**Multivariate Techniques**

**December 2023 Examination**

**Q1: Carry out Multiple linear Regressions for the following case. (10 Marks)**

**Sawari Rajdan operates a candle production company situated in Gulalwadi, Mumbai. She is actively promoting her products through social media platforms, crafting engaging reels featuring a variety of candles accompanied by trendy music. In her pursuit to enhance her business strategy, she is in search of a model that can forecast her product sales based on the quantity of likes and comments garnered by her Instagram reels. She has also extended her content to YouTube Shorts, believing that the number of likes and comments on these videos might influence sales as well. To aid in this endeavor, Sawari has carefully compiled data specific to each reel, with each reel showcasing a different type of candle. The scale of likes and comments mentioned below.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **REEL**  **Number** | **Sales (in  000' INR)** | **Likes on  Instagram**  **REELs** | **Comments**  **on Instagram  REELs** | **Likes on  YouTube**  **Shorts** | **Comments**  **on YouTube  Shorts** |
| **REEL\_1** | **10** | **298** | **108** | **266** | **111** |
| **REEL\_2** | **10** | **112** | **108** | **113** | **125** |
| **REEL\_3** | **11** | **234** | **117** | **117** | **133** |
| **REEL\_4** | **12** | **137** | **103** | **143** | **120** |
| **REEL\_5** | **17** | **165** | **136** | **274** | **119** |
| **REEL\_6** | **17** | **300** | **116** | **114** | **118** |
| **REEL\_7** | **17** | **121** | **104** | **181** | **108** |
| **REEL\_8** | **18** | **208** | **105** | **296** | **144** |
| **REEL\_9** | **19** | **281** | **108** | **171** | **101** |
| **REEL\_10** | **21** | **244** | **108** | **119** | **121** |
| **REEL\_11** | **21** | **417** | **343** | **506** | **225** |
| **REEL\_12** | **24** | **766** | **350** | **936** | **178** |
| **REEL\_13** | **27** | **687** | **287** | **660** | **231** |
| **REEL\_14** | **27** | **783** | **332** | **825** | **294** |
| **REEL\_15** | **29** | **514** | **266** | **932** | **237** |
| **REEL\_16** | **29** | **554** | **308** | **649** | **271** |
| **REEL\_17** | **30** | **472** | **342** | **791** | **168** |
| **REEL\_18** | **30** | **632** | **209** | **505** | **151** |
| **REEL\_19** | **38** | **948** | **290** | **525** | **310** |
| **REEL\_20** | **40** | **710** | **198** | **799** | **175** |
| **REEL\_21** | **40** | **895** | **208** | **697** | **181** |
| **REEL\_22** | **40** | **982** | **349** | **497** | **227** |

* **Write the regression model.**
* **Interpret the Regression statistics Table**
* **Interpret the ANOVA Table**

**Discuss the bo and b1, b2,b3,and b4 (discuss significant one only**

**Ans:**

The regression model for Sawari Rajdan's candle income is based on the likes and comments garnered via her Instagram and YouTube Shorts videos. We can use multiple linear regression. This model will have four independent variables: Likes on Instagram Reels, comments on Instagram Reels, Likes on YouTube Shorts, and comments on YouTube Shorts. The dependent variable is sales (in 000's INR). The regression equation can be written as:

**Sales = b0 + b1(Likes on Instagram Reels) + b2(Comments on Instagram Reels) + b3(Likes on YouTube Shorts) + b4(Comments on YouTube Shorts)**

Where:

Sales: The predicted sales (dependent variable).

b0: The intercept (constant) term.

b1, b2, b3, and b4: The coefficients related to the independent variables.

Likes on Instagram Reels: The number of likes on Instagram reels.

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**Q2: Run the Discriminant Analysis in the following case. (10 Marks)**

**Sharmila Kaul, an entrepreneur based in Mumbai, heads a company named "Bhartiya Khanna." She has developed a line of nutritious meal products consisting of ten different options for both morning and evening consumption. These products are focused solely on their nutritional value. Sharmila has incorporated a variety of healthful ingredients, including millets, into the product formulations.**

**Over the past year, she received numerous comments about her products not aligning well with traditional Indian cuisine in terms of taste. In response, she made the decision to carry out a brief survey within her workplace's vicinity. Following product demonstrations and trials, she gathered input from random individuals in the neighbourhood.**

**The respondents sampled and comprehended the products before providing their feedback. The feedback required customers to indicate their preferences and concerns on a scale of 1 to 9, where higher numbers reflected a stronger liking. The resulting data is presented below. Can this information be used to distinguish potential purchasing intent? (Set the prior probabilities are equal for each group)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Craving** | **Nutrition/**  **micronutrition** | **Fat** | **Protein**  **intake** |
| **Will buy the product** | **9** | **6** | **7** | **8** |
| **Will buy the product** | **9** | **9** | **8** | **8** |
| **Will buy the product** | **7** | **7** | **6** | **7** |
| **Will buy the product** | **6** | **8** | **9** | **7** |
| **Will buy the product** | **9** | **6** | **6** | **7** |
| **Won't Buy the Product** | **4** | **2** | **1** | **2** |
| **Won't Buy the Product** | **1** | **4** | **2** | **2** |
| **Won't Buy the Product** | **2** | **2** | **3** | **4** |
| **Won't Buy the Product** | **2** | **1** | **2** | **2** |
| **Won't Buy the Product** | **3** | **1** | **2** | **2** |
| **Won't Buy the Product** | **1** | **2** | **1** | **1** |
| **Won't Buy the Product** | **4** | **4** | **3** | **4** |

**Wilks Lambda table and its interpretation**

**Centroid table and its interpretation**

**Conclusion about model with justification (include group wise mean and classification matrix in your writing)**

**Ans:**

**Introduction to Discriminate Analysis**

A discriminate analysis is a statistical technique categorizing observations or individuals into predefined classes based on their traits or capabilities. It is typically utilized in device learning and statistics to determine which attributes or variables contribute the most to group separation. The goal is to locate the high-quality discriminating features that distinguish different groups.

In the case of Sharmila Kaul, an entrepreneur strolling "Bhartiya Khanna" in Mumbai, Discriminant analysis can offer treasured insights into client preferences and ability

**Q3: Cluster Analysis Case**

**Ruchika Taploo, an entrepreneur is looking for some insights for her beauty product that can fit to dry skincare routine; she has formulated a whole product with some herbal ingredients. The product designed with some ecofriendly packaging material. After spending a whole economic year with the same product into market, now she is looking from consumers by keeping the focus on product features. She is thinking for redesigning her products aligned with customer’s need. She has gathered the few attributes related to her product as well as tried to capture customers’ liking on a scale of 1 to 9 (1=strong dislike…9=strong like).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Fragrance** | **Price** | **Packaging** | **Texture** | **Long**  **lasting**  **effect** |
| **Rahila Kaul** | **2** | **5** | **3** | **5** | **2** |
| **Rashmi**  **Taploo** | **5** | **2** | **1** | **1** | **5** |
| **Sima Kikoo** | **4** | **5** | **4** | **4** | **5** |
| **Rima**  **Razdan** | **1** | **3** | **2** | **5** | **4** |
| **Sarika**  **Saproo** | **5** | **3** | **1** | **5** | **1** |
| **Rima Kikkoo** | **9** | **5** | **9** | **4** | **7** |
| **Keshav Butt** | **5** | **8** | **6** | **8** | **7** |
| **Kruna**  **Saproo** | **4** | **9** | **6** | **4** | **5** |
| **Sameer**  **Bhatt** | **8** | **7** | **5** | **4** | **6** |

**Part A: Discuss how many clusters are advisable to form using the results of Hierarchical cluster analysis**

**Ans:**

**Enhancing Beauty Product Design through Consumer-Centric Clustering Analysis**

**Introduction:**

In the dynamic realm of the beauty industry, understanding consumer preferences is a critical factor that drives product innovation and success. Entrepreneurs like Ruchika Taploo recognize the pivotal function of aligning their beauty products with their target market's beauty needs and goals. In this case, Ruchika Taploo, an entrepreneur in the beauty product industry, seeks to decorate her existing beauty product tailored for dry skincare exercises.

**Part B: Discuss the K-means Clusters significance with ANOVA considering suggestion form part A, also wrote memberships and labels of clusters. (5 Marks) –**

**Ans:**

**Introduction**

In this situation study, we study the scenario of Ruchika Taploo, an entrepreneur in the beauty product enterprise. Ruchika has evolved a splendor product crafted with herbal ingredients, aiming to cater to people with dry skin. Furthermore, she has emphasized using eco-friendly packaging for her product, aligning with sustainable practices.

After a year of having her product in the market, Ruchika is keen to gain insights into customer options regarding the product functions. Knowing the importance of customer remarks and evolving market demands, she is considering a product redesign to better align