

```
In [200]: import pandas as pd
import numpy as np
```

```
In [201]: data=pd.read_csv("/home/placement/Downloads/rainfall in india 1901-2015.csv")
```

```
In [202]: data.describe()
```

```
Out[202]:
```

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
count	4116.000000	4112.000000	4113.000000	4110.000000	4112.000000	4113.000000	4111.000000	4109.000000	4112.000000	4110.000000	4109.0
mean	1958.218659	18.957320	21.805325	27.359197	43.127432	85.745417	230.234444	347.214334	290.263497	197.361922	95.0
std	33.140898	33.585371	35.909488	46.959424	67.831168	123.234904	234.710758	269.539667	188.770477	135.408345	99.0
min	1901.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.400000	0.000000	0.000000	0.100000	0.0
25%	1930.000000	0.600000	0.600000	1.000000	3.000000	8.600000	70.350000	175.600000	155.975000	100.525000	14.0
50%	1958.000000	6.000000	6.700000	7.800000	15.700000	36.600000	138.700000	284.800000	259.400000	173.900000	65.0
75%	1987.000000	22.200000	26.800000	31.300000	49.950000	97.200000	305.150000	418.400000	377.800000	265.800000	148.0
max	2015.000000	583.700000	403.500000	605.600000	595.100000	1168.600000	1609.900000	2362.800000	1664.600000	1222.000000	948.0

In [203]: data.head()

Out[203]:

	SUBDIVISION	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec
0	ANDAMAN & NICOBAR ISLANDS	1901	49.2	87.1	29.2	2.3	528.8	517.5	365.1	481.1	332.6	388.5	558.2	33.6	3373.2	136.3	560.3	1696.3	980.3
1	ANDAMAN & NICOBAR ISLANDS	1902	0.0	159.8	12.2	0.0	446.1	537.1	228.9	753.7	666.2	197.2	359.0	160.5	3520.7	159.8	458.3	2185.9	716.7
2	ANDAMAN & NICOBAR ISLANDS	1903	12.7	144.0	0.0	1.0	235.1	479.9	728.4	326.7	339.0	181.2	284.4	225.0	2957.4	156.7	236.1	1874.0	690.6
3	ANDAMAN & NICOBAR ISLANDS	1904	9.4	14.7	0.0	202.4	304.5	495.1	502.0	160.1	820.4	222.2	308.7	40.1	3079.6	24.1	506.9	1977.6	571.0
4	ANDAMAN & NICOBAR ISLANDS	1905	1.3	0.0	3.3	26.9	279.5	628.7	368.7	330.5	297.0	260.7	25.4	344.7	2566.7	1.3	309.7	1624.9	630.8

```
In [204]: list(data)
```

```
Out[204]: ['SUBDIVISION',  
           'YEAR',  
           'JAN',  
           'FEB',  
           'MAR',  
           'APR',  
           'MAY',  
           'JUN',  
           'JUL',  
           'AUG',  
           'SEP',  
           'OCT',  
           'NOV',  
           'DEC',  
           'ANNUAL',  
           'Jan-Feb',  
           'Mar-May',  
           'Jun-Sep',  
           'Oct-Dec']
```

```
In [205]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4116 entries, 0 to 4115
Data columns (total 19 columns):
#   Column          Non-Null Count  Dtype
---  -
0   SUBDIVISION     4116 non-null   object
1   YEAR            4116 non-null   int64
2   JAN             4112 non-null   float64
3   FEB             4113 non-null   float64
4   MAR             4110 non-null   float64
5   APR             4112 non-null   float64
6   MAY             4113 non-null   float64
7   JUN             4111 non-null   float64
8   JUL             4109 non-null   float64
9   AUG             4112 non-null   float64
10  SEP             4110 non-null   float64
11  OCT             4109 non-null   float64
12  NOV             4105 non-null   float64
13  DEC             4106 non-null   float64
14  ANNUAL          4090 non-null   float64
15  Jan-Feb         4110 non-null   float64
16  Mar-May         4107 non-null   float64
17  Jun-Sep         4106 non-null   float64
18  Oct-Dec         4103 non-null   float64
dtypes: float64(17), int64(1), object(1)
memory usage: 611.1+ KB
```

```
In [206]: data.isna().sum()
```

```
Out[206]: SUBDIVISION      0  
YEAR      0  
JAN       4  
FEB       3  
MAR       6  
APR       4  
MAY       3  
JUN       5  
JUL       7  
AUG       4  
SEP       6  
OCT       7  
NOV      11  
DEC      10  
ANNUAL    26  
Jan-Feb   6  
Mar-May   9  
Jun-Sep  10  
Oct-Dec  13  
dtype: int64
```

```
In [207]: data=data.groupby(['SUBDIVISION']).count()
```

In [208]: data

Out[208]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec
SUBDIVISION																		
ANDAMAN & NICOBAR ISLANDS	110	110	110	108	108	109	108	108	108	107	108	108	107	104	110	107	107	107
ARUNACHAL PRADESH	97	96	96	95	97	97	96	96	97	97	95	95	95	91	96	95	95	94
ASSAM & MEGHALAYA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
BIHAR	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
CHHATTISGARH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
COASTAL ANDHRA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
COASTAL KARNATAKA	115	114	115	115	115	115	115	115	115	115	115	115	115	114	114	115	115	115
EAST MADHYA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
EAST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
EAST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
GANGETIC WEST BENGAL	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
GUJARAT REGION	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
HARYANA DELHI & CHANDIGARH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
HIMACHAL PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
JAMMU & KASHMIR	115	115	115	115	115	115	115	114	115	115	115	114	114	114	115	115	114	114
JHARKHAND	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
KERALA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
KONKAN & GOA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
LAKSHADWEEP	114	112	113	112	112	112	112	111	112	111	111	108	110	103	111	110	110	108
MADHYA MAHARASHTRA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
MATATHWADA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
NAGA MANI MIZO TRIPURA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec
SUBDIVISION																		
NORTH INTERIOR KARNATAKA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
ORISSA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
PUNJAB	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
RAYALSEEMA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
SAURASHTRA & KUTCH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
SOUTH INTERIOR KARNATAKA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
SUB HIMALAYAN WEST BENGAL & SIKKIM	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
TAMIL NADU	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
TELANGANA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
UTTARAKHAND	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
VIDARBHA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
WEST MADHYA PRADESH	115	115	114	115	115	115	115	115	115	115	115	115	115	114	114	115	115	115
WEST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
WEST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115

```
In [209]: data1=data.loc[(data.YEAR<=2010)]
```

```
In [210]: data1.tail(5)
```

```
Out[210]:
```

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	Jan-Feb	Mar-May	Jun-Sep	Oct-Dec
SUBDIVISION																		
UTTARAKHAND	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
VIDARBHA	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
WEST MADHYA PRADESH	115	115	114	115	115	115	115	115	115	115	115	115	115	114	114	115	115	115
WEST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
WEST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115

```
In [211]: data2=data.drop(['ANNUAL','Jan-Feb','Mar-May','Jun-Sep','Oct-Dec'],axis=1)
```


In [212]: data2

Out[212]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SUBDIVISION													
ANDAMAN & NICOBAR ISLANDS	110	110	110	108	108	109	108	108	108	107	108	108	107
ARUNACHAL PRADESH	97	96	96	95	97	97	96	96	97	97	95	95	95
ASSAM & MEGHALAYA	115	115	115	115	115	115	115	115	115	115	115	115	115
BIHAR	115	115	115	115	115	115	115	115	115	115	115	115	115
CHHATTISGARH	115	115	115	115	115	115	115	115	115	115	115	115	115
COASTAL ANDHRA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115
COASTAL KARNATAKA	115	114	115	115	115	115	115	115	115	115	115	115	115
EAST MADHYA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115
EAST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115
EAST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115
GANGETIC WEST BENGAL	115	115	115	115	115	115	115	115	115	115	115	115	115
GUJARAT REGION	115	115	115	115	115	115	115	115	115	115	115	115	115
HARYANA DELHI & CHANDIGARH	115	115	115	115	115	115	115	115	115	115	115	115	115
HIMACHAL PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115
JAMMU & KASHMIR	115	115	115	115	115	115	115	114	115	115	115	114	114
JHARKHAND	115	115	115	115	115	115	115	115	115	115	115	115	115
KERALA	115	115	115	115	115	115	115	115	115	115	115	115	115
KONKAN & GOA	115	115	115	115	115	115	115	115	115	115	115	115	115
LAKSHADWEEP	114	112	113	112	112	112	112	111	112	111	111	108	110
MADHYA MAHARASHTRA	115	115	115	115	115	115	115	115	115	115	115	115	115
MATATHWADA	115	115	115	115	115	115	115	115	115	115	115	115	115
NAGA MANI MIZO TRIPURA	115	115	115	115	115	115	115	115	115	115	115	115	115
NORTH INTERIOR KARNATAKA	115	115	115	115	115	115	115	115	115	115	115	115	115

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
SUBDIVISION													
ORISSA	115	115	115	115	115	115	115	115	115	115	115	115	115
PUNJAB	115	115	115	115	115	115	115	115	115	115	115	115	115
RAYALSEEMA	115	115	115	115	115	115	115	115	115	115	115	115	115
SAURASHTRA & KUTCH	115	115	115	115	115	115	115	115	115	115	115	115	115
SOUTH INTERIOR KARNATAKA	115	115	115	115	115	115	115	115	115	115	115	115	115
SUB HIMALAYAN WEST BENGAL & SIKKIM	115	115	115	115	115	115	115	115	115	115	115	115	115
TAMIL NADU	115	115	115	115	115	115	115	115	115	115	115	115	115
TELANGANA	115	115	115	115	115	115	115	115	115	115	115	115	115
UTTARAKHAND	115	115	115	115	115	115	115	115	115	115	115	115	115
VIDARBHA	115	115	115	115	115	115	115	115	115	115	115	115	115
WEST MADHYA PRADESH	115	115	114	115	115	115	115	115	115	115	115	115	115
WEST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115
WEST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115

```
In [214]: data2['ANNUAL RAIN']=data2.apply(lambda row:row.JAN+row.FEB,axis=1)
data2
```

Out[214]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL RAIN
SUBDIVISION														
ANDAMAN & NICOBAR ISLANDS	110	110	110	108	108	109	108	108	108	107	108	108	107	220
ARUNACHAL PRADESH	97	96	96	95	97	97	96	96	97	97	95	95	95	192
ASSAM & MEGHALAYA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
BIHAR	115	115	115	115	115	115	115	115	115	115	115	115	115	230
CHHATTISGARH	115	115	115	115	115	115	115	115	115	115	115	115	115	230
COASTAL ANDHRA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	230
COASTAL KARNATAKA	115	114	115	115	115	115	115	115	115	115	115	115	115	229
EAST MADHYA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	230
EAST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115	230
EAST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	230
GANGETIC WEST BENGAL	115	115	115	115	115	115	115	115	115	115	115	115	115	230
GUJARAT REGION	115	115	115	115	115	115	115	115	115	115	115	115	115	230
HARYANA DELHI & CHANDIGARH	115	115	115	115	115	115	115	115	115	115	115	115	115	230
HIMACHAL PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	230
JAMMU & KASHMIR	115	115	115	115	115	115	115	114	115	115	115	114	114	230
JHARKHAND	115	115	115	115	115	115	115	115	115	115	115	115	115	230
KERALA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
KONKAN & GOA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
LAKSHADWEEP	114	112	113	112	112	112	112	111	112	111	111	108	110	225
MADHYA MAHARASHTRA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
MATATHWADA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
NAGA MANI MIZO TRIPURA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
NORTH INTERIOR KARNATAKA	115	115	115	115	115	115	115	115	115	115	115	115	115	230

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL RAIN
SUBDIVISION														
ORISSA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
PUNJAB	115	115	115	115	115	115	115	115	115	115	115	115	115	230
RAYALSEEMA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
SAURASHTRA & KUTCH	115	115	115	115	115	115	115	115	115	115	115	115	115	230
SOUTH INTERIOR KARNATAKA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
SUB HIMALAYAN WEST BENGAL & SIKKIM	115	115	115	115	115	115	115	115	115	115	115	115	115	230
TAMIL NADU	115	115	115	115	115	115	115	115	115	115	115	115	115	230
TELANGANA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
UTTARAKHAND	115	115	115	115	115	115	115	115	115	115	115	115	115	230
VIDARBHA	115	115	115	115	115	115	115	115	115	115	115	115	115	230
WEST MADHYA PRADESH	115	115	114	115	115	115	115	115	115	115	115	115	115	229
WEST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115	230
WEST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	230

In [235]: data2['ANNUAL RAIN']=data2.apply(**lambda** row:row.JAN+row.FEB+row.MAR+row.APR+row.MAY+row.JUN+row.JUL+row.AUG+

In [237]: data2

Out[237]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL RAIN
SUBDIVISION														
ANDAMAN & NICOBAR ISLANDS	110	110	110	108	108	109	108	108	108	107	108	108	107	1299
ARUNACHAL PRADESH	97	96	96	95	97	97	96	96	97	97	95	95	95	1152
ASSAM & MEGHALAYA	115	115	115	115	115	115	115	115	115	115	115	115	115	1380
BIHAR	115	115	115	115	115	115	115	115	115	115	115	115	115	1380
CHHATTISGARH	115	115	115	115	115	115	115	115	115	115	115	115	115	1380
COASTAL ANDHRA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	1380
COASTAL KARNATAKA	115	114	115	115	115	115	115	115	115	115	115	115	115	1379
EAST MADHYA PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	1380
EAST RAJASTHAN	115	115	115	115	115	115	115	115	115	115	115	115	115	1380
EAST UTTAR PRADESH	115	115	115	115	115	115	115	115	115	115	115	115	115	1380
GANGETIC WEST BENGAL	115	115	115	115	115	115	115	115	115	115	115	115	115	1380

In [224]: cor=data.corr()

In [238]:

cor

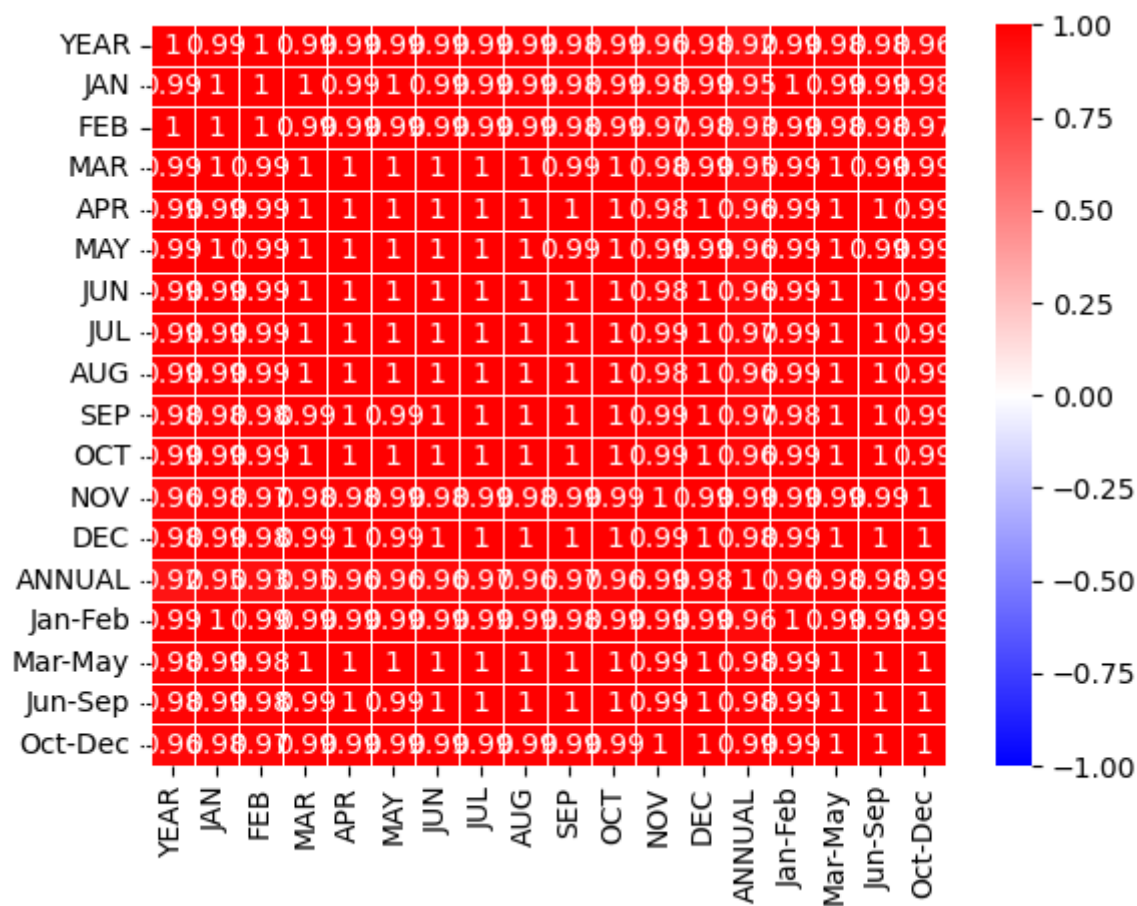
Out[238]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANI
YEAR	1.000000	0.993760	0.997455	0.993973	0.989823	0.993275	0.992164	0.985452	0.989823	0.978107	0.988810	0.960883	0.977662	0.915536
JAN	0.993760	1.000000	0.996021	0.995347	0.992011	0.996508	0.993926	0.991848	0.992011	0.984236	0.994791	0.979961	0.986975	0.986539
FEB	0.997455	0.996021	1.000000	0.994589	0.990564	0.994906	0.992840	0.988334	0.990564	0.980386	0.991652	0.970022	0.981743	0.993725
MAR	0.993973	0.995347	0.994589	1.000000	0.999312	0.999747	0.999844	0.997201	0.999312	0.994813	0.998903	0.982465	0.994152	0.992345
APR	0.989823	0.992011	0.990564	0.999312	1.000000	0.998759	0.999812	0.997771	1.000000	0.997767	0.998838	0.984162	0.996123	0.989647
MAY	0.993275	0.996508	0.994906	0.999747	0.998759	1.000000	0.999447	0.997619	0.998759	0.994332	0.999432	0.985250	0.994718	0.995659
JUN	0.992164	0.993926	0.992840	0.999844	0.999812	0.999447	1.000000	0.997644	0.999812	0.996393	0.999043	0.983443	0.995263	0.996219
JUL	0.985452	0.991848	0.988334	0.997201	0.997771	0.997619	0.997644	1.000000	0.997771	0.996559	0.998641	0.991730	0.999047	0.997785
AUG	0.989823	0.992011	0.990564	0.999312	1.000000	0.998759	0.999812	0.997771	1.000000	0.997767	0.998838	0.984162	0.996123	0.997101
SEP	0.978107	0.984236	0.980386	0.994813	0.997767	0.994332	0.996393	0.996559	0.997767	1.000000	0.996543	0.988190	0.997805	0.998866
OCT	0.988810	0.994791	0.991652	0.998903	0.998838	0.999432	0.999043	0.998641	0.998838	0.996543	1.000000	0.989853	0.997170	0.998154
NOV	0.960883	0.979961	0.970022	0.982465	0.984162	0.985250	0.983443	0.991730	0.984162	0.988190	0.989853	1.000000	0.994641	0.993647
DEC	0.977662	0.986975	0.981743	0.994152	0.996123	0.994718	0.995263	0.999047	0.996123	0.997805	0.997170	0.994641	1.000000	0.998940
ANNUAL	0.915536	0.945631	0.930247	0.952015	0.958152	0.955291	0.955106	0.967881	0.958152	0.971438	0.964448	0.988780	0.976902	0.976902
Jan-Feb	0.986539	0.997512	0.993725	0.992345	0.989647	0.994332	0.991228	0.991424	0.989647	0.984169	0.994090	0.985808	0.988203	0.988203
Mar-May	0.978447	0.987926	0.982640	0.995088	0.997101	0.995659	0.996219	0.997785	0.997101	0.998866	0.998154	0.993647	0.998940	0.997785
Jun-Sep	0.977662	0.986975	0.981743	0.994152	0.996123	0.994718	0.995263	0.999047	0.996123	0.997805	0.997170	0.994641	1.000000	0.997170
Oct-Dec	0.963418	0.980399	0.971337	0.985289	0.987682	0.987376	0.986600	0.993899	0.987682	0.992147	0.991854	0.999479	0.996960	0.996960

In [239]: import seaborn as sns

```
In [241]: sns.heatmap(cor,vmax=1,vmin=-1,annot=True,linewidth=.5,cmap='bwr')
```

```
Out[241]: <Axes: >
```



```
In [ ]:
```

