 , 1957 , 1963 , 1972 , 1974 , 1975 , 1976 ,  
1980 , 1988 , 1991 , 1992 , 1993 , 1996 , ( 22 )

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----- ( 3 Clusters ) -----

No. of iteration = 386

C( 0){ 109.92 46.90 51.88 33.28 16.16 1.01 0.30 0.04 0.43 7.65 38.54 66.07 }

Include -> 1938 , 1940 , 1944 , 1945 , 1947 , 1950 , 1951 , 1956 ,  
 1958 , 1962 , 1965 , 1969 , 1970 , 1977 , 1978 , 1979 ,  
 1988 , 1992 , 1996 , 1998 , ( 20 )

C( 1){ 43.42 53.27 55.20 39.68 14.66 0.80 0.03 0.07 0.82 15.61 57.80 46.62 }

Include -> 1935 , 1936 , 1937 , 1942 , 1955 , 1959 , 1960 , 1961 ,  
 1964 , 1966 , 1967 , 1968 , 1971 , 1973 , 1975 , 1981 ,  
 1982 , 1983 , 1984 , 1985 , 1986 , 1987 , 1989 , 1990 ,  
 1994 , 1995 , 1997 , 1999 , ( 28 )

C( 2){ 53.73 90.69 106.45 83.03 33.46 1.03 0.13 0.00 0.47 8.75 28.92 82.42 }

Include -> 1939 , 1941 , 1943 , 1946 , 1948 , 1949 , 1952 , 1953 ,  
 1954 , 1957 , 1963 , 1972 , 1974 , 1976 , 1980 , 1991 ,  
 1993 , ( 17 )

----- ( 4 Clusters ) -----

No. of iteration = 368

C( 0){ 58.83 37.45 56.64 36.20 15.63 0.00 0.00 0.20 1.59 14.96 112.02 37.90 }

Include -> 1935 , 1936 , 1937 , 1942 , 1944 , 1960 , 1967 , 1982 ,  
 1984 , 1989 , ( 10 )

C( 1){ 62.24 50.64 52.81 29.60 16.33 0.89 0.31 0.00 0.47 11.07 22.19 34.45 }

Include -> 1947 , 1950 , 1956 , 1958 , 1959 , 1962 , 1964 , 1965 ,  
 1966 , 1970 , 1973 , 1978 , 1981 , 1983 , 1985 , 1986 ,  
 1987 , 1990 , 1995 , 1998 , 1999 , ( 21 )

C( 2){ 91.46 62.60 55.65 40.81 13.71 1.40 0.01 0.05 0.36 11.83 46.34 95.91 }

Include -> 1938 , 1940 , 1941 , 1945 , 1951 , 1955 , 1961 , 1968 ,  
 1969 , 1975 , 1977 , 1979 , 1988 , 1992 , 1994 , 1996 ,  
 1997 , ( 17 )

C( 3){ 51.50 86.37 104.13 88.89 33.54 1.03 0.13 0.00 0.44 9.18 30.09 76.14 }

Include -> 1939 , 1943 , 1946 , 1948 , 1949 , 1952 , 1953 , 1954 ,  
1957 , 1963 , 1971 , 1972 , 1974 , 1976 , 1980 , 1991 ,  
1993 , ( 17 )

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------( 5 Clusters )-----

No. of iteration = 392

C( 0){ 70.19 40.35 52.40 37.45 14.45 0.00 0.00 0.14 1.24 13.00 102.47 50.30 }

Include -> 1935 , 1936 , 1937 , 1938 , 1942 , 1944 , 1945 , 1960 ,  
1961 , 1967 , 1982 , 1984 , 1989 , 1994 , ( 14 )

C( 1){ 43.94 55.58 63.62 29.98 19.40 1.13 0.46 0.00 0.41 14.15 19.20 28.43 }

Include -> 1959 , 1964 , 1966 , 1973 , 1976 , 1981 , 1983 , 1985 ,  
1987 , 1990 , 1995 , 1998 , 1999 , ( 13 )

C( 2){ 107.86 45.34 57.39 35.00 12.75 0.92 0.04 0.06 0.47 9.60 23.08 62.66 }

Include -> 1940 , 1947 , 1950 , 1951 , 1956 , 1958 , 1962 , 1965 ,  
1969 , 1970 , 1977 , 1978 , 1979 , 1988 , 1996 , ( 15 )

C( 3){ 49.19 108.72 55.89 49.79 19.92 1.55 0.22 0.00 0.21 11.13 40.06 94.51 }

Include -> 1941 , 1943 , 1946 , 1952 , 1955 , 1968 , 1975 , 1980 ,  
1986 , 1992 , 1997 , ( 11 )

C( 4){ 51.35 67.16 112.81 100.12 36.45 1.19 0.00 0.00 0.62 8.85 34.55 81.32 }

Include -> 1939 , 1948 , 1949 , 1953 , 1954 , 1957 , 1963 , 1971 ,  
1972 , 1974 , 1991 , 1993 , ( 12 )

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------( 6 Clusters )-----

No. of iteration = 400

C( 0){ 51.23 96.49 80.32 97.63 48.42 1.55 0.00 0.00 0.05 9.10 36.07 100.28 }

Include -> 1941 , 1946 , 1948 , 1949 , 1954 , 1963 , 1972 , 1980 ,  
1992 , 1993 , ( 10 )

C( 1){ 97.50 57.49 131.07 55.28 15.86 1.82 0.00 0.00 2.51 8.31 44.78 79.53 }

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Include -> 1939 , 1953 , 1957 , 1969 , 1974 , 1982 , 1988 , 1991 ,  
1994 , 1996 , ( 10 )

C( 2){ 46.13 97.27 80.69 40.22 12.19 0.86 0.25 0.00 0.00 13.94 35.11 41.23 }

Include -> 1943 , 1952 , 1964 , 1967 , 1976 , 1981 , 1985 , 1986 ,  
1995 , ( 9 )

C( 3){ 69.12 50.92 38.45 55.33 9.05 0.74 0.05 0.06 0.78 14.13 32.62 72.43 }

Include -> 1940 , 1947 , 1951 , 1955 , 1956 , 1961 , 1962 , 1965 ,  
1966 , 1968 , 1971 , 1975 , 1977 , 1979 , 1997 , ( 15 )

C( 4){ 61.44 43.22 46.09 14.12 26.55 0.67 0.54 0.00 0.01 11.19 14.62 28.19 }

Include -> 1950 , 1958 , 1959 , 1970 , 1973 , 1978 , 1983 , 1987 ,  
1990 , 1998 , 1999 , ( 11 )

C( 5){ 71.20 31.43 46.45 31.23 12.18 0.00 0.00 0.20 0.21 10.41 111.16 46.34 }

Include -> 1935 , 1936 , 1937 , 1938 , 1942 , 1944 , 1945 , 1960 ,  
1984 , 1989 , ( 10 )

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----- ( 7 Clusters ) -----

No. of iteration = 357

C( 0){ 43.67 40.87 53.45 29.40 13.83 0.00 0.00 0.25 0.07 16.34 112.98 34.07 }

Include -> 1935 , 1936 , 1937 , 1942 , 1960 , 1967 , 1984 , 1989 , ( 8 )

C( 1){ 44.03 67.15 85.69 52.59 15.88 1.40 0.00 0.00 0.78 18.33 33.03 31.69 }

Include -> 1957 , 1964 , 1972 , 1976 , 1981 , 1985 , 1986 , 1987 ,  
1995 , ( 9 )

C( 2){ 53.62 56.18 43.95 19.60 29.06 1.46 0.60 0.00 0.54 9.73 13.78 37.36 }

Include -> 1950 , 1959 , 1966 , 1973 , 1978 , 1983 , 1990 , 1997 ,  
1998 , 1999 , ( 10 )

C( 3){ 93.96 40.30 39.26 41.75 7.96 0.33 0.05 0.08 0.42 10.77 29.66 57.19 }

Include -> 1940 , 1947 , 1951 , 1956 , 1958 , 1961 , 1962 , 1965 ,



1970 , 1977 , 1979 , ( 11 )

C( 4){ 125.53 53.83 75.64 40.46 19.67 1.79 0.00 0.00 2.12 7.56 71.45 86.64 }

Include -> 1938 , 1944 , 1945 , 1969 , 1982 , 1988 , 1992 , 1994 ,  
1996 , ( 9 )

C( 5){ 44.03 54.51 39.58 104.37 54.81 1.13 0.00 0.00 0.22 14.72 33.54 95.04 }

Include -> 1946 , 1948 , 1955 , 1963 , 1968 , 1971 , 1975 , 1993 , ( 8 )

C( 6){ 52.93 111.32 132.30 62.48 5.36 0.38 0.23 0.00 0.09 4.17 30.85 92.81 }

Include -> 1939 , 1941 , 1943 , 1949 , 1952 , 1953 , 1954 , 1974 ,  
1980 , 1991 , ( 10 )

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----- ( 8 Clusters ) -----

No. of iteration = 402

C( 0){ 60.73 24.26 56.05 42.18 14.47 0.00 0.00 0.25 1.91 13.21 115.12 38.94 }

Include -> 1935 , 1936 , 1937 , 1944 , 1960 , 1982 , 1984 , 1989 , ( 8 )

C( 1){ 44.43 79.49 66.88 26.31 12.17 1.34 0.00 0.00 0.09 14.03 60.80 32.32 }

Include -> 1942 , 1964 , 1967 , 1981 , 1983 , 1986 , 1995 , ( 7 )

C( 2){ 39.82 56.86 57.16 29.76 22.61 1.41 0.08 0.00 0.60 21.62 11.71 37.95 }

Include -> 1959 , 1966 , 1973 , 1976 , 1985 , 1987 , 1990 , 1997 ,  
1999 , ( 9 )

C( 3){ 97.26 37.47 46.90 21.99 18.91 0.40 0.85 0.00 0.66 5.51 11.07 37.57 }

Include -> 1950 , 1956 , 1958 , 1965 , 1970 , 1978 , 1998 , ( 7 )

C( 4){ 85.38 57.21 31.89 47.36 14.30 0.58 0.00 0.07 0.25 9.30 53.79 84.33 }

Include -> 1938 , 1940 , 1945 , 1947 , 1951 , 1955 , 1961 , 1962 ,  
1968 , 1975 , 1977 , 1979 , 1992 , ( 13 )

C( 5){ 33.73 36.61 38.57 141.90 77.78 1.38 0.00 0.00 0.00 19.40 30.85 91.62 }

Include -> 1948 , 1963 , 1971 , 1993 , ( 4 )

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C( 6){ 95.67 66.84 108.98 57.95 23.31 2.39 0.00 0.00 1.11 9.03 33.45 96.67 }

Include -> 1939 , 1941 , 1946 , 1953 , 1957 , 1969 , 1988 , 1994 ,  
1996 , ( 9 )

C( 7){ 48.31 119.13 135.08 67.51 7.25 0.05 0.29 0.00 0.05 2.70 29.04 69.25 }

Include -> 1943 , 1949 , 1952 , 1954 , 1972 , 1974 , 1980 , 1991 , ( 8 )

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1975 1955

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1975 1955

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(1)

(1)

Years	Jan.	Feb.	Mar.	Apr.	may	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1935	23	27	11	41.5	19	0	0	2	0	6.5	84	60
1936	50	24	19	63.2	1	0	0	0	0	0	79.4	60.1
1937	84.4	13.1	10.7	44.2	7.5	0	0	0	0	54.6	127	13
1938	155.9	70.3	42.4	41	27	0	0	0	1.5	0	110.4	72.2
1939	73.3	59.5	138.1	100.4	5.8	0	0	0	0	11.3	53.1	135.3
1940	122.2	59.5	36.2	66.2	5.8	0	0	0	0	30.7	33.8	52.2
1941	38.3	93.2	80.7	28.7	0	0	0	0	0.5	0	20.4	165.5
1942	62.4	76.4	51.2	7.6	0.2	0	0	0	0.6	8.3	90	9.8
1943	51.5	134.8	103.6	42.3	8.5	0	2.3	0	0	14.1	1.7	48.7
1944	141.9	5.7	42.6	40.7	21.2	0	0	0	0	3.9	126.1	60.4
1945	105	15.7	18.5	12.3	3.3	0	0	0	0	5.2	80.4	115.8
1946	84	102.7	63.5	74.5	81.2	3.3	0	0	0	13.3	10.6	71.2
1947	88	29.8	36.8	83	9.6	1.1	0	0	0	0.1	42.9	36.7
1948	30.2	26.8	28.6	142.9	22	0	0	0	0	0	9.3	122.3
1949	42.6	129.6	167.4	74.8	10.9	0	0	0	0	0	0	117.6
1950	107.1	43	43	11.6	69.8	0.3	0	0	0	8.1	14.2	29.4

Years	Jan.	Feb.	Mar.	Apr.	may	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1951	93.1	76.9	47.2	45.2	22.5	0	0	0	0	19.9	24.6	72.5
1952	37.3	182.3	75.9	42.6	6.2	0	0	0	0	0	5.8	55.7
1953	76.4	84.1	131.1	75.7	9.5	3.8	0	0	0	9.3	45.1	102.6
1954	48.9	137.1	165	128.6	6.4	0	0	0	0	3.8	19.1	76.1
1955	41.5	59.7	39.7	73.7	6.1	0.2	0	0	1.8	0	41.7	100.7
1956	92.6	31.9	50.3	52	1.5	0	0	0	0.9	1.5	15.1	50.9
1957	55.3	45.2	111.6	85.8	67.7	4.5	0	0	7.1	3.5	44.1	35.1
1958	83.9	5	39.9	7.1	2.6	0.1	0	0	0	0.4	11.5	57.7
1959	29.7	45.6	85.5	23.9	89.4	5.4	0	0	0.1	12.7	12.4	26.1
1960	57.1	20.8	64.9	42.3	13.8	0	0	0	0	0	105.6	10.5
1961	57.5	57	12.2	45	12.9	0	0	0	0	8.9	55.5	68.4
1962	84.6	36	18.2	37.3	0.4	0	0	0	0	2.7	39.6	51.5
1963	54.3	13.3	65.4	124.5	142.8	0	0	0	0	53.1	6.8	113.3
1964	40	87.6	71	30.2	1	0	0	0	0	0	26.1	40
1965	114.1	55.4	48.9	55.5	8.9	2.4	0.6	0	3.7	27.1	10	35.2

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Years	Jan.	Feb.	Mar.	Apr.	may	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1966	32.8	56.2	58	46	12.1	0	0	0	5.3	21.2	1.5	61
1967	40.2	103.9	66.4	17	40.2	0	0	0	0	35.6	109	57.6
1968	41	26.2	45.2	55.3	25.4	0	0	0	0	26.3	53.2	127.7
1969	131.4	30.9	142.1	9.3	23.9	0	0	0	0	15.9	31.7	64
1970	124.5	14.2	62.6	2.5	20.8	0	0	0	0	0.6	24.4	23.8
1971	6	20	41.6	128.7	1.8	0	0	0	0	7.4	40.1	58.2
1972	45	77.5	108	120	19.7	0.4	0	0	0	0.5	42.2	28.2
1973	32.7	53.5	22.6	16	50.8	0	0	0	0	0	23.1	28.4
1974	111.4	95.1	172.7	39.9	3.6	0	0	0	0.4	0	43	32.8
1975	51.2	101.3	14.3	63.5	14.7	0	0	0	0	0.5	39.2	94.1
1976	65.6	77.6	91.4	66.7	36.3	0	0	0	0	19.4	3	30.6
1977	94.3	32.2	30	56.2	0.8	0	0	0	0	7.4	19.5	99.9
1978	77.7	80	35.1	5.9	4.2	0	0	0	0	0.8	2.3	56.5
1979	78.8	45.7	49.4	10.1	1.8	0	0	0.86	0	19.2	49.4	79.9
1980	21.3	165.5	81.9	83.1	0.7	0	0	0	0	3.1	75.1	112.2



Years	Jan.	Feb.	Mar.	Apr.	may	Jun.	Jul.	Aug	Sep.	Oct.	Nov.	Dec.
1981	59.4	52.1	97.1	27.1	5.8	0	0	0	0	26.6	56.5	47.3
1982	97	41.9	96	85.8	24.4	0	0	0	15.2	15	90.3	46
1983	40.5	49.2	40	18.9	27.7	1.6	0	0	0	1	54.8	18.2
1984	17.8	15.9	105.3	18.8	25.4	0	0	0	0	18.4	174.4	36
1985	52.5	50.9	78.6	52.9	1.5	0	0	0	0	3	23.9	38.1
1986	31.5	121.6	37.6	44.1	9.4	0	0	0	0	26	59.4	43.3
1987	10.2	26.2	71.6	8.4	1.3	0	0	0	0	84.7	12	12.8
1988	158.3	104.3	98.2	45.2	2.5	9.9	0	0	0	3.6	18.8	95.3
1989	14.9	45.5	97.6	1.3	3.4	0	0	0	0	7.3	133.5	25.8
1990	52.4	77.5	38.6	29.7	0.3	0	0	0	0	4	6.2	47.9
1991	28.5	32	205.6	9	2.1	0.001	0.001	0	0	0.2	44.6	82.6
1992	97.8	132.8	24.6	27.2	55.4	6.2	0	0	0.001	0	109.2	123.9
1993	49.8	85.9	18.8	171.4	144.1	5.5	0	0	0	17.1	66.7	73.1
1994	76.3	47.3	93.8	63.7	2.9	0	0	0	0	18.2	68.6	68.6

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Years	Jan.	Feb.	Mar.	Apr.	may	Jun.	Jul.	Aug	Sep.	Oct.	Nov.	Dec.
1995	37.2	65.7	104.7	39	0.9	7.7	0	0	0	0.7	30.2	10.1
1996	166.5	34.9	121.6	38.7	16.5	0	0	0	2.4	6.1	8.7	132.9
1997	45.6	75.9	48.7	12.9	11.5	7.3	0.1	0	0.001	38.9	23.3	96.6
1998	81.1	32.6	48.5	19.5	24.8	0.001	5.3	0	0	0.1	0.1	9.7
1999	36.8	48.2	19.9	11.7	1.2	0	0.6	0	0	10.5	0	0