# Round 1 - 1 Billion Rows Challenge

In [25]:

```
# Imports

# Using Polars as it's much faster than Pandas
import polars as pl
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
```

In [26]:

```
df = pl.read_csv("data/sensor_data.csv")
df
```

Out[26]: shape: (1_000_000, 9)

| sensor_id | sensor_reading | control_value | temperature | pressure | humidity | perforr |
|---|---|---|---|---|---|---|
| i64 | f64 | i64 | f64 | f64 | f64 | |
| 103 | 107.2 | 51 | 30.82 | 1018.93 | 69.07 | |
| 436 | 118.86 | 39 | 31.9 | 1007.78 | 73.6 | |
| 349 | 105.47 | 52 | 26.69 | 1025.11 | 44.62 | |
| 271 | 117.57 | 64 | 19.36 | 1004.81 | 42.15 | |
| 107 | 95.13 | 29 | 20.36 | 999.88 | 73.97 | |
| … | … | … | … | … | … | |
| 415 | 85.35 | 61 | 27.89 | 1024.01 | 34.01 | |
| 494 | 92.56 | 47 | 19.93 | 1008.53 | 74.5 | |
| 335 | 85.92 | 65 | 27.83 | 1016.02 | 35.29 | |
| 322 | 108.4 | 60 | 17.66 | 1035.48 | 43.64 | |
| 91 | 79.03 | 52 | 30.3 | 1009.32 | 55.35 | |

In [27]:

```
# Find out number of null values in each column
df.null_count()
```

Out[27]: shape: (1, 9)

| sensor_id | sensor_reading | control_value | temperature | pressure | humidity | perforr |
|---|---|---|---|---|---|---|
| u32 | u32 | u32 | u32 | u32 | u32 | |
| 0 | 0 | 0 | 0 | 0 | 0 | |

In [28]:

```
print("Number of Unique Sensor IDs: ", df["sensor_id"].n_unique())
```

```
Number of Unique Sensor IDs:  500
```

In [29]:

```
# First, add a combined column to the original dataframe
df_with_combined = df.with_columns(
    (pl.col("sensor_reading") + pl.col("control_value")).alias("combined_
)
```

```python
# Calculate statistics for all columns at once
stats = {
    "mean": df_with_combined.select(pl.mean(df_with_combined.columns)),
    "median": df_with_combined.select(pl.median(df_with_combined.columns)
    "min": df_with_combined.select(pl.min(df_with_combined.columns)),
    "max": df_with_combined.select(pl.max(df_with_combined.columns)),
    "std": df_with_combined.select(pl.std(df_with_combined.columns))
}

# Create statistics dataframe with proper syntax (list of dictionaries)
stat_df = pl.DataFrame([
    {
        "Reading": "Sensor Readings",
        "Mean": stats["mean"]["sensor_reading"][0],
        "Median": stats["median"]["sensor_reading"][0],
        "Min": stats["min"]["sensor_reading"][0],
        "Max": stats["max"]["sensor_reading"][0],
        "Standard Deviation": stats["std"]["sensor_reading"][0],
    },
    {
        "Reading": "Control Values",
        "Mean": stats["mean"]["control_value"][0],
        "Median": stats["median"]["control_value"][0],
        "Min": stats["min"]["control_value"][0],
        "Max": stats["max"]["control_value"][0],
        "Standard Deviation": stats["std"]["control_value"][0],
    },
    {
        "Reading": "Combined Values",
        "Mean": stats["mean"]["combined_value"][0],
        "Median": stats["median"]["combined_value"][0],
        "Min": stats["min"]["combined_value"][0],
        "Max": stats["max"]["combined_value"][0],
        "Standard Deviation": stats["std"]["combined_value"][0],
    }
])

# Display the statistics dataframe
stat_df
```

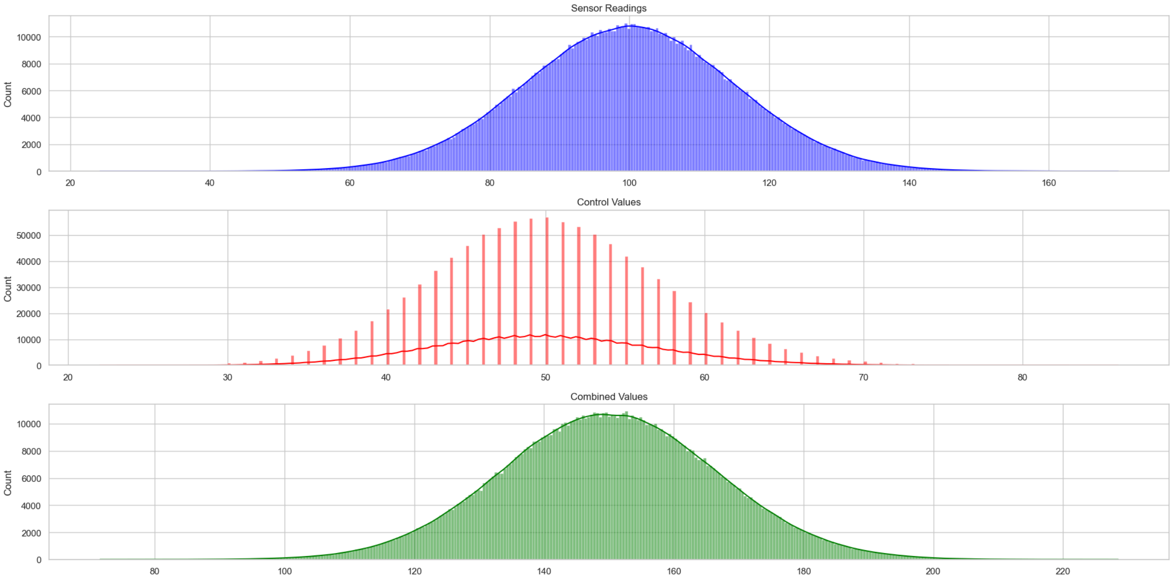
Out[29]: shape: (3, 6)

| Reading | Mean | Median | Min | Max | Standard Deviation |
|---:|---:|---:|---:|---:|---:|
| str | f64 | f64 | f64 | f64 | f64 |
| "Sensor Readings" | 100.000359 | 100.01 | 24.27 | 169.93 | 15.006399 |
| "Control Values" | 50.007403 | 50.0 | 22.0 | 86.0 | 7.070789 |
| "Combined Values" | 150.007762 | 149.96 | 71.58 | 228.49 | 16.593408 |

In [ ]:

```python
# Plotting all the columns
sns.set(style="whitegrid")
plt.figure(figsize=(20, 10))

# Plotting Sensor Readings
plt.subplot(3, 1, 1)
sns.histplot(df["sensor_reading"], kde=True, color="blue")
plt.title("Sensor Readings")
```

```
# Plotting Control Values
plt.subplot(3, 1, 2)
sns.histplot(df["control_value"], kde=True, color="red")
plt.title("Control Values")

# Plotting Combined Values
plt.subplot(3, 1, 3)
sns.histplot(df_with_combined["combined_value"], kde=True, color="green")
plt.title("Combined Values")

plt.tight_layout()

plt.show()
```


Sensor Readings
Count
Control Values
Count
Combined Values
Count