### Clustering Analysis Report

#### Executive Summary

This report presents the findings from the k-means clustering analysis conducted on hotel booking data. The analysis identified three distinct guest segments, each with unique characteristics. The report includes detailed profiles of each cluster, visualizations, and actionable recommendations for marketing and operational strategies.

K-Means Clustering Methodology

K-means clustering is a popular unsupervised machine learning algorithm used for partitioning a dataset into distinct, non-overlapping groups or clusters. Each data point belongs to the cluster with the nearest mean, serving as a prototype of the cluster. Here's a brief overview of the methodology:

1.Initialization: Choose the number of clusters k and randomly initialize the centroids (mean points) for each cluster.

2.Assignment: Assign each data point to the nearest centroid, forming k clusters.

3.Update: Recalculate the centroids as the mean of all data points assigned to each cluster.

4.Iterate: Repeat the assignment and update steps until the centroids no longer change significantly or a maximum number of iterations is reached.

Number of Clusters Identified

For this analysis, we used the k-means clustering algorithm with different values of K, the final cluster k is 3.

### Cluster Profiles

#### Cluster 0: Budget-Conscious, Loyal Guests

* **Size**: 110,742 guests
* **Characteristics**:
  + **Lead Time**: 104.89 days (average)
  + **ADR**: 97.36 (average)
  + **Total Stay**: 3.39 nights (average)
  + **Total Special Requests**: 0.55 (average)
  + **Adults**: 1.85 (average)
  + **Children**: 0.001 (average)
  + **Is Repeated Guest**: 3.37%
  + **Previous Cancellations**: 6.46%
  + **Previous Bookings Not Canceled**: 14.67%
  + **Booking Changes**: 21.09%
  + **Days in Waiting List**: 2.49 days (average)

#### Cluster 1: High-Risk Speculative Bookings

* **Size**: 145 guests
* **Characteristics**:
  + **Lead Time**: 229.70 days (average)
  + **ADR**: 58.15 (average)
  + **Total Stay**: 3.87 nights (average)
  + **Total Special Requests**: 0.00 (average)
  + **Adults**: 2.00 (average)
  + **Children**: 0.000 (average)
  + **Is Repeated Guest**: 8.97%
  + **Previous Cancellations**: 21.98%
  + **Previous Bookings Not Canceled**: 7.59%
  + **Booking Changes**: 0.69%
  + **Days in Waiting List**: 2.35 days (average)

#### Cluster 2: High-Spending, Complex Needs Guests

* **Size**: 8,491 guests
* **Characteristics**:
  + **Lead Time**: 90.02 days (average)
  + **ADR**: 160.48 (average)
  + **Total Stay**: 3.94 nights (average)
  + **Total Special Requests**: 0.87 (average)
  + **Adults**: 1.96 (average)
  + **Children**: 1.447 (average)
  + **Is Repeated Guest**: 0.81%
  + **Previous Cancellations**: 0.67%
  + **Previous Bookings Not Canceled**: 1.25%
  + **Booking Changes**: 35.89%
  + **Days in Waiting List**: 0.10 days (average)

### Recommendations

**Cluster 0: Budget-Conscious, Loyal Guests**

**Marketing Strategy:**

1. **Focus on Loyalty Programs and Offer Discounts for Repeated Bookings:**
   * **Example**: Introduce a tiered loyalty program where guests earn points for each stay. Points can be redeemed for discounts, free nights, or special perks like free breakfast or late check-out.
   * **Challenges**: Ensuring the program is attractive enough to retain guests while maintaining profitability. Tracking and managing points efficiently.
2. **Create Personalized Offers to Retain These Guests:**
   * **Example**: Use past booking data to send personalized emails with exclusive offers, such as a special discount on their favorite room type or complimentary services like airport transfers.
   * **Challenges**: Maintaining data privacy and security, ensuring personalized offers are truly relevant and valued by the guests.
3. **Highlight Value-for-Money Deals and Consistent Quality of Service:**
   * **Example**: Promote packages that bundle services at a discount, such as weekend getaways with included meals and activities. Emphasize customer reviews and testimonials that highlight consistent quality.
   * **Challenges**: Competing with online travel agencies that also offer bundled deals. Ensuring that the perceived value matches the actual guest experience.

**Operational Strategy:**

1. **Ensure Consistent Quality to Maintain Loyalty and Satisfaction:**
   * **Example**: Implement standard operating procedures (SOPs) for all guest-facing services to ensure a uniform experience. Conduct regular training sessions for staff on service quality.
   * **Challenges**: Maintaining consistency across different locations and shifts. Ensuring all staff adhere to SOPs.
2. **Optimize Operations to Cater to Budget-Conscious Travelers, Ensuring Essential Amenities are Provided:**
   * **Example**: Offer essential amenities like free Wi-Fi, complimentary breakfast, and convenient check-in/check-out processes. Optimize room cleaning and maintenance schedules to reduce costs without compromising quality.
   * **Challenges**: Balancing cost-cutting measures with maintaining quality. Handling peak times efficiently without reducing service levels.

#### Cluster 1: High-Risk Speculative Bookings

**Marketing Strategy:**

1. **Implement Stricter Cancellation Policies or Require Non-Refundable Deposits:**
   * **Example**: Introduce a tiered cancellation policy where guests receive partial refunds based on the timing of the cancellation (e.g., 50% refund if canceled within 7 days of booking).
   * **Challenges**: Potential guest dissatisfaction with stricter policies. Communicating policy changes clearly to avoid disputes.
2. **Encourage Commitment Through Special Offers that Incentivize Keeping Bookings:**
   * **Example**: Offer discounts or perks (e.g., free breakfast, room upgrades) for bookings that are kept without modifications or cancellations.
   * **Challenges**: Balancing incentives to ensure they are attractive yet financially viable. Monitoring and managing these offers effectively.
3. **Consider Marketing Strategies that Reduce Speculative Booking Behavior:**
   * **Example**: Use targeted advertising to reach guests who have a history of reliable bookings. Offer flexible booking options with lower discounts for those who might need to change plans.
   * **Challenges**: Identifying and reaching the right audience. Managing the financial impact of offering more flexible options.

**Operational Strategy:**

1. **Closely Monitor and Manage Booking Cancellations to Minimize Revenue Loss:**
   * **Example**: Use predictive analytics to identify high-risk bookings and proactively manage these by offering incentives to keep the booking or by double-booking rooms with low cancellation risk.
   * **Challenges**: Accurate prediction of cancellations. Handling the logistics of managing overbooked situations.
2. **Implement Systems to Quickly Rebook Canceled Slots to Maximize Occupancy:**
   * **Example**: Use real-time inventory management systems to immediately make canceled rooms available to other potential guests. Partner with last-minute booking platforms.
   * **Challenges**: Ensuring systems are robust and integrated with all sales channels. Managing guest expectations and experiences for last-minute bookings.

#### Cluster 2: High-Spending, Complex Needs Guests

**Marketing Strategy:**

1. **Offer Premium Services, Personalized Packages, and Special Requests Handling:**
   * **Example**: Provide concierge services that offer personalized itineraries, exclusive access to events, and custom dining experiences. Create packages that cater to special occasions like anniversaries or business conferences.
   * **Challenges**: Ensuring the delivery of high-quality personalized services. Managing the cost of providing premium services.
2. **Focus on Upselling and Cross-Selling Higher-End Amenities:**
   * **Example**: Train staff to identify opportunities to upsell room upgrades, spa services, or exclusive dining options. Use CRM data to recommend services based on past preferences.
   * **Challenges**: Avoiding the perception of being too pushy. Ensuring that upselling efforts enhance rather than detract from the guest experience.
3. **Create Targeted Marketing Campaigns that Highlight Luxury Experiences and Family-Friendly Options:**
   * **Example**: Use targeted digital marketing campaigns that showcase luxury experiences, such as private tours, gourmet dining, and high-end wellness retreats. Highlight family-friendly amenities like kids’ clubs and family suites.
   * **Challenges**: Identifying and reaching the right audience segments. Measuring the effectiveness of targeted campaigns.

**Operational Strategy:**

1. **Ensure High-Quality, Responsive Service to Meet Complex Needs and Enhance Guest Satisfaction:**
   * **Example**: Implement a guest satisfaction tracking system that collects real-time feedback and allows staff to respond quickly to issues. Offer personalized check-in experiences.
   * **Challenges**: Training staff to handle complex needs efficiently. Maintaining high service levels during peak times.
2. **Train Staff to Handle Special Requests Efficiently and Provide Personalized Attention to this Segment:**
   * **Example**: Conduct specialized training programs for staff on handling VIP guests and managing special requests. Use technology to track and fulfill special requests seamlessly.
   * **Challenges**: Keeping staff motivated and well-trained. Balancing personalized attention with overall operational efficiency.

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