ANALYSIS REPORT

1. **Which city recorded the highest and lowest average annual rainfall for each year between 2015 and 2023?**

Output:

year_	city	Highest avg. annual rainfall (mm)
2015	Dresden	133.43
2016	Stuttgart	121.41
2017	Leipzig	122.92
2018	Berlin	109.51
2019	Cologne	125.48
2020	Cologne	127.81
2021	Hamburg	117.04
2022	Stuttgart	115.53
2023	Munich	141.6

year_	city	Lowest avg. annual rainfall (mm)
2015	Dusseldorf	69.3
2016	Dresden	73.78
2017	Berlin	75.02
2018	Leipzig	80.88
2019	Dresden	85.74
2020	Hamburg	79.61
2021	Leipzig	65.43
2022	Munich	72.58
2023	Stuttgart	63.35

Insights:

City-Specific Rainfall Trends:

- Dresden experienced the highest average annual rainfall in 2015.
- Munich recorded the highest average rainfall in 2023, with 141.6 mm, indicating a significant amount of precipitation compared to other years and cities.
- Dusseldorf had the lowest average annual rainfall in 2015, with only 69.3 mm.
- Stuttgart recorded the lowest average rainfall in 2023, with 63.35 mm, indicating relatively dry conditions compared to other cities.

Consistency in Rainfall:

- Cologne appeared twice, in 2019 and 2020, showing a consistent trend of higher rainfall in these years.
- Stuttgart also appeared twice, in 2016 and 2022, suggesting a recurring pattern of significant rainfall.
- Dresden appeared twice, in 2016 and 2019, showing a pattern of low rainfall in these years.
- Leipzig also appeared twice, in 2018 and 2021, suggesting consistent low rainfall during these periods.

Geographical Insights:

- The cities listed (Dusseldorf, Dresden, Berlin, Leipzig, Hamburg, Munich, Stuttgart, Cologne) cover different regions of Germany, highlighting that high and low average rainfall is not confined to a specific area but varies across the country.

2. **How has rainfall varied over the years across different cities or regions in Germany?**

Output:

year_	Avg_Berlin_Rain	Avg_Munich_Rain	Avg_Hamburg_Rain	Avg_Cologne_Rain	Avg_Frankfurt_Rain	Avg_Stuttgart_Rain	Avg_Dusseldorf_Rain	Avg_Dresden_Rain	Avg_Leipzig_Rain	Avg_Hanover_Rain
2015	98.18	91.79	133.34	78.82	85.99	89.77	69.3	133.43	119.73	87.12
2016	91.46	91.01	94.65	108.54	96.8	121.41	109.05	73.78	103.29	120.35
2017	75.02	108.09	80.49	117.58	94.37	109.59	79.14	109.35	122.92	107.62
2018	109.51	86.68	103.09	100.98	83.02	83.77	86.23	97.84	80.88	95.49
2019	104.54	110.56	112.86	125.48	91.03	87.4	117.09	85.74	118.3	93.66
2020	103.98	106.8	79.61	127.81	118.94	97.3	98.82	123.93	118.17	93.45
2021	101.3	84.13	117.04	110.7	101.3	112.17	88.93	89.65	65.43	93.47
2022	93.19	72.58	96.92	92.17	87.74	115.53	94.29	108.86	96.94	83.93
2023	68.07	141.6	94.28	109.25	90.83	63.35	112.4	123.67	78.3	96.09

Insights:

Berlin:

- Shows a **general decrease** in rainfall, from 98.18 mm in 2015 to 68.07 mm in 2023, with fluctuations in between.

Munich:

- **Significant increase** in average rainfall, particularly in 2023 (141.6 mm), showing an upward trend over the years.

Hamburg:

- Rainfall varies, with peaks in 2015 (133.34 mm) and dips like in 2020 (79.61 mm), indicating no clear trend. Although there are fluctuations, there is a **general decreasing** trend from 2015 (133.34 mm) to 2023 (94.28 mm).

Cologne:

- Exhibits a **general increasing** trend in rainfall, peaking in 2020 (127.81 mm) and consistent high values thereafter.

Frankfurt:

- Data from **2019 onwards** generally shows higher average rainfall compared to 2015, indicating an **upward trend** in precipitation. While there are fluctuations, the overall pattern suggests **increasing** rainfall in recent years.

Stuttgart:

- **Initially increasing** to a peak in 2016 (121.41 mm) and then varying, with a **significant drop in 2023** (63.35 mm).

Dusseldorf:

- Generally **increasing** after a low in 2015 (69.3 mm), peaking in 2019 (117.09 mm) and showing variability thereafter. Despite all variability, all years recorded average rainfall more than year 2015.

Dresden:

- Fluctuating pattern, with a high in 2015 (133.43 mm) and subsequent variability, though it maintains **relatively high values**.

Leipzig:

- **Decreasing trend**, particularly notable in 2021 (65.43 mm) compared to earlier high years like 2015 (119.73 mm).

Hanover:

- Despite a minor uptick in 2023, the overall trend since the peak in 2016 shows a decline in average annual rainfall. The data highlights fluctuations in annual rainfall, but the general pattern indicates a **downward trend after 2016**.

3. Which months typically receive the most and least rainfall on average?

Output:

i. **Most rainfall on average**

MONTH	Avg Rainfall (mm)
December	111.83

ii. **Least rainfall on average**

MONTH	Avg Rainfall (mm)
October	89.53

Insights:

- **December:** With an average rainfall of 111.83 mm, December is the month with the most rainfall.
- **October:** With an average rainfall of 89.53 mm, October receives the least rainfall.

4. **Which cities recorded the highest and lowest average temperatures for each season over the years?**

Output:

Highest Seasonal Average Temperature:

year_	city	season	Highest Avg. Temperature
2015	Berlin	Winter	21.3
2015	Cologne	Spring	19.6
2015	Dresden	Autumn	16.9
2015	Dusseldorf	Summer	20.9
2015	Frankfurt	Spring	18.2
2015	Hamburg	Autumn	22.5
2015	Hanover	Autumn	28.5
2015	Leipzig	Spring	21.5
2015	Munich	Autumn	27.1
2015	Stuttgart	Summer	15.6
2016	Berlin	Autumn	20.9
2016	Cologne	Summer	15.5
2016	Dresden	Summer	20.9
2016	Dusseldorf	Summer	24.9
2016	Frankfurt	Spring	20.7
2016	Hamburg	Winter	26.8
2016	Hanover	Spring	23.3
2016	Leipzig	Winter	21.1
2016	Munich	Winter	28.8
2016	Stuttgart	Spring	13.9
2017	Berlin	Spring	24
2017	Cologne	Autumn	18.8
2017	Dresden	Winter	21.2
2017	Dusseldorf	Summer	15.8
2017	Frankfurt	Autumn	26.9
2017	Hamburg	Spring	18
2017	Hanover	Autumn	23.2
2017	Leipzig	Spring	27
2017	Munich	Spring	13.2
2017	Stuttgart	Winter	29.9
2018	Berlin	Spring	29.2
2018	Cologne	Summer	26
2018	Dresden	Spring	28.4
2018	Dusseldorf	Winter	29.7
2018	Frankfurt	Winter	21
2018	Hamburg	Autumn	27.3
2018	Hanover	Winter	20.4
2018	Leipzig	Winter	32.2
2018	Munich	Winter	27.2
2018	Stuttgart	Autumn	16.7
2019	Berlin	Summer	22.2
2019	Cologne	Summer	31.8
2019	Dresden	Autumn	23.1
2019	Dusseldorf	Winter	19.2
2019	Frankfurt	Summer	27
2019	Hamburg	Autumn	18.2
2019	Hanover	Winter	25.5
2019	Leipzig	Autumn	29.1
2019	Munich	Spring	21.7
2019	Stuttgart	Spring	20.8
2020	Berlin	Spring	23.2
2020	Cologne	Autumn	27.6
2020	Dresden	Winter	20.3
2020	Dusseldorf	Autumn	13.4
2020	Frankfurt	Autumn	22.2
2020	Hamburg	Summer	22.6
2020	Hanover	Summer	20.2
2020	Leipzig	Spring	22.3
2020	Munich	Summer	21.9
2020	Stuttgart	Winter	17.6
2021	Berlin	Autumn	24.8
2021	Cologne	Autumn	20.1
2021	Dresden	Summer	22.4
2021	Dusseldorf	Summer	21.7
2021	Frankfurt	Autumn	16.5
2021	Hamburg	Autumn	22
2021	Hanover	Winter	21.8
2021	Leipzig	Autumn	22.1
2021	Munich	Autumn	25
2021	Stuttgart	Winter	26.2
2022	Berlin	Autumn	23.3
2022	Cologne	Summer	20
2022	Dresden	Winter	16.7
2022	Dusseldorf	Spring	16.8
2022	Frankfurt	Winter	28.3
2022	Hamburg	Summer	13.4
2022	Hanover	Spring	22
2022	Leipzig	Winter	20.4
2022	Munich	Spring	24.5
2022	Stuttgart	Spring	21.9
2023	Berlin	Summer	17.5
2023	Cologne	Autumn	16.1
2023	Dresden	Summer	19.4
2023	Dusseldorf	Spring	30
2023	Frankfurt	Spring	23.6
2023	Hamburg	Winter	26
2023	Hanover	Winter	23.1
2023	Leipzig	Summer	25.9
2023	Munich	Winter	14.4
2023	Stuttgart	Autumn	23.9

Insights:

Seasonal Peaks:

- **Winter:** Cities like Munich (2016 - 28.8°C), Leipzig (2018 - 32.2°C), and Stuttgart (2017 - 29.9°C) show unusually high winter temperatures.
- **Spring:** Berlin (2018 - 29.2°C) and Leipzig (2017 - 27°C) experienced the highest spring temperatures.
- **Summer:** Cologne (2019 - 31.8°C) and Dusseldorf (2016 - 24.9°C) show significant summer peaks.
- **Autumn:** Hanover (2015 - 28.5°C) and Cologne (2020 - 27.6°C) had the highest autumn temperatures.

Yearly Peaks:

- Certain years exhibit higher overall seasonal temperatures across multiple cities, such as **2018** and **2019**, indicating potential regional heatwaves or climatic anomalies.

Lowest Seasonal Average Temperature:

year_	city	season	Lowest Avg. Temperature
2015	Berlin	Summer	8.6
2015	Cologne	Winter	1.7
2015	Dresden	Spring	5.3
2015	Dusseldorf	Winter	10.3
2015	Frankfurt	Summer	2.5
2015	Hamburg	Winter	13.6
2015	Hanover	Winter	4.9
2015	Leipzig	Autumn	4.5
2015	Munich	Spring	6.1
2015	Stuttgart	Winter	9.9
2016	Berlin	Winter	0.5
2016	Cologne	Autumn	9.2
2016	Dresden	Autumn	4.4
2016	Dusseldorf	Autumn	9.5
2016	Frankfurt	Winter	5.8
2016	Hamburg	Summer	16.8
2016	Hanover	Autumn	11.6
2016	Leipzig	Summer	5.4
2016	Munich	Spring	4.8
2016	Stuttgart	Autumn	11.7
2017	Berlin	Summer	1.3
2017	Cologne	Spring	5.3
2017	Dresden	Autumn	12.5
2017	Dusseldorf	Winter	1.1
2017	Frankfurt	Spring	14.6
2017	Hamburg	Autumn	13.6
2017	Hanover	Winter	11.8
2017	Leipzig	Summer	9.1
2017	Munich	Autumn	8.8
2017	Stuttgart	Summer	12.3
2018	Berlin	Winter	11.8
2018	Cologne	Winter	6.8
2018	Dresden	Summer	6.9
2018	Dusseldorf	Spring	18.2
2018	Frankfurt	Spring	2.6
2018	Hamburg	Winter	4.5
2018	Hanover	Autumn	12.9
2018	Leipzig	Autumn	3.2
2018	Munich	Summer	1
2018	Stuttgart	Winter	11.9
2019	Berlin	Winter	9.6
2019	Cologne	Winter	11.4
2019	Cologne	Spring	11.4
2019	Dresden	Spring	11
2019	Dusseldorf	Summer	6.3
2019	Frankfurt	Spring	2.6
2019	Hamburg	Winter	11.9
2019	Hanover	Autumn	4.3
2019	Leipzig	Summer	7.4
2019	Munich	Winter	7.2
2019	Stuttgart	Winter	6
2020	Berlin	Autumn	-0.8
2020	Cologne	Spring	10.6
2020	Dresden	Summer	11.1
2020	Dusseldorf	Spring	2.3
2020	Frankfurt	Winter	-2.3
2020	Hamburg	Autumn	2.7
2020	Hanover	Winter	5.7
2020	Leipzig	Autumn	12.2
2020	Munich	Winter	9.2
2020	Stuttgart	Spring	13.8
2021	Berlin	Spring	11
2021	Cologne	Winter	7
2021	Dresden	Winter	1.8
2021	Dusseldorf	Winter	4.3
2021	Frankfurt	Summer	1.8
2021	Hamburg	Spring	0.6
2021	Hanover	Autumn	10.1
2021	Leipzig	Summer	11.7
2021	Munich	Spring	8.9
2021	Stuttgart	Autumn	4.1
2022	Berlin	Spring	6.8
2022	Cologne	Winter	13.4
2022	Dresden	Summer	5.5
2022	Dusseldorf	Autumn	0.6
2022	Frankfurt	Autumn	10.1
2022	Hamburg	Winter	1.5
2022	Hanover	Winter	6.1
2022	Leipzig	Summer	3.8
2022	Munich	Summer	8.1
2022	Stuttgart	Winter	10.7
2023	Berlin	Winter	5.2
2023	Cologne	Summer	8.7
2023	Dresden	Autumn	9.4
2023	Dusseldorf	Autumn	5
2023	Frankfurt	Autumn	6.1
2023	Hamburg	Spring	11.8
2023	Hanover	Spring	8.7
2023	Leipzig	Autumn	14.7
2023	Munich	Autumn	4.8
2023	Stuttgart	Spring	4.7

Insights:

Seasonal Analysis:

a. **Winter:**
   - **2016:** Berlin recorded the lowest average winter temperature at 0.5°C.
   - **2017:** Dusseldorf had a low of 1.1°C.
   - **2020:** Frankfurt had a notable low of -2.3°C, the coldest in the dataset.

b. **Spring:**
   - **2020:** Dusseldorf had a significant low temperature of 2.3°C.
   - **2018:** Frankfurt also recorded a very low temperature of 2.6°C in spring.
   - **2022:** Berlin had a low spring temperature of 6.8°C.

c. **Summer:**
   - **2015:** Frankfurt had a very low summer temperature of 2.5°C.
   - **2017:** Berlin recorded a summer temperature as low as 1.3°C.
   - **2018:** Munich had an extremely low summer temperature of 1°C.

d. **Autumn:**
   - **2018:** Leipzig recorded the lowest average autumn temperature at 3.2°C.
   - **2016:** Dresden had a low autumn temperature of 4.4°C.
   - **2019:** Hanover recorded 4.3°C in autumn.

Overall Trends:

Notable Low Temperatures:

- **Frankfurt** and **Berlin** frequently appear with significantly low temperatures across various seasons, indicating possible microclimates or specific weather conditions.
- **Munich** also shows extreme low temperatures, especially in summer (2018 - 1°C).

Seasonal Extremes:

- **Winter and Spring:** Show the most significant low temperature variations, with some cities experiencing temperatures **below zero**.
- **Summer:** Despite being typically warmer, some cities like **Berlin** and **Munich** record unexpectedly **low** summer temperatures.

Yearly Trends:

- **2018** and **2020** stand out with particularly low temperatures across multiple seasons, indicating colder-than-average conditions during these years.

5. Which city had the highest and lowest average temperature in each year?

Output:

year_	city	Highest avg. annual temperature
2015	Hanover	18.3
2016	Hamburg	20
2017	Stuttgart	19
2018	Dusseldorf	22.2
2019	Cologne	19.4
2020	Cologne	17.9
2021	Berlin	19.2
2022	Cologne	17.6
2023	Leipzig	19.1

year_	city	Lowest avg. annual temperature
2015	Frankfurt	10.7
2016	Berlin	10.4
2017	Dusseldorf	10.1
2018	Frankfurt	12.9
2019	Munich	13.2
2020	Dusseldorf	8.8
2021	Dusseldorf	10
2022	Hamburg	7.7
2023	Munich	9.9

Insights:

Highest Average Annual Temperature:

- **Cologne** appears multiple times (2019, 2020, and 2022), suggesting it frequently experiences warmer conditions.
- **2018:** Dusseldorf had the highest average temperature at 22.2°C, indicating an exceptionally warm year.
- **Hamburg** in 2016 (20°C) and **Hanover** in 2015 (18.3°C) also recorded notable highs.
- The temperatures show fluctuations year-to-year, reflecting variations in annual weather patterns. For example, the highest average temperature decreased from **22.2°C in 2018 to 17.6°C in 2022**.

Lowest Average Annual Temperature:

- **Dusseldorf** appears frequently (2017, 2020, and 2021), suggesting it often experiences cooler conditions.
- **2016:** Berlin recorded the lowest average temperature at 10.4°C.
- **2015:** Frankfurt had a notable low of 10.7°C.
- **2022:** Hamburg had the lowest average temperature of 7.7°C, indicating particularly cold conditions.

6. What are the maximum and minimum temperatures recorded for each year between 2015 and 2023?

Output:

year_	city	month_name	temperature
2015	Dusseldorf	September	33.8
2016	Dusseldorf	October	34.3
2017	Dresden	January	34.7
2018	Leipzig	February	34.9
2019	Stuttgart	November	34.9
2019	Dresden	January	34.9
2020	Hanover	October	34.3
2021	Cologne	June	34.7
2022	Frankfurt	February	34.8
2022	Hanover	April	34.8
2023	Dusseldorf	March	34.6

year_	city	month_name	temperature
2015	Frankfurt	July	-4.5
2016	Munich	May	-4.6
2017	Leipzig	January	-4.4
2018	Frankfurt	April	-5
2019	Berlin	May	-4.6
2019	Hanover	October	-4.6
2020	Frankfurt	February	-5
2021	Cologne	February	-4.4
2022	Hanover	December	-5
2023	Dusseldorf	October	-4.8

Insights:

- 2018 (**Leipzig**), 2019 (**Stuttgart**), 2019 (**Dresden**) recorded the highest temperature of 34.9°C.
- **Frankfurt** (2018, 2020) and **Hanover** (2022) has experienced the lowest temperature of -5°C.

7. **Which cities experience the highest and lowest humidity levels for each year between 2015 and 2023?**

Output:

year_	city	month_name	humidity
2015	Berlin	August	99
2015	Munich	June	99
2015	Dusseldorf	April	99
2015	Leipzig	January	99
2015	Leipzig	March	99
2016	Dusseldorf	July	99
2016	Dresden	June	99
2017	Berlin	June	99
2017	Dresden	January	99
2018	Berlin	July	99
2018	Frankfurt	September	99
2019	Hanover	June	99
2020	Cologne	April	99
2021	Berlin	June	99
2022	Dresden	December	99
2022	Leipzig	May	99
2023	Berlin	December	99
2023	Hamburg	August	99

year_	city	month_name	humidity
2015	Munich	March	30
2015	Dresden	March	30
2016	Cologne	April	30
2017	Hamburg	May	30
2018	Munich	May	30
2018	Cologne	December	30
2018	Hanover	October	30
2019	Dusseldorf	December	30
2020	Dusseldorf	December	30
2020	Leipzig	November	30
2020	Hanover	May	30
2021	Berlin	April	30
2021	Berlin	October	30
2022	Cologne	February	31
2023	Frankfurt	December	30
2023	Stuttgart	April	30
2023	Leipzig	February	30
2023	Hanover	October	30

Insights:

Highest Humidity Levels:

Recurring Cities and Months:

- **Berlin** consistently appears across multiple years (2015, 2017, 2018, 2021, 2023), indicating it frequently experiences high humidity.
- **Dresden** also shows up in several years (2016, 2017, 2022) with maximum humidity levels.
- **Leipzig** has multiple cities in 2015 and another in 2022, suggesting recurring high humidity events.

NOTE:

- **Summer Months (June-August):** High humidity levels are frequently recorded in summer months, possibly due to increased moisture and warmer temperatures.

Lowest Humidity Levels:

Recurring Cities and Months:

- **Cologne** frequently appears across multiple years (2016, 2018, 2022).
- **Dusseldorf** showed fixed pattern of low humidity level (30%) in December month in the years 2019 and 2020.
- **Hanover, Leipzig, Munich** and **Berlin** also show up multiple times, suggesting consistent low humidity events in these cities.

NOTE:

- **Spring and Autumn**: Low humidity levels are often recorded during transitional seasons (March, April, May, October, and November), likely due to changing weather patterns.
- The humidity level of 30% appears consistently, indicating very dry conditions. One exception is February 2022 in **Cologne**, where the humidity level was slightly higher at **31%.**

8. Identify periods of high thermal discomfort in cities due to elevated temperatures (27°C or above) combined with high humidity (above 60%)?

Output: 128 records (Just a preview below)

year_	month_name	city
2015	February	Berlin
2015	September	Berlin
2015	June	Munich
2015	April	Hamburg
2015	September	Hamburg
2015	December	Hamburg
2015	March	Cologne
2015	August	Cologne
2015	March	Stuttgart
2015	June	Stuttgart
2015	March	Dusseldorf

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year_	month_name	city
2023	November	Cologne
2023	June	Frankfurt
2023	March	Dusseldorf
2023	November	Dresden
2023	July	Leipzig
2023	January	Hanover
2023	February	Hanover
2023	August	Hanover

Insights:

City Recurrence:

- **Hanover** frequently appears, indicating recurring periods of high thermal discomfort.
- **Berlin, Dusseldorf** and **Munich** are also notable for consistently experiencing high thermal discomfort.

Monthly Distribution:

- **Summer Months (June-August):** High thermal discomfort is prevalent during summer months, which is expected due to higher temperatures.
- **Winter and Transitional Months:** Surprisingly, high thermal discomfort is also noted in winter and transitional months.

9. Are there any cities with a significant increase in the frequency of heavy rainfall events?

Output:

City-wise Insights on Heavy Rainfall Events:

A. Berlin

- **2018**: Significant increase with 11 heavy rainfall events compared to 7 in the previous year (difference of 4).
- **2020**: Increase with 10 events compared to 9 in the previous year (difference of 1).
- **Insight:** Berlin saw a notable spike in heavy rainfall in 2018, with a smaller but consistent increase in 2020.

city	year_	heavy_rain_count	prev_year_count	diff
Berlin	2018	11	7	4
Berlin	2020	10	9	1
Cologne	2016	10	7	3
Cologne	2019	11	10	1
Cologne	2023	10	8	2
Dresden	2017	11	7	4
Dresden	2020	9	8	1
Dresden	2022	9	8	1
Dresden	2023	11	9	2
Dusseldorf	2016	11	5	6
Dusseldorf	2018	9	7	2
Dusseldorf	2019	10	9	1
Dusseldorf	2021	10	8	2
Dusseldorf	2023	9	8	1
Frankfurt	2018	10	9	1
Frankfurt	2020	10	9	1
Hamburg	2018	10	7	3
Hamburg	2021	11	7	4
Hamburg	2023	9	8	1
Hanover	2016	11	9	2
Hanover	2023	9	7	2
Leipzig	2017	10	9	1
Leipzig	2022	10	5	5
Munich	2017	10	8	2
Munich	2020	11	8	3
Munich	2023	10	7	3
Stuttgart	2016	10	7	3
Stuttgart	2017	11	10	1
Stuttgart	2020	10	7	3
Stuttgart	2021	11	10	1

B. Cologne

- **2016:** Significant increase with 10 events compared to 7 in the previous year (difference of 3).
- **2019:** Increase with 11 events compared to 10 in the previous year (difference of 1).
- **2023:** Increase with 10 events compared to 8 in the previous year (difference of 2).
- **Insight**: Cologne experienced recurring increases in heavy rainfall events, particularly in 2016 and 2023.

C. Dresden

- **2017:** Significant increase with 11 events compared to 7 in the previous year (difference of 4).
- **2020, 2022, 2023:** Smaller increases with consistent heavy rainfall counts.
- **Insight:** Dresden showed a notable spike in 2017, with smaller, consistent increases in the subsequent years.

D. Dusseldorf

- **2017:** Major increase with 11 events compared to 5 in the previous year (difference of 6).
- **2018, 2021:** Moderate increases with consistent heavy rainfall counts.
- **Insight:** Dusseldorf experienced a significant rise in heavy rainfall events in 2016, with smaller increases in other years.

E. Frankfurt

- **2018, 2020:** Consistent increases with 10 events each year compared to 9 in the previous year (difference of 1).
- **Insight:** Frankfurt saw minor but consistent increases in heavy rainfall events in 2018 and 2020.

F. Hamburg

- **2018**: Increase with 10 events compared to 7 in the previous year (difference of 3).
- **2021**: Significant increase with 11 events compared to 7 in the previous year (difference of 4).
- **Insight:** Hamburg experienced notable increases in heavy rainfall events in 2018 and 2021.

G. Hanover

- **2016**: Increase with 11 events compared to 9 in the previous year (difference of 2).
- **2023**: Increase with 9 events compared to 7 in the previous year (difference of 2).
- **Insight**: Hanover saw consistent increases in heavy rainfall events in 2016 and 2023.

H. Leipzig

- **2017**: Increase with 10 events compared to 9 in the previous year (difference of 1).
- **2022**: Significant increase with 10 events compared to 5 in the previous year (difference of 5).
- **Insight**: Leipzig had a significant rise in heavy rainfall events in 2022.

I. Munich

- **2017**: Increase with 10 events compared to 8 in the previous year (difference of 2).
- **2020**: Significant increase with 11 events compared to 8 in the previous year (difference of 3).
- **2023**: Increase with 10 events compared to 7 in the previous year (difference of 3).
- **Insight**: Munich experienced significant increases in heavy rainfall events in 2020 and 2023.

J. Stuttgart

- **2016, 2020:** Significant increase with 10 events compared to 7 in the previous years (difference of 3).
- **2017, 2021:** Increase with 11 events compared to 10 in the previous years (difference of 1).
- **Insight:** Stuttgart experienced significant increases in heavy rainfall events in 2016 and 2020.

10. What is the correlation between temperature and humidity levels in different cities during summer months?

Output:

city	temp_humidity_correlation
Berlin	-0.16
Cologne	0.15
Dresden	0.11
Dusseldorf	-0.14
Frankfurt	0.08
Hamburg	0.09
Hanover	0.01
Leipzig	-0.18
Munich	-0.09
Stuttgart	-0.4

Insights:

- **Weak Correlations**: Most cities show weak correlations (both positive and negative), suggesting that other factors might influence humidity levels besides temperature alone.
- **Stuttgart's Strong Negative Correlation**: Stuttgart stands out with a stronger negative correlation, indicating a significant decrease in humidity with increasing temperatures or vice - versa. This could be due to local climate characteristics or geographic factors.

11. Which year had the most significant anomalies in temperature and rainfall across cities?

Output:

year_	temp_anomaly	rain_anomaly	total_anomaly
2020	-1.16	7.67	8.83

Insights:

- **Year:** The year 2020 recorded significant anomalies.
- **Temperature Anomaly (-1.16):** This indicates that the average temperature in 2020 was 1.16°C below the expected norm.
- **Rainfall Anomaly (7.67):** This shows that the average rainfall in 2020 was 7.67 units above the expected norm.
- **Total Anomaly (8.83):** The combined anomaly for temperature and rainfall sums to 8.83, indicating a significant deviation from the norm.

NOTE:

- **Significant Weather Anomalies:** The negative temperature anomaly and the positive rainfall anomaly suggest that 2020 experienced unusual weather patterns across multiple cities. Despite the cooler temperatures, there was significantly more rainfall than expected.