TASK 1

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Problem Definition and Research Questions

Title Page:

- Project Title: Analyzing **MTA** Ridership Patterns Post-COVID-19
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1. Introduction The Metropolitan Transportation Authority (MTA), the largest public transit network in North America, experienced unprecedented disruption during the COVID-19 pandemic. Ridership across subways, buses, commuter railroads, and other services plummeted to historic lows, with some modes collapsing to as little as 2–7% of pre-pandemic baselines. While recovery has occurred, it remains **multi-speed and uneven**, shaped by the adoption of hybrid work, resilience of essential-worker transit, and increased reliance on private vehicles

2. Business Problem Statement

The MTA is still facing big problems after COVID, and they haven't gone away:

- **Riders didn't come back.**
  Subways and commuter trains are still only at about 60–70% of the riders they had before COVID. This doesn't look temporary — it's a real change in how people travel.

- **Less money coming in.**
  Fewer riders means less money from fares. This is putting pressure on the MTA's budget and making the future less secure.

- **Recovery isn't the same everywhere.**
  Buses and Access-A-Ride have bounced back well. But subways and trains — the backbone of the system — are still weak. That makes running the whole system harder.

- **People's habits changed.**
  There's now a "Friday Effect" — fewer people commute on Fridays, but weekends are busier. Why? Because hybrid work is here to stay. People don't go to the office five days a week anymore; they use transit more for weekends, leisure, or fewer workdays.

- **Here's the irony:**
  While public transit struggles, bridges and tunnels are actually busier than before COVID. More cars mean more traffic and pollution... while the cleaner, cheaper option (public transit) is being underused.

3. Research Questions To address the identified business challenges, the project focuses on answering the following key research questions:

Analytical Focus

1. How did COVID-19 impact ridership across different MTA services, and what are the long-term recovery patterns?

2. What are the seasonal trends in ridership for each mode of transport?

3. How long did it take for ridership to recover to 50%, 75%, and 100% of pre-pandemic levels for each mode?

Behavioral / Travel Patterns

4. How do weekday vs. weekend ridership trends reflect changing commuter and leisure behaviors?

5. What is the magnitude and implication of the **"Friday Effect"** on transit operations?

6. How does ridership change on holidays compared to regular weekdays?

Operational & Strategic Focus

7. Which services (buses, subways, rail, paratransit, bridges/tunnels) are most resilient, and why?

8. What insights from ridership trends can support **resource allocation** decisions across services?

4.Objectives

- **Measure recovery**: See how ridership across all services compares to pre-COVID levels.
- **Spot patterns**: Look at weekday, weekend, holiday, and Friday travel trends.
- **Compare services**: Find which modes recovered fastest and which are still lagging.
- **Use resources better**: Adjust schedules, staff, and budgets based on real demand.
- **Check finances**: Link ridership to revenue and test new flexible fare options.
- **Plan ahead**: Give recommendations for service, pricing, and investments in the new normal.

5. Scope & Limitations

Scope :

- Use daily ridership data from **March 2020 to 2024**.

- Include all MTA services: **subways, buses, commuter rail (LIRR & Metro-North), Access-A-Ride, bridges and tunnels, and Staten Island Railway**.

- Compare today's ridership with **2019 pre-COVID levels**.

- Focus on **what happened and why** (not future predictions).

Limitations :

- Data is based on **estimates**, not always final numbers.

- Access-A-Ride shows **trips booked**, not trips actually completed.

- No **forecasting or predictions** will be done.

- We won't study outside factors like **economy, weather, or tourism**.

7. Key Performance Indicators (KPIs)

These are the main measures we will use to study the MTA ridership data:

1. **Total Ridership**

   o What it means: How many people use MTA services each day.

   o Formula: Sum of all riders across all modes.

2. **Ridership Recovery %**

   o What it means: How close today's ridership is to pre-COVID levels (2019).

   o Formula: (Current Ridership ÷ 2019 Average) × 100.

3. **Mode Share %**

    o What it means: The share of each service (subway, bus, rail, etc.) out of total ridership.

    o Formula: (Ridership of mode ÷ Total Ridership) × 100.

4. **Weekday vs Weekend Ratio**

    o What it means: How weekdays compare with weekends to see changes in work vs leisure travel.

    o Formula: (Average Weekday Ridership ÷ Average Weekend Ridership).

5. **Friday Effect Gap**

    o What it means: How much lower ridership is on Fridays compared to other weekdays.

    o Formula: ((Tue–Thu Average – Friday) ÷ Tue–Thu Average) × 100.

6. **Traffic Recovery % (Bridges & Tunnels)**

    o What it means: How car traffic compares to pre-COVID levels.

    o Formula: (Current Traffic ÷ 2019 Average) × 100.

7. **Revenue Impact (Optional)**

    o What it means: Link between ridership and fare revenue.

    o Formula: Ridership × Average Fare.

6. Expected Outcomes

- **Recovery trends:** Show how each service bounced back after COVID.
- **New patterns:** Explain weekday vs weekend use, the Friday Effect, and leisure travel.
- **Strong vs weak:** Identify which modes recovered fastest and which are still behind.
- **Better resources:** Give ideas to adjust schedules, staff, and budgets.
- **Money impact:** Link lower ridership to lower revenue, suggest flexible fares.
- **Future planning:** Recommend changes in service, pricing, and investment for the new normal.