task-2

May 19, 2024

#Task-2 ''Load a CSV file into a Pandas DataFrame. Perform operations like filtering data based on conditions, handling missing values, and calculating summary statistics."'

import pandas as pd

- [3]: data = pd.read_csv("01.Data Cleaning and Preprocessing.csv")
- [4]: type(data)
- [4]: pandas.core.frame.DataFrame
- [5]: data.info

[5]:	: data.inio										
[5]:		method Data		fo of	Observa	ation	Y-Kappa	Ch	nipRate	BF-CM	ratio
	0	31-00:00		16 520	121	717	1177 607		169.8	05	
	1	31-01:00				.022					
		31-02:00									
		31-03:00									
	4	31-04:00	22.90	15.618	93	.244	1334.168		243.13	31	
	• •	•••	•••	•••	•••	•••	•	••			
	319	10-16:00		12.667		.450					
	320	9-19:00				.352	1184.119		297.0	71	
	321	9-20:00	23.01	12.550	90	.842	1188.517		289.8	26	
	322	9-21:00	24.32	13.083	88	.910	1192.879		318.0	06	
	323	9-22:00	25.75	13.417	85	.451	1186.342		248.3	12	
	Т	-upperExt-2	T-lowe:	rExt-2	UCZAA	White	eFlow-4		SteamFl	ow-4	\
	0	358.282			1.443			•••		7.122	•
	1	351.050					537.201				
	2	350.022					549.611			1.304	
	3	350.938					623.362			8.496	
	4	351.640		332.709						0.022	
								•••		0.022	
	 319	 247 296		310.970			 513.956			1.141	
	320				1.451						
		399.135						•••		7.667	
	321	373.633					549.306			6.446	
	322	364.081		308.559	1.523		504.852	•••	6:	1.054	

323	356.289	310.482	1.474	497.375	58.247	
	Lower-HeatT-3	Upper-HeatT-3	ChipMass-4	WeakLiguorF	BlackFlow-2	\
0	329.432	303.099	_	_	1319.039	·
1	330.823	304.879	163.202	665.975	1297.317	
2	329.140	303.383				
3	328.875	302.254			1324.461	
4	328.352	300.954	183.929	888.448	1343.424	
	•••	•••	•••	•••	•••	
319	330.117	304.006	148.174	1027.201	1357.271	
320	330.848	304.616	165.178	906.962	1311.177	
321	330.226	304.686	160.841	887.125	1319.226	
322	327.346	304.363	147.589	804.423	1320.225	
323	328.092	304.093	144.218	828.328	1320.848	
				G 7 1 1 1 1 1 1 1 4		
_		eamHeatF-3 T-T				
0	257.325	54.612	252.077	NaN		
1	241.182	46.603	251.406	29.11		
2	237.272	51.795	251.335	NaN		
3	239.478	54.846	250.312	29.02		
4	215.372	54.186	249.916	29.01		
	•••	•••	•••	•••		
319	381.643	45.264	252.947	30.86		
320	25.494	50.528	252.092	30.70		
321	0.638	45.549	252.438	NaN		
322	0.000	43.725	253.176	31.13		
323	1.276	43.840	253.216	NaN		

[324 rows x 23 columns]>

[6]: data.describe()

5 6 7								\	
[6]:		Y-Kappa	${\tt ChipRate}$	BF-CMrati	o Blo	owFlow	ChipLev	el4 \	
	count	324.000000	319.000000	307.00000	0 308.	000000	323.00	0000	
	mean	20.635370	14.347937	87.46445	6 1237.	837614	258.16	4483	
	std	3.070036	1.499095	7.99501	2 100.	593735	87.98	7452	
	min	12.170000	9.983000	68.64500	0.0	000000	0.00	0000	
	25%	18.382500	13.358000	81.82300	0 1193.	215250	213.52	7000	
	50%	20.845000	14.308000	86.73900	0 1273.	138500	271.79	2000	
	75%	23.032500	15.517000	92.37200	0 1289.	196000	321.68	0000	
	max	27.600000	16.958000	121.71700	0 1351.	240000	419.01	4000	
		T-upperExt-	2 T-lowerE	xt-2	UCZAA	White	Flow-4	AAWhiteSt-4	\
	count	322.0000	00 322.	000000 29	9.000000	323	.000000	173.000000	
	mean	356.9042	95 324.	020180	1.492010	591	.732260	6.140410	
	std	9.2092	90 7.	621402	0.105923	67	.016351	0.081609	
	min	339.1680	00 284.	633000	1.182000	405	.111000	5.890000	

```
25%
                350.241250
                                 321.420000
                                                1.431500
                                                             540.989500
                                                                              6.089000
     50%
                356.843000
                                 325.669000
                                                1.498000
                                                             592.895000
                                                                              6.135000
     75%
                362.242250
                                 329.175000
                                                1.560500
                                                             639.480500
                                                                              6.199000
                399.135000
                                 337.012000
                                                1.747000
                                                             731.394000
                                                                              6.340000
     max
                SteamFlow-4
                               Lower-HeatT-3
                                                                ChipMass-4
                                               Upper-HeatT-3
                  323.000000
                                  322.000000
                                                   322.000000
                                                                  323.000000
     count
                   66.668285
                                  325.567820
                                                   300.525699
                                                                  162.222322
     mean
                    5.708587
                                    4.609862
                                                      4.568484
                                                                   14.160688
     std
     min
                   48.568000
                                  318.051000
                                                    293.312000
                                                                  113.922000
     25%
                   62.518000
                                  321.385500
                                                    296.513250
                                                                  153.032500
     50%
                   67.429000
                                  324.741000
                                                   299.126000
                                                                  163.690000
     75%
                   71.522000
                                  329.845250
                                                    304.244750
                                                                  172.555000
            •••
                   76.147000
                                  333.854000
                                                   311.146000
                                                                  189.268000
     max
            WeakLiquorF
                            BlackFlow-2
                                           WeakWashF
                                                        SteamHeatF-3
                                                                        T-Top-Chips-4
               323.000000
                              322.000000
                                           323.000000
                                                           322.000000
                                                                            323.000000
     count
     mean
               873.828941
                             1175.917016
                                           263.543068
                                                            49.696907
                                                                            251.240087
     std
               122.073521
                              149.334010
                                           163.666942
                                                             4.551909
                                                                              1.283432
                              838.948000
     min
               486.938000
                                             0.000000
                                                            35.510000
                                                                            248.359000
     25%
               792.019500
                             1044.817500
                                           134.649000
                                                            46.389750
                                                                            250.312000
     50%
               865.254000
                             1150.221500
                                           269.193000
                                                            50.277000
                                                                            251.380000
     75%
                             1319.021250
                                                                            252.323500
               965.286500
                                           405.563000
                                                            53.294250
     max
              1226.277000
                             1395.767000
                                           715.715000
                                                            63.332000
                                                                            254.122000
            SulphidityL-4
                 173.000000
     count
                  30.411671
     mean
     std
                   0.701317
     min
                  29.010000
     25%
                  29.970000
     50%
                  30.370000
     75%
                  30.820000
     max
                  32.840000
     [8 rows x 22 columns]
[7]: data = data.drop_duplicates()
     data
                       Y-Kappa
                                 ChipRate
                                            BF-CMratio
                                                         BlowFlow
                                                                    ChipLevel4
         Observation
                         23.10
     0
             31-00:00
                                   16.520
                                               121.717
                                                         1177.607
                                                                        169.805
                         27.60
     1
             31-01:00
                                   16.810
                                                79.022
                                                         1328.360
                                                                        341.327
     2
             31-02:00
                         23.19
                                   16.709
                                                79.562
                                                         1329.407
                                                                        239.161
     3
            31-03:00
                         23.60
                                   16.478
                                                81.011
                                                         1334.877
                                                                        213.527
     4
                         22.90
                                                93.244
            31-04:00
                                   15.618
                                                         1334.168
                                                                        243.131
```

[7]:

298	12-09:00	20.90 15.	167	84	.640	1283.706		339.440	
299	12-10:00		NaN		.034	1278.345		368.564	
300	12-11:00		NaN		.013	1307.722		278.842	
301	12-12:00		NaN		.490	1255.986		273.484	
307	31-05:00		308		.172	1327.832		251.120	
501	51 05.00	20.03	500	34	.112	1027.002		201.120	
	T-upperExt-2	T-lowerExt-	2	UCZAA	White	eFlow-4	St	teamFlow-4	\
0	358.282	329.	545	1.443		599.253		67.122	
1	351.050	329.	067	1.549		537.201	•••	60.012	
2	350.022	329.	260	1.600		549.611		61.304	
3	350.938	331.	142	1.604		623.362		68.496	
4	351.640	332.	709	NaN		638.672	•••	70.022	
			•••		•••	•••	•	.	
298	354.803	311.	041	1.635		532.419	•••	65.561	
299	357.723	321.	387	NaN		520.365	•••	65.729	
300	357.438	323.	757	NaN		553.070	•••	65.795	
301	361.365	322.	689	NaN		590.199	•••	71.456	
307	351.263	332.	485	1.522		631.514	•••	71.286	
			_				_		
_	Lower-HeatT-3			ChipMa		WeakLiq		BlackFlow-2	
0	329.432				5.964		7.197	1319.03	
1	330.823				3.202		5.975	1297.31	
2	329.140				4.013		7.534	1327.07	
3	328.875				1.487		7.853	1324.46	
4	328.352		954	18	3.929	88	8.448	1343.42	24
 298	 332.924	307.	626	 14	5.299	 83	2.906	 1344.70	18
299	332.523				1.544		5.639	1344.46	
300	331.263				7.954		8.691	1344.58	
301	333.032				4.069		6.206	1348.74	
307	328.699				0.229		3.605	1323.08	
	WeakWashF S	teamHeatF-3	T-T	op-Chip	s-4	Sulphidi	tyL-4		
0	257.325	54.612			.077		Nal		
1	241.182	46.603		251	.406		29.13	1	
2	237.272	51.795		251	.335		Nal	1	
3	239.478	54.846		250	.312		29.02	2	
4	215.372	54.186		249	.916		29.03	1	
208	 399 011	 49.524		 251	.833	•••	30 00	2	
298	388.911						30.29		
299	418.979	48.135			.614		30.47		
300	462.712	54.373			.197		Nal		
301	457.313	53.194			.324		30.46		
307	232.729	54.503		250	.084		Nal	V	

[8]: data.isnull()

[8]:		Observation	Y-Kappa	ChipRate	BF-CMr	atio	BlowFlow	w Chi	pLevel4	\	
	0	False	False	False	F	alse	False	Э	False		
	1	False	False	False	F	alse	False	Э	False		
	2	False	False	False	F	alse	False	Э	False		
	3	False	False	False	F	alse	False	Э	False		
	4	False	False	False	F	alse	False	Э	False		
		•••	•••	•••	•••	•••		•••			
	298	False	False	False	F	alse	False	Э	False		
	299	False	False	True	F	alse	False	Э	False		
	300	False	False	True	F	alse	False	Э	False		
	301	False	False	True	F	alse	False	Э	False		
	307	False	False	False	F	alse	False	Э	False		
		T-upperExt-2		rExt-2		White	Flow-4		eamFlow-4		
	0	False			False		False		False		
	1	False			False		False		False	9	
	2	False			False		False		False		
	3	False		False			False		False		
	4	False	Э	False	True		False	•••	False	9	
	• •	•••				•••	•••				
	298	False		False			False		False		
	299	False		False	True		False		False		
	300	False		False	True		False	•••	False		
	301	False		False	True		False	•••	False		
	307	False	Э	False	False		False	•••	False	9	
					01 · M	4			D1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0	,
	^	Lower-HeatT-3		False	-	s-4 alse	_	orr False	BlackFlow		\
	0	False		False				False		alse alse	
	1 2	False		False		alse alse		False		alse	
	3	False		False		alse		False		alse	
	4	False		False		alse		False		alse	
			3			aise		raise		irse	
	 298	 False	3	… False	 E	alse		False	 Fe	alse	
	299	False		False		alse		False		alse	
	300	False		False		alse		False		alse	
	301	False		False		alse		False		alse	
	307	False		False		alse		False		alse	
	001	I dib	5	1 4100	•	albo	•	albo	10	1100	
		WeakWashF S	SteamHeat	F-3 T-T	op-Chips	-4	Sulphidit	tyL-4			
	0	False		alse		lse	-	True			
	1	False	F	alse	Fa	lse		False			
	2	False	F	alse	Fa	lse		True			
	3	False	F	alse	Fa	lse		False			
	4	False	F	alse	Fa	lse		False			

```
298
          False
                          False
                                            False
                                                             False
299
          False
                          False
                                            False
                                                             False
                          False
                                                              True
300
          False
                                            False
301
          False
                          False
                                            False
                                                             False
307
          False
                          False
                                            False
                                                              True
```

[9]: data.isnull().sum()

```
[9]: Observation
                           0
     Y-Kappa
                           0
                           4
     ChipRate
     BF-CMratio
                          14
     BlowFlow
                          13
     ChipLevel4
                           1
     T-upperExt-2
                           1
     T-lowerExt-2
                           1
     UCZAA
                          24
     WhiteFlow-4
                           1
     AAWhiteSt-4
                         141
     AA-Wood-4
                           1
     ChipMoisture-4
                           1
     SteamFlow-4
                           1
     Lower-HeatT-3
                           1
     Upper-HeatT-3
                           1
     ChipMass-4
                           1
     WeakLiquorF
                           1
     BlackFlow-2
                           1
     WeakWashF
                           1
     SteamHeatF-3
                           1
     T-Top-Chips-4
                           1
     SulphidityL-4
                         141
     dtype: int64
```

[10]: data.isnull().sum()

[10]: Observation 0 0 Y-Kappa ChipRate 4 BF-CMratio 14 BlowFlow 13 ChipLevel4 1 T-upperExt-2 1 T-lowerExt-2 1 UCZAA 24

```
AAWhiteSt-4
                          141
      AA-Wood-4
                            1
      ChipMoisture-4
                            1
      SteamFlow-4
                            1
      Lower-HeatT-3
                            1
      Upper-HeatT-3
                            1
                            1
      ChipMass-4
      WeakLiquorF
                            1
      BlackFlow-2
                            1
      WeakWashF
                            1
      SteamHeatF-3
                            1
      T-Top-Chips-4
                            1
      SulphidityL-4
                          141
      dtype: int64
[11]: data.isnull().sum().sum()
[11]: 352
[12]: data2 = data.fillna(value=0)
      data2
[12]:
          Observation Y-Kappa ChipRate BF-CMratio
                                                        BlowFlow
                                                                   ChipLevel4
      0
             31-00:00
                          23.10
                                    16.520
                                               121.717
                                                        1177.607
                                                                       169.805
                          27.60
      1
             31-01:00
                                    16.810
                                                79.022
                                                        1328.360
                                                                       341.327
      2
                          23.19
                                    16.709
             31-02:00
                                                79.562
                                                        1329.407
                                                                       239.161
      3
             31-03:00
                          23.60
                                   16.478
                                                81.011
                                                        1334.877
                                                                       213.527
      4
                          22.90
             31-04:00
                                   15.618
                                                93.244
                                                        1334.168
                                                                       243.131
      298
             12-09:00
                          20.90
                                   15.167
                                                84.640
                                                        1283.706
                                                                       339.440
      299
             12-10:00
                          24.98
                                    0.000
                                                85.034
                                                        1278.345
                                                                       368.564
      300
                          21.00
                                    0.000
                                                88.013
                                                                       278.842
             12-11:00
                                                        1307.722
      301
                          21.40
                                    0.000
             12-12:00
                                                85.490
                                                        1255.986
                                                                       273.484
      307
             31-05:00
                          20.89
                                    14.308
                                                94.172
                                                        1327.832
                                                                       251.120
           T-upperExt-2
                           T-lowerExt-2
                                            UCZAA
                                                   WhiteFlow-4
                                                                     SteamFlow-4
      0
                 358.282
                                  329.545
                                            1.443
                                                         599.253
                                                                            67.122
      1
                 351.050
                                  329.067
                                            1.549
                                                         537.201 ...
                                                                            60.012
      2
                                                         549.611
                 350.022
                                  329.260
                                            1.600
                                                                            61.304
      3
                 350.938
                                  331.142
                                            1.604
                                                         623.362
                                                                            68.496
      4
                 351.640
                                  332.709
                                            0.000
                                                         638.672
                                                                            70.022
      . .
      298
                 354.803
                                  311.041 1.635
                                                         532.419
                                                                            65.561
      299
                 357.723
                                  321.387
                                           0.000
                                                         520.365
                                                                            65.729
      300
                 357.438
                                  323.757
                                            0.000
                                                        553.070
                                                                            65.795
      301
                 361.365
                                  322.689
                                           0.000
                                                         590.199
                                                                            71.456
```

WhiteFlow-4

1

307	351.2	63 332.4	185 1.522	631.514	71.286	
	Lower-HeatT	-3 Upper-HeatT-	-3 ChipMass-4	WeakLiquorF	BlackFlow-2	\
0	329.4	32 303.0	175.964	1127.197	1319.039	
1	330.8	23 304.8	163.202	665.975	1297.317	
2	329.1	40 303.3	383 164.013	677.534	1327.072	
3	328.8	75 302.2	254 181.487	767.853	1324.461	
4	328.3	52 300.9	954 183.929	888.448	1343.424	
	•••	•••	•••	•••	•••	
298	332.9	24 307.6	326 145.299	832.906	1344.708	
299	332.5	23 307.1	169 151.544	905.639	1344.469	
300	331.2	63 306.4	157.954	908.691	1344.588	
301	333.0	32 308.7	732 174.069	986.206	1348.747	
307	328.6	99 300.7	706 180.229	903.605	1323.082	
	WeakWashF	SteamHeatF-3	T-Top-Chips-4	SulphidityL-4		
0	257.325	54.612	252.077	0.00		
1	241.182	46.603	251.406	29.11		
2	237.272	51.795	251.335	0.00		
3	239.478	54.846	250.312	29.02		
4	215.372	54.186	249.916	29.01		
• •	•••	•••	•••	•••		
298	388.911	49.524	251.833	30.29		
299	418.979	48.135	251.614	30.47		
300	462.712	54.373	251.197	0.00		
301	457.313	53.194	251.324	30.46		
307	232.729	54.503	250.084	0.00		

[13]: data2.isnull().sum().sum()

[13]: 0

[14]: data

[14]:	Observation	Y-Kappa	ChipRate	BF-CMratio	BlowFlow	ChipLevel4	\
0	31-00:00	23.10	16.520	121.717	1177.607	169.805	
1	31-01:00	27.60	16.810	79.022	1328.360	341.327	
2	31-02:00	23.19	16.709	79.562	1329.407	239.161	
3	31-03:00	23.60	16.478	81.011	1334.877	213.527	
4	31-04:00	22.90	15.618	93.244	1334.168	243.131	
	•••	•••	•••		•••		
298	3 12-09:00	20.90	15.167	84.640	1283.706	339.440	
299	9 12-10:00	24.98	NaN	85.034	1278.345	368.564	
300	12-11:00	21.00	NaN	88.013	1307.722	278.842	
301	12-12:00	21.40	NaN	85.490	1255.986	273.484	

307	31-05:00	20.89 14.308	94.172	1327.832	251.120	
	T-upperExt-2	T-lowerExt-2	UCZAA White	eFlow-4 St	eamFlow-4 \	
0	358.282	329.545	1.443	599.253	67.122	
1	351.050	329.067	1.549	537.201	60.012	
2	350.022	329.260	1.600	549.611	61.304	
3	350.938	331.142	1.604	623.362	68.496	
4	351.640	332.709	NaN	638.672	70.022	
298	354.803	311.041	1.635	532.419	65.561	
299	357.723	321.387	NaN	520.365	65.729	
300	357.438	323.757	NaN	553.070	65.795	
301	361.365	322.689	NaN	590.199	71.456	
307	351.263	332.485	1.522	631.514	71.286	
301	301.203	332.403	1.022	001.014	71.200	
	Lower-HeatT-3	Upper-HeatT-3	ChipMass-4	WeakLiquorF	BlackFlow-2	\
0	329.432	303.099	175.964	1127.197	1319.039	
1	330.823	304.879	163.202	665.975	1297.317	
2	329.140	303.383	164.013	677.534	1327.072	
3	328.875	302.254	181.487	767.853	1324.461	
4	328.352	300.954	183.929	888.448	1343.424	
	•••	•••	•••	•••	•••	
298	332.924	307.626	145.299	832.906	1344.708	
299	332.523	307.169	151.544	905.639	1344.469	
300	331.263	306.400	157.954	908.691	1344.588	
301	333.032	308.732	174.069	986.206	1348.747	
307	328.699	300.706	180.229	903.605	1323.082	
				G 7 1 1 1 1 1 7 4		
0			Cop-Chips-4	SulphidityL-4		
0	257.325	54.612	252.077	NaN		
1	241.182	46.603	251.406	29.11		
2	237.272	51.795	251.335	NaN		
3	239.478	54.846	250.312	29.02		
4	215.372	54.186	249.916	29.01		
	•••					
298	388.911	49.524	251.833	30.29		
299	418.979	48.135	251.614	30.47		
300	462.712	54.373	251.197	NaN		
301	457.313	53.194	251.324	30.46		
307	232.729	54.503	250.084	NaN		

[15]: data3 = data.fillna(method='pad')
data3

[15]:		Observation	Y-Kappa	ChipRate	BF-CMratio	BlowFlow Chi	pLevel4 \	
[10].	0	31-00:00	23.10	16.520	121.717	1177.607	169.805	
	1	31-01:00	27.60	16.810	79.022	1328.360	341.327	
	2	31-02:00	23.19	16.709	79.562	1329.407	239.161	
	3	31-03:00	23.60	16.478	81.011		213.527	
	4	31-04:00	22.90	15.618	93.244		243.131	
				10.010			240.101	
	 298	 12-09:00	 20.90	 15.167	84.640	 1283.706	339.440	
	299	12-10:00	24.98	15.167	85.034	1278.345	368.564	
	300	12-11:00	24.90	15.167	88.013	1307.722	278.842	
	301	12-11:00	21.40	15.167	85.490	1255.986	273.484	
		31-05:00	20.89	14.308				
	307	31-05:00	20.09	14.300	94.172	1321.032	251.120	
		T-upperExt-2	T-low	erExt-2	UCZAA Whit	eFlow-4 S	teamFlow-4 \	
	0	358.28	2	329.545	1.443	599.253	67.122	
	1	351.05	0	329.067	1.549	537.201	60.012	
	2	350.02	2	329.260	1.600	549.611	61.304	
	3	350.93	8	331.142	1.604	623.362	68.496	
	4	351.64	0	332.709	1.604	638.672	70.022	
		•••					•••	
	298	354.80	3	311.041	1.635	532.419	65.561	
	299	357.72	3	321.387	1.635	520.365	65.729	
	300	357.43	8	323.757	1.635	553.070	65.795	
	301	361.36	5	322.689	1.635	590.199	71.456	
	307	351.26	3	332.485	1.522	631.514	71.286	
		Lower-HeatT-			ChipMass-4	_		\
	0	329.43		303.099	175.964			
	1	330.82		304.879	163.202			
	2	329.14		303.383	164.013			
	3	328.87		302.254	181.487			
	4	328.35	2	300.954	183.929	888.448	1343.424	
		***		•••	•••	•••	•••	
	298	332.92	4	307.626	1/5 000	832.906	1344.708	
				301.020	145.299	032.900		
	299	332.52	3	307.169	151.544			
	299 300	332.52 331.26				905.639	1344.469	
			3	307.169	151.544	905.639 908.691	1344.469 1344.588	
	300	331.26	3 2	307.169 306.400	151.544 157.954	905.639 908.691 986.206	1344.469 1344.588 1348.747	
	300 301	331.26 333.03 328.69	3 2 9	307.169 306.400 308.732 300.706	151.544 157.954 174.069 180.229	905.639 908.691 986.206 903.605	1344.469 1344.588 1348.747 1323.082	
	300 301 307	331.26 333.03 328.69 WeakWashF	3 2 9 SteamHea	307.169 306.400 308.732 300.706 tF-3 T-T	151.544 157.954 174.069 180.229 Op-Chips-4	905.639 908.691 986.206 903.605 SulphidityL-4	1344.469 1344.588 1348.747 1323.082	
	300 301 307	331.26 333.03 328.69 WeakWashF 257.325	3 2 9 SteamHea 5	307.169 306.400 308.732 300.706 tF-3 T-1 4.612	151.544 157.954 174.069 180.229 'op-Chips-4 252.077	905.639 908.691 986.206 903.605 SulphidityL-4 Na	1344.469 1344.588 1348.747 1323.082	
	300 301 307 0 1	331.26 333.03 328.69 WeakWashF 257.325 241.182	3 2 9 SteamHea 5 4	307.169 306.400 308.732 300.706 tF-3 T-1 4.612 6.603	151.544 157.954 174.069 180.229 Top-Chips-4 252.077 251.406	905.639 908.691 986.206 903.605 SulphidityL-4 Na 29.1	1344.469 1344.588 1348.747 1323.082	
	300 301 307 0 1 2	331.26 333.03 328.69 WeakWashF 257.325 241.182 237.272	3 2 9 SteamHea 5 4 5	307.169 306.400 308.732 300.706 tF-3 T-1 4.612 6.603 1.795	151.544 157.954 174.069 180.229 Cop-Chips-4 252.077 251.406 251.335	905.639 908.691 986.206 903.605 SulphidityL-4 Na 29.1	1344.469 1344.588 1348.747 1323.082 N 1	
	300 301 307 0 1 2 3	331.26 333.03 328.69 WeakWashF 257.325 241.182 237.272 239.478	3 2 9 SteamHea 5 4 5	307.169 306.400 308.732 300.706 tF-3 T-T 4.612 6.603 1.795 4.846	151.544 157.954 174.069 180.229 Cop-Chips-4 252.077 251.406 251.335 250.312	905.639 908.691 986.206 903.605 SulphidityL-4 Na: 29.1 29.1	1344.469 1344.588 1348.747 1323.082 N 1	
	300 301 307 0 1 2 3 4	331.26 333.03 328.69 WeakWashF 257.325 241.182 237.272 239.478 215.372	3 2 9 SteamHea 5 4 5 5	307.169 306.400 308.732 300.706 tF-3 T-1 4.612 6.603 1.795 4.846 4.186	151.544 157.954 174.069 180.229 Cop-Chips-4 252.077 251.406 251.335 250.312 249.916	905.639 908.691 986.206 903.605 SulphidityL-4 Na 29.1	1344.469 1344.588 1348.747 1323.082 N 1	
	300 301 307 0 1 2 3	331.26 333.03 328.69 WeakWashF 257.325 241.182 237.272 239.478	3 2 9 SteamHea 5 4 5 5	307.169 306.400 308.732 300.706 tF-3 T-T 4.612 6.603 1.795 4.846	151.544 157.954 174.069 180.229 Cop-Chips-4 252.077 251.406 251.335 250.312	905.639 908.691 986.206 903.605 SulphidityL-4 Na: 29.1 29.1	1344.469 1344.588 1348.747 1323.082 N 1	

299	418.979	48.135	251.614	30.47
300	462.712	54.373	251.197	30.47
301	457.313	53.194	251.324	30.46
307	232.729	54.503	250.084	30.46

```
[16]: data4 = data.fillna(method='bfill')
data4
```

[16]:		Observation	V-Kanna	ChinRate	RF-CMratio	BlowFlow	Chin	Γρυρ] Δ	\	
[10].	0	31-00:00	23.10	16.520	121.717		_	169.805	`	
	1	31-01:00	27.60	16.810	79.022	1328.360		341.327		
	2	31-02:00	23.19	16.709	79.562	1329.407		239.161		
	3	31-03:00	23.60	16.478	81.011	1334.877		213.527		
	4	31-04:00	22.90	15.618	93.244	1334.168		243.131		
								210.101		
	298	12-09:00	20.90	 15.167	84.640	1283.706		339.440		
	299	12-10:00	24.98	14.308	85.034	1278.345		368.564		
	300	12-11:00	21.00	14.308	88.013	1307.722		278.842		
	301	12-12:00	21.40	14.308	85.490			273.484		
	307	31-05:00	20.89	14.308	94.172			251.120		
		T-upperExt-2	T-low	erExt-2	UCZAA Whit	eFlow-4	St	eamFlow-4	1 \	
	0	358.28		329.545	1.443	599.253	•••	67.12	22	
	1	351.05	50	329.067	1.549	537.201	•••	60.03	12	
	2	350.02	22	329.260	1.600	549.611	•••	61.30)4	
	3	350.93	8	331.142	1.604	623.362	•••	68.49	96	
	4	351.64	:0	332.709	1.436	638.672	•••	70.02	22	
		•••			•••	•••	•••			
	298	354.80	3	311.041	1.635	532.419	•••	65.56	31	
	299	357.72	.3	321.387	1.522	520.365	•••	65.72	29	
	300	357.43	88	323.757	1.522	553.070	•••	65.79	95	
	301	361.36	55	322.689	1.522	590.199	•••	71.45	56	
	307	351.26	3	332.485	1.522	631.514	•••	71.28	36	
		Lower-HeatT-			_	_		BlackFlo		\
	0	329.43		303.099	175.964		1.197		9.039	
	1	330.82		304.879	163.202		.975		7.317	
	2	329.14		303.383	164.013		7.534		7.072	
	3	328.87		302.254	181.487		7.853		1.461	
	4	328.35	52	300.954	183.929	888	3.448	1343	3.424	
		•••		•••	•••	•••		•••		
	298	332.92		307.626	145.299		2.906		1.708	
	299	332.52		307.169	151.544		.639		1.469	
	300	331.26		306.400	157.954		3.691		1.588	
	301	333.03	32	308.732	174.069	986	3.206	1348	3.747	

```
WeakWashF
                       SteamHeatF-3
                                      T-Top-Chips-4
                                                      SulphidityL-4
              257.325
      0
                              54.612
                                             252.077
                                                               29.11
      1
              241.182
                              46.603
                                             251,406
                                                               29.11
      2
              237.272
                              51.795
                                             251.335
                                                               29.02
      3
              239.478
                              54.846
                                             250.312
                                                               29.02
      4
              215.372
                              54.186
                                             249.916
                                                               29.01
      298
              388.911
                              49.524
                                             251.833
                                                               30.29
              418.979
                              48.135
                                             251.614
                                                               30.47
      299
      300
              462.712
                              54.373
                                             251.197
                                                               30.46
      301
              457.313
                              53.194
                                             251.324
                                                               30.46
      307
              232.729
                              54.503
                                             250.084
                                                                 NaN
      [301 rows x 23 columns]
[17]: import numpy as np
      import matplotlib.pyplot as plt
      import scipy as stats
[18]: #detecting the outliers using IQR
      data2.columns
[18]: Index(['Observation', 'Y-Kappa', 'ChipRate', 'BF-CMratio', 'BlowFlow',
             'ChipLevel4 ', 'T-upperExt-2 ', 'T-lowerExt-2 ', 'UCZAA',
             'WhiteFlow-4 ', 'AAWhiteSt-4 ', 'AA-Wood-4 ', 'ChipMoisture-4 ',
             'SteamFlow-4', 'Lower-HeatT-3', 'Upper-HeatT-3', 'ChipMass-4',
             'WeakLiquorF', 'BlackFlow-2', 'WeakWashF', 'SteamHeatF-3',
             'T-Top-Chips-4', 'SulphidityL-4'],
            dtype='object')
[19]: data2.drop(['Observation'], axis=1, inplace=True)
      data2.columns
[19]: Index(['Y-Kappa', 'ChipRate', 'BF-CMratio', 'BlowFlow', 'ChipLevel4',
             'T-upperExt-2 ', 'T-lowerExt-2 ', 'UCZAA', 'WhiteFlow-4 ',
             'AAWhiteSt-4', 'AA-Wood-4', 'ChipMoisture-4', 'SteamFlow-4',
             'Lower-HeatT-3', 'Upper-HeatT-3', 'ChipMass-4', 'WeakLiquorF',
             'BlackFlow-2', 'WeakWashF', 'SteamHeatF-3', 'T-Top-Chips-4',
             'SulphidityL-4 '],
            dtype='object')
[20]: Q1= data2.quantile(0.25)
      Q3= data2.quantile(0.75)
      IQR=Q3-Q1
      print(IQR)
```

307

328.699

300.706

180.229

903.605

1323.082

Y-Kappa	4.550
ChipRate	2.233
BF-CMratio	10.912
BlowFlow	96.766
ChipLevel4	105.868
T-upperExt-2	11.994
T-lowerExt-2	7.609
UCZAA	0.152
WhiteFlow-4	100.098
AAWhiteSt-4	6.143
AA-Wood-4	1.486
ChipMoisture-4	2.186
SteamFlow-4	8.840
Lower-HeatT-3	8.585
Upper-HeatT-3	7.852
ChipMass-4	19.347
WeakLiquorF	180.613
BlackFlow-2	280.829
WeakWashF	267.219
SteamHeatF-3	6.903
T-Top-Chips-4	2.044
SulphidityL-4	30.420
dtype: float64	

[21]: data2=data2[~((data2<(Q1-1.5*IQR))|(data2>(Q3+1.5*IQR))).any(axis=1)] data2

[21]:		Y-Kappa	ChipRat	e BF-	-CMratio	BlowF	low	${ t ChipLevel}$	4	T-upperExt-2	! '
	1	27.60	16.81	.0	79.022	1328.	360	341.3	27	351.05	0
	2	23.19	16.70	9	79.562	1329.	407	239.1	61	350.02	22
	3	23.60	16.47	' 8	81.011	1334.	877	213.5	27	350.93	88
	5	14.23	15.35	50	85.518	1171.	604	198.5	38	344.01	.4
	6	13.49	13.70	00	98.186	1243.	688	116.2	75	346.20	8(
		•••	•••		•••	•••		•••		•••	
	276	22.70	15.51	.7	83.008	1288.	010	306.8	86	350.15	55
	296	20.50	13.35	8	97.662	1304.	597	377.6	78	347.67	'2
	297	20.40	14.23	33	89.790	1278.	006	379.4	58	354.29	0
	298	20.90	15.16	57	84.640	1283.	706	339.4	40	354.80)3
	307	20.89	14.30	8(94.172	1327.	832	251.1	20	351.26	3
		T-lowerE	xt-2	UCZAA	WhiteFl	ow-4	AAWh	iteSt-4	•••	SteamFlow-4	\
	1	3	29.067	1.549	53	7.201		6.076	•••	60.012	?
	2	3	29.260	1.600	54	9.611		0.000	•••	61.304	F
	3	3	31.142	1.604	62	3.362		6.054	•••	68.496	;
	5	3	25.195	1.436	62	8.245		6.020	•••	65.225)
	6	3	26.982	1.434	69	6.766		0.000	•••	72.989)
			•••	•••			•••	•••		•••	

276 296 297 298 307	322.485 313.147 315.558 311.041 332.485	1.546 4 1.515 4 1.635 5	68.752 96.460 91.374 32.419 31.514	6.170 6.340 0.000 6.340 0.000	67.678 60.119 60.424 65.561 71.286	
	Lower-HeatT-3	Upper-HeatT-3	ChipMass-4	WeakLiquorF	BlackFlow-2	\
1	330.823	304.879	163.202	665.975	1297.317	
2	329.140	303.383	164.013	677.534	1327.072	
3	328.875	302.254	181.487	767.853	1324.461	
5	322.103	298.517	165.814	826.243	907.641	
6	322.982	296.080	182.018	784.281	929.527	
	•••	•••	•••	•••	•••	
276	331.854	309.346	160.061	910.013	1381.389	
296	332.615	308.575	141.076	997.904	1334.703	
297	331.980	308.078	140.301	975.016	1344.835	
298	332.924	307.626	145.299	832.906	1344.708	
307	328.699	300.706	180.229	903.605	1323.082	
	WeakWashF St	eamHeatF-3 T-	Top-Chips-4	SulphidityL-4		
1	241.182	46.603	251.406	29.11		
2	237.272	51.795	251.335	0.00		
3	239.478	54.846	250.312	29.02		
5	595.875	52.807	249.580	30.34		
6	201.272	58.118	248.741	0.00		
	•••	•••	•••	•••		
276	441.934	51.466	252.216	29.59		
296	389.497	46.206	252.423	30.43		
297	388.676	47.803	252.311	0.00		
298	388.911	49.524	251.833	30.29		
307	232.729	54.503	250.084	0.00		

[226 rows x 22 columns]

[]: data2.describe()