Entities in the building's IoT system include the following:

1. Device: A device equipped with multiple points, which can be either a sensor or a setpoint.
2. Point: A sensor that measures specific aspects of the building, or a setpoint that accepts values and reacts accordingly.
   For example, HVAC devices are used to regulate the temperature and air quality of a building or room. These devices have several points, which include both sensors and setpoints. Each point is identified by a unique field that indicates its type and purpose. Some of the essential points related to temperature regulation are:
   a. Zone Air Temperature Sensor: Measures the current temperature.
      Field: zone_air_temperature_sensor

   b. Zone Air Temperature Setpoint: Sets the target temperature.
      Field: zone_air_temperature_setpoint

   c. Occupancy Sensor: Indicates whether the device is currently in use.
      Field: occupied_mode

Problem 1:

Using the timeseries.parquet dataset, the aim is to analyze how well a device maintained the desired temperature in different occupied modes on an hourly basis throughout the day.

Keywords: time series alignment, missing values

Problem 2:

By analyzing the timeseries.parquet dataset, determine the time taken by a device to reach the setpoint temperature after the device turned on (occupied_mode changed from Unoccupied to Occupied).

Keywords: time series alignment, missing values

Problem 3:

Given a building equipped with multiple types of sensors that provide information about space occupancy, we need to develop a metric that can accurately assess and unify occupancy data across these different sensor types. The challenge lies in integrating the varying formats and granularity of the data provided by the following sensor types:

1. **Entry/Exit Counters:** Sensors that track the number of people entering and exiting a space over time.
2. **Binary Occupancy Sensors:** Sensors that provide a boolean output, indicating whether a space is currently occupied (True) or unoccupied (False).

3. **Occupancy Count Sensors:** Sensors that directly report the number of people present in a space at any given moment.

The goal is to create a unified occupancy metric that can reconcile the differences in data provided by these sensors to produce a consistent and reliable measure of space utilization in the building.

Problem 4:

This task is to create an occupancy dashboard that enables historical data analysis of the occupancy.parquet dataset. The dataset contains occupancy data for various spaces in different buildings. The goal is to define relevant metrics, charts, graphs, and other data visualizations that allow for meaningful insights into building occupancy trends and patterns over time. It should be designed to help identify correlations, trends, and anomalies in the occupancy data, with the ability to compare occupancy data across different buildings and spaces.

Column	Data type	Comment
organization_id	string	Organization unique identifier
state	string	State
city	string	City
building_name	string	Building name
space_name	string	Space name
space_type	string	Space type can be Building, Tower or Retail and one building can have spaces of these types with their relevant capacity.
space_description	string	Space description
capacity	integer	Capacity of space
date_time	timestamp	Hourly time
date_daily	timestamp	Date
people_in	integer	Total number of people that entered a space within an hour
people_out	integer	Total number of people that left a space within an hour
traffic	integer	Total traffic within an hour
occupancy	integer	Occupant number within an hour