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**1. Introduction**

* **Objective:** Analyze user data (deposits, withdrawals, gameplay) to calculate loyalty points, rank players, allocate bonuses, and derive insights. Summarize findings and suggest improvements to the loyalty formula.

**2. Data Overview**

* **Datasets:**
  + **User Gameplay Data:** Contains User ID, Datetime, Games Played.
  + **Deposit Data:** Contains User Id, Datetime, Amount.
  + **Withdrawal Data:** Contains User Id, Datetime, Amount.
* **Initial Cleaning:**
  + Converted Datetime columns to datetime type and dropped invalid entries.

**3. Methodology**

* **Slot Assignment:**
  + Defined two time slots:
    - S1: 12:00:00 – 23:59:59
    - S2: 00:00:00 – 11:59:59
  + Assigned each transaction to a slot based on its time.
* **Loyalty Point Calculation:**
  + **Deposits:** 0.01 × deposit amount.
  + **Withdrawals:** 0.005 × withdrawal amount.
  + **Net Deposit Count Difference:** 0.001 × max(num\_deposits − num\_withdrawals, 0).
  + **Games Played:** 0.2 × total games played by user.
* **Aggregation:**
  + Summed points per user per slot for deposits and withdrawals.
  + Added games-played points.
  + Calculated overall loyalty points as the sum of all components.
  + Ranked users descending by overall loyalty points.

**4. Key Metrics & Descriptive Statistics**

* **Descriptive Stats of Overall Loyalty Points:**
  + Mean, median, min, max, quartiles.
  + Interpretation: e.g., average loyalty point, spread, skewness if max >> median.
* **Average Metrics:**
  + Average deposit amount across all transactions.
  + Average games played per user.
* **User Distribution:**
  + Total number of unique users and distribution across loyalty points tiers.

**5. Slot-Specific Analysis**

* **Predefined Dates & Slots:**
  + For dates 2022-10-02 S1, 2022-10-16 S2, 2022-10-18 S1, 2022-10-26 S2:
    - Filter gameplay on those dates and slots; compute games-played points per user.
  + **Findings:** List which users were most active in each slot, their points, any patterns.

**6. Top Players & Bonus Allocation**

* **Top 10 Users by Loyalty Points:**
  + Table listing User ID, Overall Loyalty Points, Rank.
  + Visualization: Bar chart.
* **Top 50 Bonus Distribution:**
  + Bonus pool: ₹50,000.
  + Distribute proportionally to overall loyalty points for top 50 users.
  + Table: User ID, Points, Rank, Bonus Amount.
  + Interpretation: e.g., top user receives X%, bottom in top 50 receives Y%.

**7. Correlation Analysis**

* **Deposit vs. Loyalty Points:**
  + Scatter plot: total deposit amount vs. loyalty points.
  + Insight: correlation strength; do high depositors always rank highest?
* **Games Played vs. Loyalty Points:**
  + Scatter plot: total games played vs. loyalty points.
  + Insight: how gameplay contributes relative to deposit behavior.
* **Withdrawal Impact:**
  + Optionally analyze withdrawal amounts vs. net points.
* **Interpretation:**
  + E.g., “Loyalty points correlate strongly with deposit sum (r ≈ 0.8), moderately with games played (r ≈ 0.5), indicating deposit-heavy users tend to lead, but active gamers also gain significant points.”

**8. Visualization Summary**

* Embed the histogram of overall loyalty points, bar charts, scatter plots.
* Highlight any notable skewness or outliers.

**9. Conclusions**

* **General Findings:**
  + E.g., majority of users cluster at lower loyalty points; a small fraction achieves very high scores.
  + Deposit behavior drives most points; gameplay also contributes but to a lesser extent.
* **Business Implications:**
  + If the goal is increased engagement, consider boosting weight of gameplay or adding quality metrics.
  + If too few users reach high tiers, consider onboarding boosts to encourage early activity.

**10. Recommendations for Loyalty Formula**

* Summarize the robustness suggestions:
  + Nonlinear scaling/caps, point decay, tiered/onboarding bonuses, quality engagement metrics, feedback & A/B testing, transparency, fraud controls, periodic review.
* Tailor recommendations based on observed distributions: e.g., if deposit dominance is extreme, emphasize diminishing returns or higher gameplay weight.

**11. Next Steps**

* **Implement Adjustments:** Pilot new weight configurations for a subset of users.
* **Monitor Impact:** Track changes in engagement, deposit frequency, retention.
* **Iterate:** Refine based on data and player feedback.

**12. Appendices**

* **Code Snippets:** Include key code sections for data processing, point calculations, and visualizations.
* **Data Definitions:** Clarify column meanings, slot logic, formula weights.