practical-2-1

March 4, 2025

Data Wrangling II Create an "Academic performance" dataset of students and perform the following operations using Python. 1. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them. 2. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them. 3. Apply data transformations on at least one of the variables. The purpose of this transformation should be one of the following reasons: to change the scale for better understanding of the variable, to convert a non-linear relation into a linear one, or to decrease the skewness and convert the distribution into a normal distribution.

```
convert the distribution into a normal distribution.
[1]: import pandas as pd
     import numpy as np
     data=pd.read_csv("Desktop\StudentPerformance.csv")
[3]:
     data
[3]:
                                                          placement_score
          math_score
                        reading_score
                                         writing_score
     0
                    74
                                     67
                                                      80
                                                                         88
     1
                    77
                                     74
                                                      66
                                                                         84
     2
                                     68
                                                      63
                                                                         79
                    66
     3
                    80
                                     78
                                                      69
                                                                         79
                                     79
     4
                    62
                                                      69
                                                                         82
     5
                    65
                                     75
                                                      62
                                                                         89
     6
                    63
                                     79
                                                      68
                                                                         71
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21	79	69	74	68
22	70	71	70	80
23	60	61	63	98
24	71	65	66	79
25	70	69	68	75
26	73	62	63	94
27	70	65	71	71
28	74	72	74	83
29	67	72	72	82
•		placement_offer_count		
0	2016	3		
1	2025	2		
2	2025	2		
3	2024	2		
4	2024	2		
5	2024	3		
6	2022	1		
7	2024	1		
8	2022	3		
9	2023	2		
10	2025	1		
11	2015	1		
12	2024	3		
13	2021	1		
14	2020	3		
15	2021	1		
16	2017	1		
17	2024	1		
18	2016	1		
19	2021	3		
20	2015	2		
21	2025	1		
22	2015	2		
23	2024	3		
24	2023	2		
25 26	2015	2		
26	2022	3		
27	2016	1		
28	2016	2		
29	2016	2	2	
: dat	a.ismull()			

[4]: data.isnull()

2	False	False	False	False
3	False	False	False	False
4	False	False	False	False
5	False	False	False	False
6	False	False	False	False
7	False	False	False	False
8	False	False	False	False
9	False	False	False	False
10	False	False	False	False
11	False	False	False	False
12	False	False	False	False
13	False	False	False	False
14	False	False	False	False
15	False	False	False	False
16	False	False	False	False
17	False	False	False	False
18	False	False	False	False
19	False	False	False	False
20	False	False	False	False
21	False	False	False	False
22	False	False	False	False
23	False	False	False	False
24	False	False	False	False
25	False	False	False	False
26	False	False	False	False
27	False	False	False	False
28	False	False	False	False
29	False	False	False	False

club_join_year placement_offer_count False False 0 1 False False 2 False False 3 False False False False 4 5 False False 6 False False 7 False False False False 8 9 False False False False 10 11 False False 12 False False 13 False False 14 False False 15 False False 16 False False

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17
                    False
                                            False
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                    False
                                            False
      19
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      20
                    False
                                            False
      21
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      22
                    False
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      25
                    False
                                            False
      26
                    False
                                            False
      27
                    False
                                            False
      28
                    False
                                            False
      29
                    False
                                            False
 [9]: series = pd.isnull(data['math_score '])
      data[series]
 [9]: Empty DataFrame
      Columns: [math_score , reading_score, writing_score, placement_score,
      club_join_year, placement_offer_count]
      Index: []
[14]: print(data.columns)
     Index(['math_score ', 'reading_score', 'writing_score', 'placement_score',
             'club_join_year', 'placement_offer_count'],
            dtype='object')
[10]: data.notnull()
[10]:
          math_score
                        reading_score writing_score placement_score \
                 True
                                 True
                                                 True
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      1
                  True
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16	True	True	True	True
17	True	True	True	True
18	True	True	True	True
19	True	True	True	True
20	True	True	True	True
21	True	True	True	True
22	True	True	True	True
23	True	True	True	True
24	True	True	True	True
25	True	True	True	True
26	True	True	True	True
27	True	True	True	True
28	True	True	True	True
29	True	True	True	True

0	True	True
1	True	True
2	True	True
3	True	True
4	True	True
5	True	True
6	True	True
7	True	True
8	True	True
9	True	True
10	True	True
11	True	True
12	True	True
13	True	True
14	True	True
15	True	True
16	True	True
17	True	True
18	True	True
19	True	True
20	True	True
21	True	True
22	True	True
23	True	True
24	True	True
25	True	True
26	True	True
27	True	True
28	True	True
29	True	True

```
[11]: series1 = pd.notnull(data['math_score '])
      data[series1]
[11]:
           math_score
                         reading_score writing_score placement_score
                     74
      0
                                      67
                                                       80
                                                                          88
                     77
                                      74
      1
                                                       66
                                                                          84
      2
                     66
                                      68
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                                      74
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      21
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      22
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      23
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                                      61
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                                                       66
      25
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                                      69
                                                       68
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      26
                     73
                                      62
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      27
                     70
                                      65
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                                                                          71
      28
                     74
                                      72
                                                       74
                                                                          83
      29
                     67
                                      72
                                                       72
                                                                          82
                            placement_offer_count
           club_join_year
      0
                      2016
                                                    3
                                                    2
                      2025
      1
                                                    2
                      2025
      2
      3
                      2024
                                                    2
      4
                      2024
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                      2024
      6
                      2022
                                                    1
      7
                      2024
                                                    1
      8
                      2022
                                                    3
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                      2023
      10
                      2025
                                                    1
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12
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                                                 1
                     2021
                                                 3
      14
                     2020
      15
                     2021
                                                 1
      16
                     2017
                                                 1
                     2024
      17
                                                 1
      18
                     2016
                                                 1
      19
                     2021
                                                 3
      20
                     2015
                                                 2
      21
                                                 1
                     2025
      22
                     2015
                                                 2
      23
                     2024
                                                 3
      24
                     2023
                                                 2
      25
                     2015
                                                 2
      26
                     2022
                                                 3
      27
                     2016
                                                 1
      28
                     2016
                                                 2
                                                 2
      29
                     2016
[16]: print(data.columns)
     Index(['math_score ', 'reading_score', 'writing_score', 'placement_score',
             'club_join_year', 'placement_offer_count'],
            dtype='object')
 [6]: import pandas as pd
      import numpy as np
      data=pd.read_csv("Desktop\StudentPerformance.csv")
 [8]: data
 [8]:
          gender
                   math_score
                                 reading_score writing_score placement_score \
          female
                           74.0
                                           67.0
                                                           80.0
                                                                             88.0
            male
                           77.0
                                           74.0
                                                           66.0
                                                                             84.0
      1
      2
            male
                           66.0
                                           68.0
                                                           63.0
                                                                             79.0
                                           78.0
      3
          female
                           80.0
                                                           69.0
                                                                             79.0
      4
            male
                                           79.0
                                                           69.0
                                                                             82.0
                           62.0
                           65.0
                                           75.0
                                                                             89.0
      5
          female
                                                            NaN
      6
            male
                           NaN
                                           79.0
                                                           68.0
                                                                             71.0
      7
          female
                           72.0
                                           72.0
                                                           64.0
                                                                             65.0
      8
          female
                           77.0
                                           73.0
                                                           72.0
                                                                             99.0
      9
            male
                          67.0
                                           71.0
                                                           64.0
                                                                              NaN
      10
            male
                           66.0
                                           70.0
                                                           60.0
                                                                             63.0
      11
            male
                           77.0
                                           74.0
                                                           62.0
                                                                             66.0
          female
                                           80.0
                                                           67.0
                                                                             97.0
      12
                           60.0
```

2015

11

13	male	75.0	NaN	63.0	68.0
14	male	78.0	78.0	69.0	85.0
15	female	66.0	77.0	68.0	NaN
16	female	76.0	64.0	69.0	71.0
17	male	71.0	73.0	79.0	72.0
18	female	67.0	80.0	80.0	64.0
19	male	66.0	72.0	69.0	95.0
20	male	72.0	74.0	69.0	81.0
21	female	79.0	69.0	74.0	68.0
22	male	70.0	71.0	70.0	80.0
23	male	60.0	61.0	63.0	NaN
24	male	71.0	65.0	66.0	79.0
25	female	70.0	69.0	68.0	75.0
26	male	73.0	62.0	63.0	94.0
27	male	70.0	65.0	71.0	71.0
28	male	74.0	72.0	74.0	83.0
29	female	67.0	72.0	72.0	82.0

			ъ.
_	•	placement_offer_count	Region
0	NaN	3	Pune
1	2025.0	2	Nashik
2	2025.0	2	NaN
3	2024.0	2	Pune
4	2024.0	2	na
5	2024.0	3	Nashik
6	2022.0	1	na
7	2024.0	1	Pune
8	2022.0	3	NaN
9	2023.0	2	Nashik
10	2025.0	1	na
11	2015.0	1	NaN
12	2024.0	3	na
13	2021.0	1	Pune
14	2020.0	3	Nashik
15	2021.0	1	NaN
16	2017.0	1	Na
17	2024.0	1	Pune
18	2016.0	1	na
19	2021.0	3	Nashik
20	2015.0	2	NaN
21	2025.0	1	Na
22	2015.0	2	Pune
23	2024.0	3	Nashik
24	2023.0	2	Na
25	2015.0	2	NaN
26	2022.0	3	Pune
27	2016.0	1	Nashik

```
2
     28
                  2016.0
                                                         Na
     29
                  2016.0
                                                 2
                                                       Pune
[9]: from sklearn.preprocessing import LabelEncoder
     le = LabelEncoder()
     data['gender'] = le.fit_transform(data['gender'])
     newdata=data
     data
[9]:
         gender
                  math_score
                                 reading_score
                                                 writing_score placement_score \
               0
     0
                          74.0
                                          67.0
                                                           80.0
                                                                              88.0
     1
               1
                          77.0
                                          74.0
                                                                              84.0
                                                           66.0
     2
               1
                          66.0
                                          68.0
                                                           63.0
                                                                              79.0
     3
               0
                          80.0
                                          78.0
                                                           69.0
                                                                              79.0
     4
               1
                          62.0
                                          79.0
                                                           69.0
                                                                              82.0
               0
     5
                          65.0
                                          75.0
                                                            NaN
                                                                              89.0
     6
               1
                                          79.0
                                                           68.0
                                                                              71.0
                           NaN
     7
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                          72.0
                                          72.0
                                                           64.0
                                                                              65.0
     8
               0
                          77.0
                                                                              99.0
                                          73.0
                                                           72.0
     9
               1
                          67.0
                                          71.0
                                                           64.0
                                                                               NaN
                                                           60.0
     10
               1
                          66.0
                                          70.0
                                                                              63.0
     11
               1
                          77.0
                                          74.0
                                                           62.0
                                                                              66.0
     12
               0
                          60.0
                                          80.0
                                                           67.0
                                                                              97.0
     13
               1
                          75.0
                                            NaN
                                                           63.0
                                                                              68.0
     14
               1
                          78.0
                                          78.0
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                                                           69.0
               0
     15
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                                          77.0
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     16
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     17
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                                          73.0
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     19
               1
                          66.0
                                          72.0
                                                           69.0
                                                                              95.0
     20
               1
                          72.0
                                          74.0
                                                           69.0
                                                                              81.0
     21
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                          79.0
                                          69.0
                                                           74.0
                                                                              68.0
     22
               1
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                                          71.0
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     23
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                                          62.0
                                                           63.0
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     28
               1
                          74.0
                                          72.0
                                                           74.0
                                                                              83.0
     29
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                          67.0
                                          72.0
                                                           72.0
                                                                              82.0
                           placement_offer_count
         club_join_year
                                                    Region
     0
                                                       Pune
                      NaN
                                                 3
                                                 2
     1
                  2025.0
                                                    Nashik
                                                 2
     2
                  2025.0
                                                        NaN
     3
                  2024.0
                                                 2
                                                       Pune
     4
                                                 2
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na

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5
      6
                  2022.0
                                                1
                                                       na
      7
                  2024.0
                                                1
                                                     Pune
                                                3
      8
                  2022.0
                                                      NaN
                                                  Nashik
      9
                  2023.0
                                                2
      10
                  2025.0
                                                1
                                                       na
      11
                  2015.0
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                                                      NaN
      12
                  2024.0
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                                                       na
      13
                  2021.0
                                                1
                                                     Pune
      14
                  2020.0
                                                3
                                                  Nashik
      15
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                  2021.0
      16
                  2017.0
                                                1
                                                       Na
      17
                                                     Pune
                  2024.0
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      18
                  2016.0
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                                                       na
      19
                  2021.0
                                                3
                                                  Nashik
      20
                  2015.0
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                                                      NaN
      21
                                                1
                  2025.0
                                                       Na
                                                2
      22
                  2015.0
                                                     Pune
                                                3
      23
                  2024.0
                                                  Nashik
      24
                                                2
                  2023.0
                                                       Na
      25
                  2015.0
                                                2
                                                      NaN
      26
                                                3
                                                     Pune
                  2022.0
      27
                  2016.0
                                                1
                                                  Nashik
      28
                                                2
                  2016.0
                                                       Na
      29
                  2016.0
                                                     Pune
[10]: series = pd.isnull(data["math_score "])
      data[series]
[10]:
         gender math_score
                               reading_score writing_score placement_score \
              1
                                        79.0
                                                        68.0
                                                                          71.0
      6
                         NaN
         club_join_year placement_offer_count Region
      6
                 2022.0
                                                     na
[11]: series = pd.isnull(data["placement_score"])
      data[series]
[11]:
          gender math_score reading_score writing_score placement_score \
      9
               1
                          67.0
                                         71.0
                                                         64.0
                                                                            NaN
               0
                                         77.0
      15
                          66.0
                                                         68.0
                                                                            NaN
      23
               1
                          60.0
                                         61.0
                                                         63.0
                                                                            NaN
          club_join_year placement_offer_count Region
      9
                  2023.0
                                                2 Nashik
                  2021.0
      15
                                                1
                                                      NaN
      23
                  2024.0
                                                  Nashik
```

Nashik

[12]: data.notnull()

[12]:	gender	math_score	reading_score	writing_score	placement_score	\
0	True	True	True	True	True	
1	True	True	True	True	True	
2	True	True	True	True	True	
3	True	True	True	True	True	
4	True	True	True	True	True	
5	True	True	True	False	True	
6	True	False	True	True	True	
7	True	True	True	True	True	
8	True	True	True	True	True	
9	True	True	True	True	False	
10	True	True	True	True	True	
11	True	True	True	True	True	
12	True	True	True	True	True	
13	True	True	False	True	True	
14	True	True	True	True	True	
15	True	True	True	True	False	
16	True	True	True	True	True	
17	True	True	True	True	True	
18	True	True	True	True	True	
19	True	True	True	True	True	
20	True	True	True	True	True	
21	True	True	True	True	True	
22	True	True	True	True	True	
23	True	True	True	True	False	
24	True	True	True	True	True	
25	True	True	True	True	True	
26	True	True	True	True	True	
27	True	True	True	True	True	
28	True	True	True	True	True	
29	True	True	True	True	True	
	club_jo		ement_offer_coun	· ·		
0		False	Tru			
1		True	Tru			
2		True	Tru -			
3		True	Tru -			
4		True	Tru			
5		True	Tru			
6		True	Tru			
7		True	Tru			
8		True	Tru			
9		True	Tru			
10		True	Tru			
11		True	Tru	e False		

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13
                      True
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      14
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      15
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      16
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      26
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      27
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      28
                      True
                                                        True
                                                True
      29
                      True
                                                True
                                                        True
[32]: series = pd.notnull(data["math_score "])
      data[series]
[32]:
           gender
                   math_score
                                  reading_score
                                                  writing_score placement_score
                                                             80.0
           female
                           74.0
                                            67.0
                                                                                88.0
                                            74.0
                                                             66.0
      1
             male
                           77.0
                                                                                84.0
      2
             male
                           66.0
                                            68.0
                                                             63.0
                                                                                79.0
      3
           female
                           0.08
                                            78.0
                                                             69.0
                                                                                79.0
      4
             male
                           62.0
                                            79.0
                                                             69.0
                                                                                82.0
      5
           female
                           65.0
                                            75.0
                                                              {\tt NaN}
                                                                                89.0
      7
           female
                           72.0
                                            72.0
                                                             64.0
                                                                                65.0
      8
           female
                           77.0
                                            73.0
                                                             72.0
                                                                                99.0
      9
                           67.0
                                            71.0
                                                             64.0
             male
                                                                                 {\tt NaN}
      10
             male
                           66.0
                                            70.0
                                                             60.0
                                                                                63.0
                                            74.0
                                                             62.0
      11
             male
                           77.0
                                                                                66.0
      12
          female
                           60.0
                                            80.0
                                                             67.0
                                                                                97.0
      13
             male
                           75.0
                                             NaN
                                                             63.0
                                                                                68.0
      14
             male
                           78.0
                                            78.0
                                                             69.0
                                                                                85.0
      15
          female
                           66.0
                                            77.0
                                                             68.0
                                                                                 NaN
      16
           female
                           76.0
                                            64.0
                                                             69.0
                                                                                71.0
      17
             male
                           71.0
                                            73.0
                                                             79.0
                                                                                72.0
      18
          female
                           67.0
                                            80.0
                                                             80.0
                                                                                64.0
      19
             male
                           66.0
                                            72.0
                                                             69.0
                                                                                95.0
      20
             male
                           72.0
                                            74.0
                                                             69.0
                                                                                81.0
      21
          female
                           79.0
                                            69.0
                                                             74.0
                                                                                68.0
```

True

True

12

22

23

24

male

male

male

70.0

60.0

71.0

True

70.0

63.0

66.0

0.08

 ${\tt NaN}$

79.0

71.0

61.0

```
70.0
                                           69.0
                                                                               75.0
      25
          female
                                                            68.0
      26
            male
                           73.0
                                           62.0
                                                            63.0
                                                                               94.0
      27
            male
                           70.0
                                           65.0
                                                            71.0
                                                                               71.0
            male
                                           72.0
      28
                           74.0
                                                            74.0
                                                                               83.0
      29
          female
                           67.0
                                           72.0
                                                            72.0
                                                                               82.0
          club_join_year placement_offer_count
                                                     Region
      0
                                                  3
                                                       Pune
                       NaN
      1
                   2025.0
                                                  2
                                                     Nashik
      2
                   2025.0
                                                  2
                                                        NaN
                                                  2
      3
                   2024.0
                                                       Pune
      4
                   2024.0
                                                  2
                                                         na
                                                  3
                                                     Nashik
      5
                   2024.0
      7
                                                  1
                   2024.0
                                                       Pune
      8
                   2022.0
                                                  3
                                                         NaN
      9
                   2023.0
                                                  2
                                                     Nashik
      10
                   2025.0
                                                  1
                                                         na
      11
                   2015.0
                                                  1
                                                         NaN
      12
                   2024.0
                                                  3
                                                         na
      13
                   2021.0
                                                  1
                                                       Pune
      14
                   2020.0
                                                  3
                                                     Nashik
      15
                   2021.0
                                                  1
                                                        {\tt NaN}
      16
                   2017.0
                                                  1
                                                         Na
      17
                   2024.0
                                                  1
                                                       Pune
      18
                   2016.0
                                                  1
                                                          na
      19
                                                  3
                                                     Nashik
                   2021.0
                                                  2
      20
                                                        NaN
                   2015.0
      21
                   2025.0
                                                  1
                                                         Na
      22
                                                  2
                                                       Pune
                   2015.0
      23
                   2024.0
                                                  3
                                                     Nashik
      24
                   2023.0
                                                  2
                                                         Na
      25
                                                  2
                   2015.0
                                                        NaN
                                                  3
      26
                   2022.0
                                                       Pune
                                                  1
      27
                   2016.0
                                                     Nashik
      28
                                                  2
                   2016.0
                                                          Na
      29
                   2016.0
                                                  2
                                                       Pune
[13]: missing_values = ["Na", "na"]
      data= pd.read_csv("Desktop\StudentPerformance.csv", na_values =
      missing_values)
      data
[13]:
                                 reading_score writing_score placement_score \
          gender
                   math_score
                           74.0
      0
          female
                                           67.0
                                                            80.0
                                                                               88.0
                           77.0
                                           74.0
      1
            male
                                                            66.0
                                                                               84.0
      2
            male
                           66.0
                                           68.0
                                                            63.0
                                                                               79.0
      3
          female
                           80.0
                                           78.0
                                                            69.0
                                                                               79.0
```

4	male	62.0	79.0	69.0	82.0
5	female	65.0	75.0	NaN	89.0
6	male	NaN	79.0	68.0	71.0
7	female	72.0	72.0	64.0	65.0
8	female	77.0	73.0	72.0	99.0
9	male	67.0	71.0	64.0	NaN
10	male	66.0	70.0	60.0	63.0
11	male	77.0	74.0	62.0	66.0
12	female	60.0	80.0	67.0	97.0
13	male	75.0	NaN	63.0	68.0
14	male	78.0	78.0	69.0	85.0
15	female	66.0	77.0	68.0	NaN
16	female	76.0	64.0	69.0	71.0
17	male	71.0	73.0	79.0	72.0
18	female	67.0	80.0	80.0	64.0
19	male	66.0	72.0	69.0	95.0
20	male	72.0	74.0	69.0	81.0
21	female	79.0	69.0	74.0	68.0
22	male	70.0	71.0	70.0	80.0
23	male	60.0	61.0	63.0	NaN
24	male	71.0	65.0	66.0	79.0
25	female	70.0	69.0	68.0	75.0
26	male	73.0	62.0	63.0	94.0
27	male	70.0	65.0	71.0	71.0
28	male	74.0	72.0	74.0	83.0
29	female	67.0	72.0	72.0	82.0
		_			

	club_join_year	placement_offer_count	Region
0	NaN	3	Pune
1	2025.0	2	Nashik
2	2025.0	2	NaN
3	2024.0	2	Pune
4	2024.0	2	NaN
5	2024.0	3	Nashik
6	2022.0	1	NaN
7	2024.0	1	Pune
8	2022.0	3	NaN
9	2023.0	2	Nashik
10	2025.0	1	NaN
11	2015.0	1	NaN
12	2024.0	3	NaN
13	2021.0	1	Pune
14	2020.0	3	Nashik
15	2021.0	1	NaN
16	2017.0	1	NaN
17	2024.0	1	Pune
18	2016.0	1	NaN

```
19
            2021.0
                                           Nashik
                                         3
20
            2015.0
                                         2
                                               NaN
            2025.0
                                               NaN
21
                                         1
22
            2015.0
                                         2
                                              Pune
                                         3
            2024.0
23
                                            Nashik
24
            2023.0
                                         2
                                               NaN
25
            2015.0
                                         2
                                               NaN
26
            2022.0
                                         3
                                              Pune
27
            2016.0
                                         1
                                            Nashik
            2016.0
                                         2
                                               NaN
28
                                         2
29
            2016.0
                                               Pune
```

[14]: ndf=data ndf.fillna(1)

[14]:	gender	math_score	reading_score	writing_score	placement_score	\
0	female	74.0	67.0	80.0	88.0	
1	male	77.0	74.0	66.0	84.0	
2	male	66.0	68.0	63.0	79.0	
3	female	80.0	78.0	69.0	79.0	
4	male	62.0	79.0	69.0	82.0	
5	female	65.0	75.0	1.0	89.0	
6	male	1.0	79.0	68.0	71.0	
7	female	72.0	72.0	64.0	65.0	
8	female	77.0	73.0	72.0	99.0	
9	male	67.0	71.0	64.0	1.0	
1	0 male	66.0	70.0	60.0	63.0	
1	1 male	77.0	74.0	62.0	66.0	
1	2 female	60.0	80.0	67.0	97.0	
1	3 male	75.0	1.0	63.0	68.0	
1	4 male	78.0	78.0	69.0	85.0	
1	5 female	66.0	77.0	68.0	1.0	
1	6 female	76.0	64.0	69.0	71.0	
1	7 male	71.0	73.0	79.0	72.0	
1	8 female	67.0	80.0	80.0	64.0	
1	9 male	66.0	72.0	69.0	95.0	
2	0 male	72.0	74.0	69.0	81.0	
2	1 female	79.0	69.0	74.0	68.0	
2	2 male	70.0	71.0	70.0	80.0	
2	3 male	60.0	61.0	63.0	1.0	
2	4 male	71.0	65.0	66.0	79.0	
2	5 female	70.0	69.0	68.0	75.0	
2	6 male	73.0	62.0	63.0	94.0	
2	7 male	70.0	65.0	71.0	71.0	
2	8 male	74.0	72.0	74.0	83.0	
2	9 female	67.0	72.0	72.0	82.0	

```
0
                       1.0
                                                        Pune
                                                  2
                    2025.0
      1
                                                      Nashik
      2
                                                  2
                    2025.0
                                                  2
      3
                   2024.0
                                                        Pune
      4
                   2024.0
                                                  2
                                                  3
                                                      Nashik
      5
                   2024.0
      6
                                                  1
                                                           1
                   2022.0
      7
                                                  1
                   2024.0
                                                        Pune
      8
                   2022.0
                                                  3
                                                           1
                                                  2
      9
                                                      Nashik
                   2023.0
      10
                   2025.0
                                                  1
                                                           1
                                                  1
                                                           1
      11
                   2015.0
      12
                                                  3
                   2024.0
                                                           1
      13
                    2021.0
                                                  1
                                                        Pune
      14
                                                  3
                                                      Nashik
                    2020.0
      15
                                                  1
                    2021.0
                                                           1
      16
                    2017.0
                                                  1
                                                           1
      17
                    2024.0
                                                  1
                                                        Pune
      18
                    2016.0
                                                  1
      19
                   2021.0
                                                  3
                                                      Nashik
      20
                                                  2
                   2015.0
                                                           1
      21
                   2025.0
                                                  1
                                                           1
      22
                                                  2
                                                        Pune
                   2015.0
      23
                   2024.0
                                                  3
                                                      Nashik
                                                  2
      24
                   2023.0
                                                           1
                                                  2
      25
                                                           1
                   2015.0
                                                  3
      26
                   2022.0
                                                        Pune
      27
                                                  1
                                                      Nashik
                    2016.0
      28
                    2016.0
                                                  2
                                                           1
      29
                   2016.0
                                                  2
                                                        Pune
[15]: m_v=data['math_score '].mean()
      data['math_score '].fillna(value=m_v, inplace=True)
      data
[15]:
           gender
                  math_score
                                  reading_score
                                                 writing_score placement_score \
           female
                       74.00000
                                            67.0
                                                            80.0
                                                                               88.0
                                            74.0
      1
             male
                       77.00000
                                                            66.0
                                                                               84.0
      2
             male
                                            68.0
                                                                               79.0
                       66.00000
                                                            63.0
      3
           female
                       80.00000
                                            78.0
                                                            69.0
                                                                               79.0
      4
                                            79.0
             male
                       62.00000
                                                            69.0
                                                                               82.0
      5
           female
                       65.00000
                                            75.0
                                                                               89.0
                                                             NaN
             male
                                            79.0
      6
                       70.62069
                                                            68.0
                                                                               71.0
      7
           female
                       72.00000
                                            72.0
                                                            64.0
                                                                               65.0
      8
           female
                       77.00000
                                            73.0
                                                            72.0
                                                                               99.0
      9
             male
                       67.00000
                                            71.0
                                                            64.0
                                                                                NaN
```

Region

club_join_year placement_offer_count

10	${\tt male}$	66.00000	70.0	60.0	63.0
11	male	77.00000	74.0	62.0	66.0
12	female	60.00000	80.0	67.0	97.0
13	male	75.00000	NaN	63.0	68.0
14	male	78.00000	78.0	69.0	85.0
15	female	66.00000	77.0	68.0	NaN
16	female	76.00000	64.0	69.0	71.0
17	male	71.00000	73.0	79.0	72.0
18	female	67.00000	80.0	80.0	64.0
19	male	66.00000	72.0	69.0	95.0
20	male	72.00000	74.0	69.0	81.0
21	female	79.00000	69.0	74.0	68.0
22	${\tt male}$	70.00000	71.0	70.0	80.0
23	male	60.00000	61.0	63.0	NaN
24	male	71.00000	65.0	66.0	79.0
25	female	70.00000	69.0	68.0	75.0
26	male	73.00000	62.0	63.0	94.0
27	${\tt male}$	70.00000	65.0	71.0	71.0
28	${\tt male}$	74.00000	72.0	74.0	83.0
29	female	67.00000	72.0	72.0	82.0

- .			
_	placement_offer_count	•	
Pune	3	NaN	0
Nashik	2	2025.0	1
NaN	2	2025.0	2
Pune	2	2024.0	3
NaN	2	2024.0	4
Nashik	3	2024.0	5
NaN	1	2022.0	6
Pune	1	2024.0	7
NaN	3	2022.0	8
Nashik	2	2023.0	9
NaN	1	2025.0	10
NaN	1	2015.0	11
NaN	3	2024.0	12
Pune	1	2021.0	13
Nashik	3	2020.0	14
NaN	1	2021.0	15
NaN	1	2017.0	16
Pune	1	2024.0	17
NaN	1	2016.0	18
Nashik	3	2021.0	19
NaN	2	2015.0	20
NaN	1	2025.0	21
Pune	2	2015.0	22
Nashik	3	2024.0	23
NaN	2	2023.0	24

```
26
                    2022.0
                                                   3
                                                         Pune
                                                   1
      27
                    2016.0
                                                      Nashik
                                                   2
      28
                    2016.0
                                                          NaN
      29
                    2016.0
                                                   2
                                                         Pune
[16]: ndf.replace(to_replace = np.nan, value = -99)
[16]:
                                                   writing_score
           gender
                   math_score
                                  reading_score
                                                                    placement_score
      0
           female
                       74.00000
                                            67.0
                                                             80.0
                                                                                88.0
      1
                                            74.0
                                                             66.0
             male
                       77.00000
                                                                                84.0
      2
             male
                       66.00000
                                            68.0
                                                             63.0
                                                                                79.0
      3
           female
                                            78.0
                       80.00000
                                                             69.0
                                                                                79.0
      4
             male
                       62.00000
                                            79.0
                                                             69.0
                                                                                82.0
      5
           female
                       65.00000
                                            75.0
                                                            -99.0
                                                                                89.0
      6
             male
                       70.62069
                                            79.0
                                                             68.0
                                                                                71.0
      7
           female
                       72.00000
                                            72.0
                                                             64.0
                                                                                65.0
      8
           female
                       77.00000
                                            73.0
                                                             72.0
                                                                                99.0
      9
             male
                       67.00000
                                            71.0
                                                             64.0
                                                                               -99.0
      10
             male
                                            70.0
                       66.00000
                                                             60.0
                                                                                63.0
      11
             male
                       77.00000
                                            74.0
                                                             62.0
                                                                                66.0
      12
           female
                                            80.0
                                                             67.0
                                                                                97.0
                       60.00000
      13
             male
                       75.00000
                                           -99.0
                                                             63.0
                                                                                68.0
      14
             male
                       78.00000
                                            78.0
                                                             69.0
                                                                                85.0
      15
           female
                       66.00000
                                            77.0
                                                             68.0
                                                                               -99.0
           female
      16
                       76.00000
                                            64.0
                                                             69.0
                                                                                71.0
      17
             male
                       71.00000
                                            73.0
                                                             79.0
                                                                                72.0
      18
           female
                       67.00000
                                            80.0
                                                             80.0
                                                                                64.0
      19
             male
                       66.00000
                                            72.0
                                                             69.0
                                                                                95.0
      20
             male
                                            74.0
                       72.00000
                                                             69.0
                                                                                81.0
      21
           female
                       79.00000
                                            69.0
                                                             74.0
                                                                                68.0
      22
                                            71.0
             male
                       70.00000
                                                             70.0
                                                                                80.0
      23
             male
                       60.00000
                                            61.0
                                                             63.0
                                                                               -99.0
      24
             male
                       71.00000
                                            65.0
                                                             66.0
                                                                                79.0
      25
           female
                                            69.0
                       70.00000
                                                             68.0
                                                                                75.0
      26
             male
                       73.00000
                                            62.0
                                                             63.0
                                                                                94.0
      27
             male
                       70.00000
                                            65.0
                                                             71.0
                                                                                71.0
      28
             male
                       74.00000
                                            72.0
                                                             74.0
                                                                                83.0
      29
           female
                       67.00000
                                            72.0
                                                             72.0
                                                                                82.0
                             placement_offer_count
           club_join_year
                                                      Region
      0
                     -99.0
                                                   3
                                                         Pune
                                                   2
      1
                    2025.0
                                                      Nashik
                                                   2
      2
                    2025.0
                                                          -99
                                                   2
      3
                                                         Pune
                    2024.0
      4
                                                   2
                                                          -99
                    2024.0
      5
```

NaN

25

2015.0

2024.0

Nashik

```
6
                    2022.0
                                                          -99
                                                   1
      7
                    2024.0
                                                   1
                                                         Pune
                                                   3
      8
                                                          -99
                    2022.0
      9
                                                   2
                    2023.0
                                                      Nashik
      10
                    2025.0
                                                   1
                                                          -99
      11
                    2015.0
                                                   1
                                                          -99
                                                   3
                                                          -99
      12
                    2024.0
      13
                                                   1
                    2021.0
                                                         Pune
                                                   3
      14
                    2020.0
                                                      Nashik
      15
                    2021.0
                                                   1
                                                          -99
                                                   1
                                                          -99
      16
                    2017.0
      17
                    2024.0
                                                   1
                                                         Pune
                                                   1
                                                          -99
      18
                    2016.0
                                                      Nashik
      19
                                                   3
                    2021.0
      20
                    2015.0
                                                   2
                                                          -99
      21
                                                   1
                                                          -99
                    2025.0
      22
                                                   2
                    2015.0
                                                         Pune
                                                   3
      23
                    2024.0
                                                      Nashik
                                                   2
                                                          -99
      24
                    2023.0
      25
                                                   2
                                                          -99
                    2015.0
      26
                    2022.0
                                                   3
                                                         Pune
                                                   1
      27
                    2016.0
                                                      Nashik
      28
                    2016.0
                                                   2
                                                          -99
                                                   2
      29
                    2016.0
                                                         Pune
[17]: ndf.dropna()
[17]:
           gender
                    math_score
                                  reading_score
                                                   writing_score
                                                                   placement_score \
                                            74.0
      1
             male
                            77.0
                                                             66.0
                                                                                84.0
      3
           female
                           80.0
                                            78.0
                                                             69.0
                                                                                79.0
      7
           female
                           72.0
                                            72.0
                                                             64.0
                                                                                65.0
      14
             male
                           78.0
                                            78.0
                                                             69.0
                                                                                85.0
      17
             male
                           71.0
                                            73.0
                                                             79.0
                                                                                72.0
      19
             male
                           66.0
                                            72.0
                                                             69.0
                                                                                95.0
      22
             male
                                            71.0
                           70.0
                                                             70.0
                                                                                80.0
      26
             male
                            73.0
                                            62.0
                                                             63.0
                                                                                94.0
      27
             male
                            70.0
                                            65.0
                                                             71.0
                                                                                71.0
      29
                            67.0
                                            72.0
           female
                                                             72.0
                                                                                82.0
           club_join_year
                            placement_offer_count
                                                      Region
      1
                    2025.0
                                                   2
                                                      Nashik
                                                   2
      3
                                                         Pune
                    2024.0
      7
                    2024.0
                                                   1
                                                         Pune
                                                   3
      14
                    2020.0
                                                      Nashik
      17
                    2024.0
                                                   1
                                                         Pune
      19
                    2021.0
                                                   3
                                                      Nashik
```

Pune

22

```
27
                    2016.0
                                                    1
                                                       Nashik
                    2016.0
                                                   2
      29
                                                         Pune
      ndf.dropna(how = 'all')
[18]:
                   math_score
                                   reading_score
                                                   writing_score placement_score
           gender
      0
           female
                       74.00000
                                             67.0
                                                              80.0
                                                                                 88.0
      1
                       77.00000
                                             74.0
                                                              66.0
                                                                                 84.0
             male
      2
             male
                       66.00000
                                             68.0
                                                             63.0
                                                                                 79.0
      3
           female
                                             78.0
                                                                                 79.0
                       80.00000
                                                              69.0
      4
             male
                       62.00000
                                             79.0
                                                              69.0
                                                                                 82.0
      5
           female
                                             75.0
                       65.00000
                                                               NaN
                                                                                 89.0
      6
             male
                       70.62069
                                             79.0
                                                              68.0
                                                                                 71.0
      7
           female
                       72.00000
                                             72.0
                                                              64.0
                                                                                 65.0
      8
           female
                       77.00000
                                             73.0
                                                             72.0
                                                                                 99.0
      9
             male
                       67.00000
                                             71.0
                                                             64.0
                                                                                  NaN
      10
             male
                       66.00000
                                             70.0
                                                             60.0
                                                                                 63.0
      11
             male
                       77.00000
                                             74.0
                                                              62.0
                                                                                 66.0
      12
           female
                                             80.0
                                                             67.0
                       60.00000
                                                                                 97.0
      13
             male
                       75.00000
                                              NaN
                                                              63.0
                                                                                 68.0
      14
             male
                       78.00000
                                             78.0
                                                              69.0
                                                                                 85.0
      15
           female
                       66.00000
                                             77.0
                                                             68.0
                                                                                  NaN
      16
           female
                                             64.0
                                                                                 71.0
                       76.00000
                                                             69.0
      17
             male
                       71.00000
                                             73.0
                                                             79.0
                                                                                 72.0
           female
                                             80.0
      18
                       67.00000
                                                             80.0
                                                                                 64.0
      19
             male
                       66.00000
                                             72.0
                                                             69.0
                                                                                 95.0
      20
             male
                       72.00000
                                             74.0
                                                              69.0
                                                                                 81.0
      21
           female
                       79.00000
                                             69.0
                                                             74.0
                                                                                 68.0
      22
             male
                       70.00000
                                             71.0
                                                                                 80.0
                                                             70.0
      23
             male
                       60.00000
                                             61.0
                                                             63.0
                                                                                  {\tt NaN}
      24
                                             65.0
             male
                       71.00000
                                                             66.0
                                                                                 79.0
           female
                                             69.0
      25
                       70.00000
                                                             68.0
                                                                                 75.0
                                             62.0
      26
             male
                       73.00000
                                                             63.0
                                                                                 94.0
      27
             male
                                             65.0
                                                                                 71.0
                       70.00000
                                                             71.0
      28
             male
                       74.00000
                                             72.0
                                                             74.0
                                                                                 83.0
      29
           female
                       67.00000
                                             72.0
                                                              72.0
                                                                                 82.0
           club_join_year
                             placement_offer_count
                                                       Region
      0
                                                         Pune
                       NaN
                                                   3
                                                   2
      1
                    2025.0
                                                       Nashik
                                                   2
      2
                                                          NaN
                    2025.0
      3
                                                   2
                    2024.0
                                                         Pune
                                                   2
      4
                    2024.0
                                                          NaN
                                                   3
      5
                                                       Nashik
                    2024.0
      6
                    2022.0
                                                   1
                                                          NaN
      7
                                                    1
                    2024.0
                                                         Pune
```

Pune

26

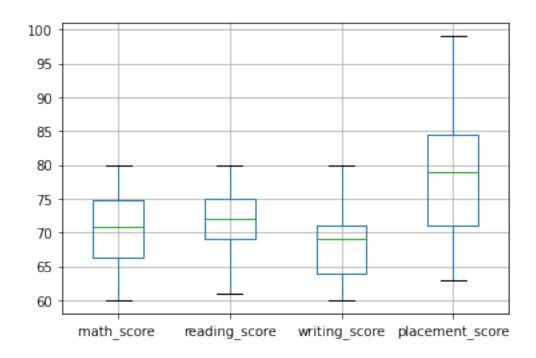
```
8
              2022.0
                                                3
                                                        {\tt NaN}
9
              2023.0
                                                2
                                                    Nashik
              2025.0
10
                                                1
                                                        {\tt NaN}
11
              2015.0
                                                1
                                                        NaN
12
                                                3
                                                       {\tt NaN}
              2024.0
13
              2021.0
                                                      Pune
                                                1
14
              2020.0
                                                3
                                                    Nashik
15
              2021.0
                                                1
                                                       {\tt NaN}
              2017.0
                                                1
16
                                                       {\tt NaN}
17
              2024.0
                                                1
                                                      Pune
18
              2016.0
                                                1
                                                        NaN
19
              2021.0
                                                3
                                                    Nashik
                                                2
20
                                                       NaN
              2015.0
21
              2025.0
                                                1
                                                        {\tt NaN}
22
              2015.0
                                                2
                                                      Pune
              2024.0
23
                                                3
                                                    Nashik
24
              2023.0
                                                2
                                                       NaN
                                                2
              2015.0
25
                                                        NaN
26
                                                3
              2022.0
                                                      Pune
27
              2016.0
                                                1
                                                    Nashik
                                                2
28
              2016.0
                                                       {\tt NaN}
29
                                                2
              2016.0
                                                      Pune
```

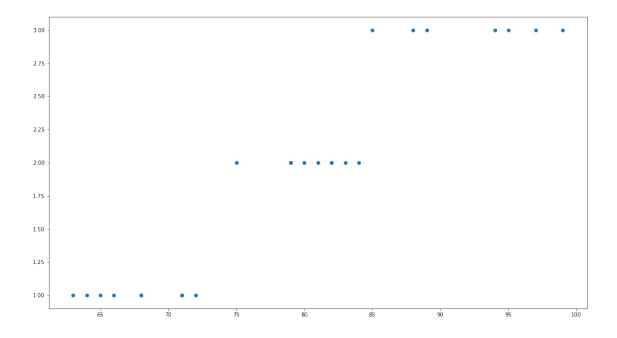
[19]: ndf.dropna(axis = 1)

[19]:		gender	math_score	placement_offer_count
	0	female	74.00000	3
	1	male	77.00000	2
	2	male	66.00000	2
	3	female	80.00000	2
	4	male	62.00000	2
	5	female	65.00000	3
	6	male	70.62069	1
	7	female	72.00000	1
	8	female	77.00000	3
	9	male	67.00000	2
	10	male	66.00000	1
	11	male	77.00000	1
	12	female	60.00000	3
	13	male	75.00000	1
	14	male	78.00000	3
	15	female	66.00000	1
	16	female	76.00000	1
	17	male	71.00000	1
	18	female	67.00000	1
	19	male	66.00000	3
	20	male	72.00000	2

```
79.00000
      21
          female
                                                     1
      22
            male
                      70.00000
                                                     2
            male
                                                     3
      23
                      60.00000
                                                     2
      24
            male
                      71.00000
      25
         female
                      70.00000
                                                     2
      26
            male
                      73.00000
                                                     3
      27
            male
                      70.00000
                                                     1
      28
            male
                      74.00000
                                                     2
                      67.00000
                                                     2
      29 female
[20]: new_data = ndf.dropna(axis = 0, how = 'any')
      new_data
[20]:
          gender math_score
                                reading_score writing_score placement_score \
      1
            male
                          77.0
                                          74.0
                                                          66.0
                                                                            84.0
          female
                                          78.0
      3
                          80.0
                                                          69.0
                                                                            79.0
      7
          female
                          72.0
                                          72.0
                                                          64.0
                                                                            65.0
            male
      14
                          78.0
                                          78.0
                                                          69.0
                                                                            85.0
            male
                          71.0
                                          73.0
      17
                                                          79.0
                                                                            72.0
      19
            male
                          66.0
                                          72.0
                                                          69.0
                                                                            95.0
            male
                                          71.0
      22
                          70.0
                                                          70.0
                                                                            80.0
            male
      26
                          73.0
                                          62.0
                                                          63.0
                                                                            94.0
      27
            male
                          70.0
                                          65.0
                                                          71.0
                                                                            71.0
      29
          female
                          67.0
                                          72.0
                                                          72.0
                                                                            82.0
          club_join_year placement_offer_count
                                                   Region
                   2025.0
      1
                                                   Nashik
                                                2
      3
                   2024.0
                                                     Pune
      7
                                                     Pune
                   2024.0
                                                1
      14
                   2020.0
                                                3
                                                   Nashik
                                                     Pune
      17
                  2024.0
                                                1
      19
                  2021.0
                                                3
                                                  Nashik
      22
                   2015.0
                                                2
                                                     Pune
      26
                   2022.0
                                                3
                                                     Pune
      27
                   2016.0
                                                1
                                                   Nashik
      29
                   2016.0
                                                     Pune
[21]: col = ['math_score ', 'reading_score', 'writing_score', 'placement_score']
      data.boxplot(col)
```

[21]: <AxesSubplot:>

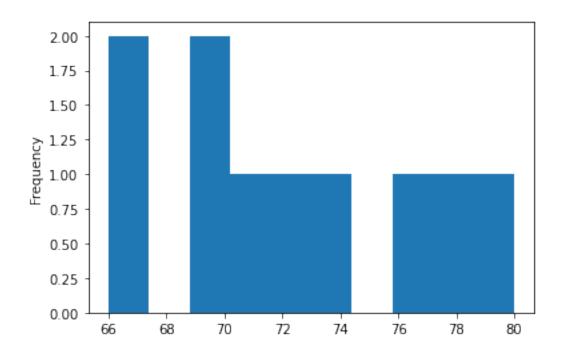




```
[25]: Text(3.2000000000017, 0.5, '(Full-value property-tax rate)/($10,000)')
[26]: print(np.where((data['placement_score']<50) &__
      print(np.where((data['placement_score']>85) &__
      (array([], dtype=int64),)
    (array([], dtype=int64),)
[27]: import numpy as np
     from scipy import stats
[28]: z = np.abs(stats.zscore(data['math_score ']))
[29]: print(z)
    0
          0.626505
    1
          1.182688
    2
          0.856650
    3
          1.738871
    4
          1.598227
    5
          1.042044
    6
         0.000000
    7
         0.255716
          1.182688
    8
    9
          0.671255
```

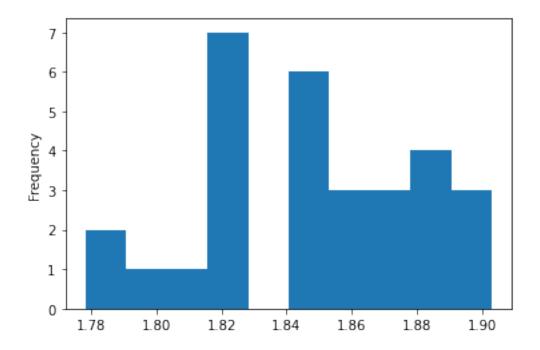
```
10
           0.856650
     11
           1.182688
     12
           1.969015
     13
           0.811899
     14
           1.368082
     15
           0.856650
     16
           0.997294
     17
           0.070322
     18
           0.671255
     19
           0.856650
     20
           0.255716
     21
           1.553476
     22
           0.115072
     23
           1.969015
     24
           0.070322
     25
           0.115072
     26
           0.441111
     27
           0.115072
     28
           0.626505
     29
           0.671255
     Name: math_score , dtype: float64
[30]: threshold = 0.18
[31]: sample_outliers = np.where(z <threshold)
      sample_outliers
[31]: (array([ 6, 17, 22, 24, 25, 27], dtype=int64),)
      sorted_rscore= sorted(data['reading_score'])
[32]:
[33]: sorted_rscore
[33]: [61.0,
       62.0,
       64.0,
       65.0,
       65.0,
       67.0,
       68.0,
       69.0,
       69.0,
       70.0,
       71.0,
       71.0,
       72.0,
       72.0,
```

```
72.0,
       72.0,
      73.0,
       73.0,
      74.0,
      74.0,
      74.0,
      75.0,
      77.0,
      78.0,
      78.0,
      79.0,
      79.0,
      80.0,
      nan,
      80.0]
[34]: q1 = np.percentile(sorted_rscore, 25)
      q3 = np.percentile(sorted_rscore, 75)
      print(q1,q3)
     nan nan
[35]: IQR = q3-q1
[36]: lwr_bound = q1-(1.5*IQR)
     upr_bound = q3+(1.5*IQR)
      print(lwr_bound, upr_bound)
     nan nan
[39]: import matplotlib.pyplot as plt
      new_data['math_score '].plot(kind = 'hist')
[39]: <AxesSubplot:ylabel='Frequency'>
```



```
[40]: data['log_math'] = np.log10(data['math_score '])
[41]: data['log_math'].plot(kind = 'hist')
```

[41]: <AxesSubplot:ylabel='Frequency'>



[]: Name= akash pachrne roll no :13254