Calculate:

- Range of variation (R)
- mean linear deviation (d)
- dispersion (D)
- standard deviation (Sig)

- The coefficient of variation (V)
- Oscillation coefficient (Vr)
- linear coefficient of variation (Vd)

- Quartile
- Decel

- Total variance
- Intergroup dispersion
- Intra-group variance

- The empirical coefficient of determination
- Empirical correlation relation

In [1]:

```
import pandas as pd
```

In [2]:

```
df = pd.read_csv('2019_nCoV_data.csv')
df = df[['Province/State', 'Confirmed']]
States = set(df['Province/State'].to_list())

State_Conf = {}
for state in States:
    State_Conf[state] = int(sum(df[df['Province/State']==state]['Confirmed']))
State_Conf
list_of_keys = list(State_Conf.keys())
list_of_values = list(State_Conf.values())
data = pd.DataFrame({'State': list_of_keys[:20], 'Confirmed': list_of_values[:20
]})
data = data.set_index('State').sort_values('Confirmed')
```

In [3]:

```
from pandas_ods_reader import read_ods
data = read_ods('ex1.ods', "Sheet1")
print(data[:5], '\n\n', data[-5:])
data.plot()
```

```
   Col_1  Col_2  Col_3
0   82.0   96.0   88.0
1   88.0  100.0   92.0
2   81.0   90.0   97.0
3   99.0   88.0   99.0
4   82.0   82.0   94.0

      Col_1  Col_2  Col_3
26   93.0   89.0   82.0
27   88.0   81.0   92.0
28   97.0   89.0   91.0
29   84.0   94.0   88.0
30   95.0   82.0   91.0
```

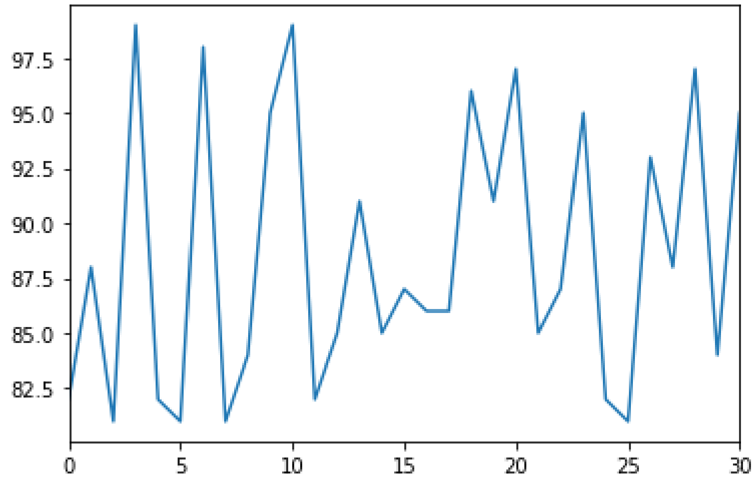
Out[3]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fe7d8cc4310>
```

In [4]:

```
data1 = data['Col_1']
data1.plot()
print(data1.describe())
data1 = data1.to_list()
```

```
count    31.000000
mean     88.483871
std       6.217561
min      81.000000
25%      83.000000
50%      87.000000
75%      95.000000
max      99.000000
Name: Col_1, dtype: float64
```



In [5]:

```
# Range of variation (R)
R = max(data1) - min(data1)
R
```

Out[5]:

```
18.0
```

In [6]:

```
# mean linear deviation (d)
m = sum(data1)/len(data1)
d = sum([abs(xi - m) for xi in data1])/len(data1)
m , d
```

Out[6]:

```
(88.48387096774194, 5.431841831425598)
```

In [7]:

```
#dispersion (D)
D = sum([(xi - m)**2 for xi in data1])/len(data1)
D
```

Out[7]:

```
37.41103017689906
```

In [8]:

```
# standard deviation (Sig)
from math import sqrt
Sig = sqrt(D)
Sig
```

Out[8]:

```
6.116455687479397
```

In [9]:

```
# The coefficient of variation (V)
V = Sig/m
V
```

Out[9]:

```
0.06912509161934426
```

In [10]:

```
# Oscillation coefficient (Vr)
Vr = R/m
Vr
```

Out[10]:

```
0.2034269048487058
```

In [11]:

```
# linear coefficient of variation (Vd)
Vd = d/m
Vd
```

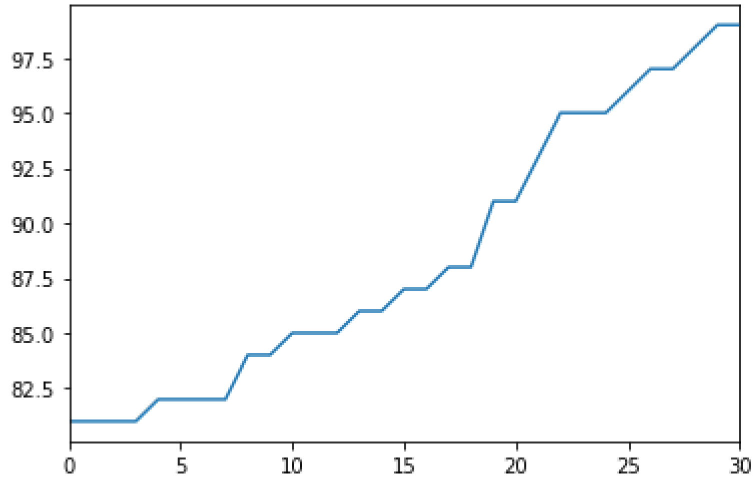
Out[11]:

```
0.06138793174414639
```

In [12]:

```
# Quartile
data['new'] = data['Col_1'].sort_values().to_list()
print(data['new'].plot())
data_list = data['new'].to_list()
Q1 = data_list[1*len(data1)//4]
Q2 = data_list[2*len(data1)//4]
Q3 = data_list[3*len(data1)//4]
print(Q1, Q2, Q3)
```

```
AxesSubplot(0.125,0.125;0.775x0.755)
82.0 87.0 95.0
```



In [13]:

```
# Decel
Q3 = data_list[3*len(data1)//4]
decels = [ data_list[i*len(data1)//10] for i in range(1, 10)]
decels
```

Out[13]:

```
[81.0, 82.0, 84.0, 85.0, 87.0, 88.0, 93.0, 95.0, 97.0]
```

In [34]:

```
# Total dispersion
def avg(l): return sum(l)/len(l)

groups = [ data_list[i:i+6] for i in range(5)]
data_groups = pd.DataFrame({'gr1': groups[0],
                            'gr2': groups[1],
                            'gr3': groups[2],
                            'gr4': groups[3],
                            'gr5': groups[4]})
print(data_groups)

Dg = 0
for i in range(len(groups)):
    for k in range(len(groups[i])):
        Dg += (groups[i][k] - avg(groups[i]))**2

Dg = Dg/len(groups[1])
Dg
```

```
    gr1   gr2   gr3   gr4   gr5
0  81.0  81.0  81.0  81.0  82.0
1  81.0  81.0  81.0  82.0  82.0
2  81.0  81.0  82.0  82.0  82.0
3  81.0  82.0  82.0  82.0  82.0
4  82.0  82.0  82.0  82.0  84.0
5  82.0  82.0  82.0  84.0  84.0
```

Out[34]:

```
2.388888888888888
```

In [35]:

```
# Intergroup dispersion
Di = 0
for i in range(len(groups)):
    for k in range(len(groups[i])):
        Di += (groups[i][k] - avg(groups[i]))**2 * len(groups[1])

Di = Di/len(data_list)
Di
```

Out[35]:

```
2.774193548387097
```

In [53]:

```
# Intra-group variance
print(sqrt(abs(Dg**2 - Di**2)))
```

```
1.4104466386417482
```

In [59]:

```
# The empirical coefficient of determination
tetta_pow2 = Sig**2/D
tetta_pow2
```

Out[59]:

```
1.0000000000000002
```

In [60]:

```
# Empirical correlation relation
sqrt(tetta_pow2)
```

Out[60]:

```
1.0
```

In [ ]:

In [ ]: