**PROBLEM**:

A company rents out furniture and space resources with specific start_date and stop_date for each item. Each item has a rate and quantity. Some items are used for partial months or overlap across different months.

- We need to generate a monthly invoice that:
- Includes only items active during the target month.
- Prorates the amount if used for partial duration in the month.
- Groups similar items (by item_code, rate, and billing period).
- Returns a total bill for the month.

**INPUT:**

1. item_list (list of dicts)
   Each dictionary represents a billing item

```
In [ ]: [
    {
        "idx": 1,
        "item_code": "Executive Desk (4*2)",
        "sales_description": "Dedicated Executive Desk",
        "qty": 10,
        "rate": "1000",
        "amount": "10000",
        "start_date": "2023-11-01",
        "stop_date": "2024-10-17",
    },
    ...
]
```

2. target_month (str)
   "2024-11"  # Format: "YYYY-MM"

**DESIRED OUTPUT:**

A dictionary containing:

- line_items: grouped, prorated line items with item_code, rate, qty, amount, billing_period
- total_revenue: sum of all prorated amounts

```
In [ ]: {
    "line_items": [
        {
            "item_code": "Executive Desk (4*2)",
            "rate": 1080.0,
            "qty": 25,
            "amount": 27000.0,
            "billing_period": "2024-11-01 to 2024-11-30"
        },
        ...
    ],
    "total_revenue": 107960.0
}
```

CODE LOGIC:

1. Parse target month and calculate month_start and month_end.

2.  For each item:

- Parse start_date and stop_date.

- Check if the item is active in the target month.

- If yes:

    ▪ Find overlap (active_start to active_end).

    ▪ Calculate prorated amount using formula:

        ✓ amount = (rate × qty) × (active_days / days_in_month)

    ▪ Generate billing_period string.

    ▪ Group items using (item_code, rate, billing_period) key.

    ▪ Aggregate qty and amount.

3.  Round amounts to 2 decimal places.

4.  Return list of grouped line items and total revenue.

**VARIABLES USED:**

| Variable | Purpose |
|---|---|
| month_start | First date of target month |
| month_end | Last date of target month |
| days_in_month | Total number of days in target month |
| active_start | Start date of usage within the target month |
| active_end | End date of usage within the target month |
| active_days | Number of days the item was active |
| amount | Prorated cost of the item |
| grouped_items | Dict used to group similar items |

**CRUCIAL PART OF THE CODE:**

**[1]** Overlap calculation:

active_start = max(start_date, month_start)

active_end = min(stop_date, month_end)

Ensures only active days within the month are billed.

[2] Proration logic:

amount = (rate * qty) * (active_days / days_in_month)

Handles both full and partial usage billing accurately.

**[3]** Grouping logic:

key = (item_code, rate, billing_period)

if key not in grouped_items:

grouped_items[key] = {"item_code": item_code, "rate": rate, "qty": 0, "amount": 0.0, "billing_period": billing_period}

grouped_items[key]["qty"] += qty

grouped_items[key]["amount"] += amount

Avoids duplicate line items and aggregates values efficiently

**FINAL OUTPUT:**

Given the sample `item_list` and `target_month = "2024-11"`, the function returns:

```
In [3]: result = generate_monthly_bill(item_list, "2024-11")
        print(result)

{'line_items': [{'item_code': 'Executive Desk (4*2)', 'rate': 1080.0, 'qty': 25, 'amount': 27000.0, 'billing_period': '2024-11-
01 to 2024-11-30'}, {'item_code': 'Executive Desk (4*2)', 'rate': 1000.0, 'qty': 5, 'amount': 5000.0, 'billing_period': '2024-1
1-01 to 2024-11-30'}, {'item_code': 'Manager Cabin', 'rate': 5000.0, 'qty': 5, 'amount': 25000.0, 'billing_period': '2024-11-01
to 2024-11-30'}, {'item_code': 'Parking (2S)', 'rate': 1000.0, 'qty': 10, 'amount': 10000.0, 'billing_period': '2024-11-01 to 2
024-11-30'}, {'item_code': 'Parking (2S)', 'rate': 0.0, 'qty': 10, 'amount': 0.0, 'billing_period': '2024-11-01 to 2024-11-3
0'}, {'item_code': 'Executive Desk (4*2)', 'rate': 1100.0, 'qty': 8, 'amount': 4693.33, 'billing_period': '2024-11-15 to 2024-1
1-30'}, {'item_code': 'Manager Cabin', 'rate': 5200.0, 'qty': 3, 'amount': 5200.0, 'billing_period': '2024-11-01 to 2024-11-1
0'}, {'item_code': 'Conference Table', 'rate': 20000.0, 'qty': 1, 'amount': 10666.67, 'billing_period': '2024-11-05 to 2024-11-
20'}, {'item_code': 'Parking (2S)', 'rate': 1000.0, 'qty': 5, 'amount': 2666.67, 'billing_period': '2024-11-15 to 2024-11-30'},
{'item_code': 'Reception Desk', 'rate': 7000.0, 'qty': 2, 'amount': 14000.0, 'billing_period': '2024-11-01 to 2024-11-30'}, {'i
tem_code': 'Reception Desk', 'rate': 7000.0, 'qty': 1, 'amount': 3733.33, 'billing_period': '2024-11-10 to 2024-11-25'}], 'tota
l_revenue': 107960.0}
```

The generate_monthly_bill function is designed to process a list of billed items for a specific month and generate a clean, structured invoice. It accurately determines which items are active in the selected month, calculates the prorated billing amounts based on active days, and groups line items by item_code, rate, and the billing period.

**Key Features:**
1. Filters only those items that are active during the target month.
2. Handles inconsistent data types for quantity, rate, and amount.
3. Groups similar items to avoid redundancy in billing.
4. Performs precise prorated billing for partial-month usage.
5. Outputs a well-structured dictionary with detailed line items and the final billing summary.

**Total Revenue Generated:**
The function computes the total revenue for the selected month based on grouped and prorated values.

**Total Revenue for 2024-11: ₹107,960.00**

This function is well-suited for billing systems involving subscriptions, equipment rentals, or workspace leasing, where date-based proration and clean aggregation are essential.