**Solution Document and Test Case**

**Test Case: 1**

### **Inputs:**

* **Number of Trucks**: 4
* **Number of Chargers**: 2
* **Total Time**: 5 hours

**Trucks:**

1. Truck 1: ID = 1, Capacity = 100 kWh, Current Charge = 50 kWh
2. Truck 2: ID = 2, Capacity = 120 kWh, Current Charge = 60 kWh
3. Truck 3: ID = 3, Capacity = 80 kWh, Current Charge = 20 kWh
4. Truck 4: ID = 4, Capacity = 90 kWh, Current Charge = 70 kWh

**Chargers:**

1. Charger 1: ID = 1, Rate = 10 kW
2. Charger 2: ID = 2, Rate = 15 kW

### **Steps and Calculations:**

1. **Calculate the remaining charge needed for each truck:**
   * Truck 1: 100 - 50 = 50 kWh
   * Truck 2: 120 - 60 = 60 kWh
   * Truck 3: 80 - 20 = 60 kWh
   * Truck 4: 90 - 70 = 20 kWh
2. **Sort the trucks based on the time needed to fully charge them using the fastest charger (Charger 2 with a rate of 15 kW):**
   * Time required for Truck 4: 20 kWh / 15 kW = 1.33 hours
   * Time required for Truck 1: 50 kWh / 15 kW = 3.33 hours
   * Time required for Truck 2: 60 kWh / 15 kW = 4 hours
   * Time required for Truck 3: 60 kWh / 15 kW = 4 hours
3. The sorted order of trucks: Truck 4, Truck 1, Truck 2, Truck 3.
4. **Assign trucks to chargers, prioritising the ones that can be fully charged within the given total time:**
   * **Charger 2 (Rate = 15 kW)**:
     + Truck 4: Needs 1.33 hours to charge, within the 5 hours available. Remaining time for Charger 2: 5 - 1.33 = 3.67 hours.
     + Truck 1: Needs 3.33 hours to charge, within the 3.67 hours available. The remaining time for Charger 2 is 3.67 - 3.33 = 0.34 hours (not enough to charge any other truck fully).
   * **Charger 1 (Rate = 10 kW)**:
     + No truck assigned as all remaining trucks need more than 5 hours to fully charge with this charger.

Output

2: 4,1

1:

**Test Case 2:**

### **Inputs:**

* **Number of Trucks**: 5
* **Number of Chargers**: 3
* **Total Time**: 10 hours

**Trucks:**

1. Truck 1: ID = 1, Capacity = 100 kWh, Current Charge = 20 kWh
2. Truck 2: ID = 2, Capacity = 120 kWh, Current Charge = 60 kWh
3. Truck 3: ID = 3, Capacity = 80 kWh, Current Charge = 30 kWh
4. Truck 4: ID = 4, Capacity = 90 kWh, Current Charge = 50 kWh
5. Truck 5: ID = 5, Capacity = 110 kWh, Current Charge = 10 kWh

**Chargers:**

1. Charger 1: ID = 1, Rate = 10 kW
2. Charger 2: ID = 2, Rate = 15 kW
3. Charger 3: ID = 3, Rate = 20 kW

### **Calculations and Scheduling:**

1. **Calculate the remaining charge needed for each truck:**
   * Truck 1: 100 - 20 = 80 kWh
   * Truck 2: 120 - 60 = 60 kWh
   * Truck 3: 80 - 30 = 50 kWh
   * Truck 4: 90 - 50 = 40 kWh
   * Truck 5: 110 - 10 = 100 kWh
2. **Sort the trucks based on the time needed to fully charge them using the fastest charger (Charger 3 with a rate of 20 kW):**
   * Time required for Truck 4: 40 kWh / 20 kW = 2 hours
   * Time required for Truck 3: 50 kWh / 20 kW = 2.5 hours
   * Time required for Truck 1: 80 kWh / 20 kW = 4 hours
   * Time required for Truck 2: 60 kWh / 20 kW = 3 hours
   * Time required for Truck 5: 100 kWh / 20 kW = 5 hours
3. The sorted order of trucks: Truck 4, Truck 3, Truck 2, Truck 1, Truck 5.
4. **Assign trucks to chargers, prioritising the ones that can be fully charged within the given total time:**
   * **Charger 3 (Rate = 20 kW)**:
     + Truck 4: Needs 2 hours to charge, within the 10 hours available. Remaining time for Charger 3: 10 - 2 = 8 hours.
     + Truck 3: Needs 2.5 hours to charge, within the 8 hours available. Remaining time for Charger 3: 8 - 2.5 = 5.5 hours.
     + Truck 2: Needs 3 hours to charge, within the 5.5 hours available. Remaining time for Charger 3: 5.5 - 3 = 2.5 hours.
     + Truck 1: Needs 4 hours to charge, but only 2.5 hours are available. So, Truck 1 cannot be fully charged.
   * **Charger 2 (Rate = 15 kW)**:
     + Truck 5: Needs 100 kWh / 15 kW ≈ 6.67 hours to charge, within the 10 hours available. Remaining time for Charger 2: 10 - 6.67 ≈ 3.33 hours.
     + Truck 1: Needs 80 kWh / 15 kW ≈ 5.33 hours to charge, but only 3.33 hours are available. So, Truck 1 cannot be fully charged.
   * **Charger 1 (Rate = 10 kW)**:
     + Truck 1: Needs 80 kWh / 10 kW = 8 hours to charge, within the 10 hours available. Remaining time for Charger 1: 10 - 8 = 2 hours.

### **Output Explanation:**

* **Charger 3**: Assigned Truck 4, Truck 3, and Truck 2, as all can be fully charged within the 10-hour time limit.
* **Charger 2**: Assigned Truck 5, as it can be fully charged within the 10-hour time limit.
* **Charger 1**: Assigned Truck 1, as it can be fully charged within the 10-hour time limit.

### **Final Output:**

1: 1

2: 5

3: 4, 3, 2