```
#import pandas library and load and read the data using pandas
import pandas as pd

dataset = pd.read_csv('CTT10.csv')
dataset.head()
```

```
         Data Último Abertura  Alta Baixa     Vol.  Var. %
0  12.04.2021   3,50     3,57  3,64  3,46    1,57M  -1,55%
1  09.04.2021   3,56     3,52  3,57  3,52  666,03K   1,14%
2  08.04.2021   3,52     3,45  3,54  3,45  882,54K   1,59%
3  07.04.2021   3,46     3,43  3,49  3,43  508,33K   0,87%
4  06.04.2021   3,43     3,44  3,49  3,43  809,46K   0,59%
```

```
#read all the columns
print(dataset.columns)
print(dataset.shape)
```

```
Index(['Data', 'Último', 'Abertura', 'Alta', 'Baixa', 'Vol.', 'Var.
%'], dtype='object')
(1875, 7)
```

```
#replace them the english names
new_dataset = dataset.rename(columns={'Data':'Date', 'Último':'Last',
'Abertura':'Opening', 'Alta':'High', 'Baixa':'Low'})
new_dataset.columns
```

```
Index(['Date', 'Last', 'Opening', 'High', 'Low', 'Vol.', 'Var. %'],
dtype='object')
```

```
#read the dataset again
new_dataset.head(5)
```

```
         Date  Last Opening  High   Low     Vol.  Var. %
0  12.04.2021  3,50    3,57  3,64  3,46    1,57M  -1,55%
1  09.04.2021  3,56    3,52  3,57  3,52  666,03K   1,14%
2  08.04.2021  3,52    3,45  3,54  3,45  882,54K   1,59%
3  07.04.2021  3,46    3,43  3,49  3,43  508,33K   0,87%
4  06.04.2021  3,43    3,44  3,49  3,43  809,46K   0,59%
```

Hence we can see that the column names are changed now

```
#replace the comma with a point in the numbers
new_dataset = new_dataset.stack().str.replace(',','.').unstack()
new_dataset.head()
```

```
         Date  Last Opening  High   Low     Vol.  Var. %
0  12.04.2021  3.50    3.57  3.64  3.46    1.57M  -1.55%
1  09.04.2021  3.56    3.52  3.57  3.52  666.03K   1.14%
2  08.04.2021  3.52    3.45  3.54  3.45  882.54K   1.59%
3  07.04.2021  3.46    3.43  3.49  3.43  508.33K   0.87%
4  06.04.2021  3.43    3.44  3.49  3.43  809.46K   0.59%
```

```
#convert M and K into respective number
def sign_to_number(x):
    if type(x) == float or type(x) == int:
        return x
    if 'K' in x:
        if len(x) > 1:
            return float(x.replace('K', '')) * 1000
        return 1000.0
    if 'M' in x:
        if len(x) > 1:
            return float(x.replace('M', '')) * 1000000
        return 1000000.0

new_dataset['Vol.'] = new_dataset['Vol.'].apply(sign_to_number)

new_dataset.head()
```

	Date	Last	Opening	High	Low	Vol.	Var. %
0	12.04.2021	3.50	3.57	3.64	3.46	1570000.0	-1.55%
1	09.04.2021	3.56	3.52	3.57	3.52	666030.0	1.14%
2	08.04.2021	3.52	3.45	3.54	3.45	882540.0	1.59%
3	07.04.2021	3.46	3.43	3.49	3.43	508330.0	0.87%
4	06.04.2021	3.43	3.44	3.49	3.43	809460.0	0.59%

```
#add one column at the last and assign negative or positive by looking
at the variation column

#here i am removing % sign
new_dataset['Var. %'] = new_dataset['Var. %'].str.replace(r'%', '')


#here I am changing the series into list
lst = new_dataset['Var. %'].tolist()


#change string into float
for i in range(0, len(lst)):
    lst[i] = float(lst[i])


#new list created and appended the category into the list
new_column = []
for i in range(len(lst)):
    if(lst[i] > 0):
        new_column.append("positive")
    elif (lst[i] < 0):
        new_column.append("negative")
    else:
        new_column.append("neutral")
print(new_column)
```

```
print(len(new_column))

#now append the list column into our dataset and our new column is
"category"
new_dataset['category'] = new_column

new_dataset
```

```
['negative', 'positive', 'positive', 'positive', 'positive',
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1875
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	Date	Last	Opening	High	Low	Vol.	Var. %	category
0	12.04.2021	3.50	3.57	3.64	3.46	1570000.0	-1.55	negative
1	09.04.2021	3.56	3.52	3.57	3.52	666030.0	1.14	positive
2	08.04.2021	3.52	3.45	3.54	3.45	882540.0	1.59	positive
3	07.04.2021	3.46	3.43	3.49	3.43	508330.0	0.87	positive
4	06.04.2021	3.43	3.44	3.49	3.43	809460.0	0.59	positive
...	...	...	...	...	...	...	...	...
1870	12.12.2013	5.74	5.75	5.76	5.71	725190.0	-0.52	negative
1871	11.12.2013	5.77	5.69	5.79	5.67	1370000.0	1.23	positive
1872	10.12.2013	5.70	5.74	5.79	5.70	1430000.0	-2.06	negative
1873	09.12.2013	5.82	5.53	5.82	5.52	5800000.0	5.24	positive
1874	06.12.2013	5.53	5.58	5.59	5.51	4290000.0	-0.18	negative

[1875 rows x 8 columns]

```
#change the date format into month-day-year
from datetime import datetime as dt
from datetime import timedelta as td

#here we are converting the date object into in Date
new_dataset['Date'] = pd.to_datetime(new_dataset.Date)

#here I am changing the date format
new_dataset['Date'] = new_dataset['Date'].dt.strftime('%d-%m-%Y')

new_dataset.head()
```

```
C:\Users\arfan.shah\AppData\Local\Temp\
ipykernel_13424\1437982748.py:6: UserWarning: Parsing dates in
DD/MM/YYYY format when dayfirst=False (the default) was specified.
This may lead to inconsistently parsed dates! Specify a format to
ensure consistent parsing.
  new_dataset['Date'] = pd.to_datetime(new_dataset.Date)
```

	Date	Last	Opening	High	Low	Vol.	Var. %	category
0	04-12-2021	3.50	3.57	3.64	3.46	1570000.0	-1.55	negative
1	04-09-2021	3.56	3.52	3.57	3.52	666030.0	1.14	positive
2	04-08-2021	3.52	3.45	3.54	3.45	882540.0	1.59	positive

```
3  04-07-2021  3.46    3.43  3.49  3.43   508330.0   0.87  positive
4  04-06-2021  3.43    3.44  3.49  3.43   809460.0   0.59  positive
```

1- Write a function to correct these points and save the file with the name of cttcorrcted.csv

```
#saving the file as a csv file

new_dataset.to_csv('cttcorrcted.csv')
```

2- What was the date with the highest volatility (difference between min and max)

```
new_dataset['Vol.'].max()
```

```
11060000.0
```

```
maxx = new_dataset[new_dataset['Vol.'] == new_dataset['Vol.'].max()]
maxx
```

```
           Date  Last Opening  High   Low        Vol.  Var. %
category
876  11-01-2017  3.96    4.50  4.50  3.95  11060000.0  -21.68
negative
```

so the date is 01.11.2017 for highest volatility

```
#or we can do like this as well

high_list = new_dataset['High'].tolist()
low_list = new_dataset['Low'].tolist()

diff_lst = []

for i in range(len(new_dataset)):
    difference = float(high_list[i]) - float(low_list[i])
    diff_lst.append(difference)

#now append this list to column into the dataset
new_dataset['diff_lst'] = diff_lst

#since another column with differences is added now find the date for
the maximum in the new column
new_dataset[new_dataset['diff_lst'] == new_dataset['diff_lst'].max()]
```

```
           Date  Last Opening  High   Low      Vol. Var. %  category
diff_lst
1440 2015-08-24  8.88    9.01  9.01  8.12  750800.0  -3.87  negative
0.89
```

3- What was the best month (30 days) during the 10 years to win with this title This means if I had to keep my stock only 30 days when was the best 30 days?

```
#30 largest values from Vol. column
# new_dataset.nlargest(30, ['Vol.'])

new_dataset['Date'] = pd.to_datetime(new_dataset['Date'])
# new_dataset['Date'].dt.to_period('M')
new_dataset['Date']
```

```
C:\Users\arfan.shah\AppData\Local\Temp\
ipykernel_13424\2976374408.py:4: UserWarning: Parsing dates in
DD/MM/YYYY format when dayfirst=False (the default) was specified.
This may lead to inconsistently parsed dates! Specify a format to
ensure consistent parsing.
  new_dataset['Date'] = pd.to_datetime(new_dataset['Date'])
```

```
0      2021-12-04
1      2021-09-04
2      2021-08-04
3      2021-07-04
4      2021-06-04
          ...
1870   2013-12-12
1871   2013-11-12
1872   2013-10-12
1873   2013-09-12
1874   2013-06-12
Name: Date, Length: 1875, dtype: datetime64[ns]
```

```
#converting into date format

new_dataset['Date'].dt.to_period('M')
```

```
0       2021-12
1       2021-09
2       2021-08
3       2021-07
4       2021-06
          ...
1870    2013-12
1871    2013-11
1872    2013-10
1873    2013-09
1874    2013-06
Name: Date, Length: 1875, dtype: period[M]
```

```
#find specific month
month_data = new_dataset[new_dataset['Date'].dt.month ==
```

```
1].nlargest(30, 'Date')
month_data
```

	Date	Last	Opening	High	Low	Vol.	Var. %	category
49	2021-01-29	2.39	2.38	2.43	2.38	259610.0	-0.83	negative
50	2021-01-28	2.41	2.34	2.41	2.30	367620.0	3.43	positive
51	2021-01-27	2.33	2.43	2.43	2.33	414030.0	-3.12	negative
52	2021-01-26	2.40	2.42	2.42	2.39	147460.0	-0.21	negative
53	2021-01-25	2.41	2.49	2.49	2.41	381890.0	-2.63	negative
54	2021-01-22	2.47	2.50	2.54	2.45	354010.0	-1.39	negative
55	2021-01-21	2.51	2.55	2.56	2.48	382150.0	-0.59	negative
56	2021-01-20	2.53	2.58	2.58	2.51	410690.0	-1.75	negative
57	2021-01-19	2.57	2.51	2.60	2.51	623420.0	3.42	positive
58	2021-01-18	2.48	2.45	2.48	2.44	189990.0	1.43	positive
59	2021-01-15	2.45	2.46	2.48	2.44	263780.0	-0.81	negative
60	2021-01-14	2.47	2.45	2.47	2.41	276760.0	1.02	positive
61	2021-01-13	2.44	2.45	2.45	2.41	245500.0	0.00	neutral
5	2021-01-04	3.41	3.36	3.42	3.36	416710.0	1.19	positive
28	2021-01-03	2.61	2.52	2.63	2.49	762070.0	4.40	positive
48	2021-01-02	2.38	2.39	2.41	2.38	154010.0	-0.21	negative
304	2020-01-31	2.93	2.97	3.00	2.92	729970.0	-2.33	negative
305	2020-01-30	3.00	3.02	3.02	2.97	433420.0	-1.32	negative
306	2020-01-29	3.04	3.07	3.10	3.03	421460.0	-0.33	negative
307	2020-01-28	3.05	3.07	3.07	2.98	470790.0	1.67	positive
308	2020-01-27	3.00	3.09	3.09	2.98	746470.0	-4.46	negative
309	2020-01-24	3.14	3.08	3.14	3.08	341250.0	2.28	positive
310	2020-01-23	3.07	3.14	3.15	3.05	606570.0	-3.46	negative
311	2020-01-22	3.18	3.16	3.19	3.15	363890.0	0.95	positive
312	2020-01-21	3.15	3.17	3.19	3.14	395600.0	-0.94	negative
313	2020-01-20	3.18	3.23	3.24	3.17	455670.0	-2.15	negative
314	2020-01-17	3.25	3.22	3.26	3.22	362970.0	0.00	neutral
315	2020-01-16	3.25	3.28	3.30	3.21	479630.0	-0.61	negative
316	2020-01-15	3.27	3.27	3.34	3.25	576130.0	-1.51	negative
317	2020-01-14	3.32	3.25	3.32	3.24	560700.0	2.15	positive

4- What was the duration of the longest sequence of ascent of the title in the closings?

```
#lets find the maximum 30 values in last column

#converting object into float
new_dataset = new_dataset.astype({'Last':'float'})

last_column = new_dataset.nlargest(30, 'Last')
last_column
```

	Date	Last	Opening	High	Low	Vol.	Var. %	category
1388	2015-04-11	10.49	10.45	10.49	10.39	316870.0	0.58	

```
positive
1389 2015-03-11  10.43   10.38  10.45  10.33  203680.0   0.77
positive
1536 2015-09-04  10.43   10.41  10.60  10.38  628740.0   0.00
neutral
1537 2015-08-04  10.43   10.34  10.44  10.28  588790.0   0.97
positive
1533 2015-04-14  10.41   10.44  10.64  10.38  944440.0   0.39
positive
1520 2015-04-05  10.38   10.15  10.55  10.15  484980.0   2.98
positive
1534 2015-04-13  10.38   10.36  10.38  10.28  307810.0   0.19
positive
1390 2015-02-11  10.35   10.20  10.40  10.20  213040.0   0.15
positive
1392 2015-10-29  10.35   10.28  10.45  10.27  414480.0   1.07
positive
1535 2015-10-04  10.35   10.44  10.45  10.30  393720.0  -0.72
negative
1391 2015-10-30  10.34   10.39  10.40  10.21  324340.0  -0.14
negative
1538 2015-07-04  10.33   10.28  10.36  10.23  456710.0   0.49
positive
1528 2015-04-21  10.32   10.09  10.32  10.09  540350.0   2.48
positive
1532 2015-04-15  10.31   10.42  10.47  10.26  491650.0  -1.06
negative
1395 2015-10-26  10.28   10.02  10.29  10.02  357700.0   2.14
positive
1539 2015-02-04  10.28   10.21  10.28  10.13  414470.0   0.73
positive
1409 2015-06-10  10.26   10.25  10.31  10.22  588160.0   0.05
positive
1527 2015-04-22  10.26   10.34  10.39  10.19  362150.0  -0.58
negative
1410 2015-05-10  10.25   10.17  10.32  10.16  651380.0   1.59
positive
1393 2015-10-28  10.24   10.16  10.28  10.14  255140.0   0.64
positive
1399 2015-10-20  10.24   10.14  10.24  10.09  269340.0   0.99
positive
1516 2015-08-05  10.24   10.15  10.27  10.09  384460.0   1.04
positive
1509 2015-05-19  10.21   10.17  10.26  10.15  454240.0   0.64
positive
1523 2015-04-28  10.21   10.19  10.30  10.10  266540.0   0.74
positive
1513 2015-05-13  10.20   10.10  10.23  10.10  276930.0   0.99
positive
1540 2015-01-04  10.20    9.94  10.20   9.94  663600.0   2.22
```

```
positive
1531 2015-04-16  10.19   10.34  10.34  10.05  329190.0  -1.12
negative
1394 2015-10-27  10.18   10.29  10.29  10.08  277560.0  -1.02
negative
1416 2015-09-25  10.18   10.02  10.20   9.99  417340.0   2.45
positive
1515 2015-11-05  10.17   10.20  10.28  10.13  310350.0  -0.68
negative
```

5- What was the date that saw the greatest turmoil in the market, ie large volumes with important variations? You can choose for example volume * (max-min) to get a measure of turbulence).

```
#here we need to find the difference of max and min in volume

maax = new_dataset['Vol.'].max()
miin = new_dataset['Vol.'].min()

print(maax - miin)
```

```
11018180.0
```

```
date = new_dataset[new_dataset['Vol.'] == (maax-miin)]
date
```

```
Empty DataFrame
Columns: [Date, Last, Opening, High, Low, Vol., Var. %, category]
Index: []
```

```
#or we can i can show some 10 varied volumes using nlargest function

new_dataset.nlargest(10, 'Vol.')
```

```
           Date  Last Opening  High   Low        Vol.  Var. %
category  \
876  2017-01-11  3.96    4.50  4.50  3.95  11060000.0  -21.68
negative
1685 2014-05-09  7.39    7.41  7.58  7.35  10200000.0   -5.38
negative
875  2017-02-11  3.78    4.00  4.05  3.77   8160000.0   -4.49
negative
1873 2013-09-12  5.82    5.53  5.82  5.52   5800000.0    5.24
positive
873  2017-06-11  3.45    3.56  3.57  3.34   5520000.0   -3.20
negative
827  2018-12-01  3.49    3.87  3.88  3.47   5390000.0   -9.25
negative
742  2018-05-16  2.93    2.95  3.02  2.85   4850000.0   -9.69
```

```
negative
874  2017-03-11  3.56    3.82  3.82  3.55   4780000.0   -5.84
negative
841  2017-12-20  3.65    3.59  3.88  3.59   4680000.0    4.61
positive
1387 2015-05-11  9.50    9.70  9.84  9.35   4680000.0   -9.44
negative
```

	diff_lst
876	0.55
1685	0.23
875	0.28
1873	0.30
873	0.23
827	0.41
742	0.17
874	0.27
841	0.29
1387	0.49