High-Level Overview of the Data Structures and Key Steps

This simulation manages **advertising budgets** and **campaign scheduling** for multiple brands, ensuring they adhere to daily and monthly spend limits while considering time-based campaign activation (dayparting).

Data Structures

1. Campaign Class (Represents Individual Advertising Campaigns)

Each **campaign** belongs to a brand and has:

- **ID** (id): Unique identifier for the campaign.
- **Brand ID** (brand_id): Associates the campaign with a brand.
- **Status** (status): Can be ACTIVE, PAUSED, or OFF based on budget and schedule.
- **Spend Tracking** (spend_today, spend_this_month): Tracks campaign-specific spending.
- **Dayparting Hours** (dayparting_hours): A list of **allowed hours** when the campaign can run.

2. Brand Class (Represents Advertisers and Their Budgets)

Each **brand** manages multiple campaigns and has:

- **ID & Name** (id, name): Identifies the brand.
- **Budget Limits** (daily_budget, monthly_budget): Constraints on advertising spend.
- **Spend Tracking** (current_daily_spend, current_monthly_spend): Monitors budget consumption.
- **Campaign List** (campaigns): Stores all campaigns under the brand.
- **Budget Reset Tracking** (last_reset_day, last_reset_month): Keeps track of when budgets were last reset.

Key Steps in Managing Budgets and Campaigns

1 Handling Ad Spend Distribution

- The spend(amount) method **distributes** ad spend across **active** campaigns.
- Checks whether the **daily or monthly budget is exceeded**.
- Allocates spend proportionally across campaigns.
- **Turns off campaigns** if spending would exceed the daily limit.

2 Campaign Activation & Dayparting

- Each campaign has **allowed hours** (dayparting_hours).
- The update_status(current_hour) method **activates or pauses** campaigns based on the current hour.
- If the campaign is outside of allowed hours, it is **paused**.

3 Budget Exhaustion Handling

- If the **monthly budget** is **exceeded**, all campaigns under the brand are **turned off** (OFF).
- If the **daily budget** is **exceeded**, all campaigns are **turned off** (OFF) for the rest of the day.
- Once a campaign is turned off due to budget limits, it will **not reactivate** until the budget resets.

4 Daily and Monthly Budget Resets

- The check_budget_reset() method resets **daily budgets at midnight** and **monthly budgets on the 1st of the month**.
- Calls reset_daily_budget() and reset_monthly_budget() to **restore** campaigns based on dayparting schedules.
- Resets spend counters to allow new ad spend.

5 Periodic Simulation Loop

- Runs every **10 seconds** (instead of an hourly cycle).
- Calls spend(amount) to **simulate ad spending**.
- Calls check_and_update_campaigns() to **update campaign statuses**.
- Calls check_budget_reset() to **reset budgets if needed**.

This system **efficiently manages advertising budgets**, **controls ad spend allocation**, and **automatically resets budgets** while ensuring campaigns run only during allowed time slots.