Selected files

1 printable files

customer_analysis.ipynb

customer_analysis.ipynb


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    "- Identifying customer segments and their chip purchasing behaviour \n",
    "- Consider what metrics would help describe the customers’ purchasing behaviour.  "
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    "customer_data = pd.read_csv('../Quantium Project/QVI_purchase_behaviour.csv')"
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      " 3   TXN_ID          264836 non-null  int64  \n",
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    "\n",
    "# Convert the integer date (assuming it's days since 30 Dec 1899) to actual dates\n",
    "transaction_data[\"DATE\"] = pd.to_datetime(transaction_data[\"DATE\"], origin=\"1899-12-30\", unit=\"D\", errors=\"coerce\")\n",
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      "Kettle Tortilla ChpsHny&Jlpno Chili 150g    3296\n",
      "Cobs Popd Swt/Chlli &Sr/Cream Chips 110g    3269\n",
      "Tyrrells Crisps     Ched & Chives 165g      3268\n",
      "Cobs Popd Sea Salt  Chips 110g              3265\n",
      "Kettle 135g Swt Pot Sea Salt                3257\n",
      "Tostitos Splash Of  Lime 175g               3252\n",
      "Infuzions Thai SweetChili PotatoMix 110g    3242\n",
      "Smiths Crnkle Chip  Orgnl Big Bag 380g      3233\n",
      "Thins Potato Chips  Hot & Spicy 175g        3229\n",
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    "\"\n",
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    "unique_count = transaction_data[\"PROD_NAME\"].nunique()\n",
    "print(f\"\\nNumber of unique product names: {unique_count}\")\n",
    "\"\n",
    "# Top 10 most frequent product names\n",
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25102), ('doritos', 24962), ('crinkle', 23960), ('110g', 22387), ('corn', 22063), ('original', 21560), ('cut', 20754), ('chip', 18645), ('170g',
('chicken', 15407)]\n",
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      "2     Smiths Crinkle Cut  Chips Chicken 170g\n",
      "3     Smiths Chip Thinly  S/Cream&Onion 175g\n",
      "4   Kettle Tortilla ChpsHny&Jlpno Chili 150g\n",
      "5   Old El Paso Salsa   Dip Tomato Mild 300g\n",
      "6   Smiths Crinkle Chips Salt & Vinegar 330g\n",
      "7      Grain Waves         Sweet Chilli 210g\n",
      "8    Doritos Corn Chip Mexican Jalapeno 150g\n",
      "9      Grain Waves Sour    Cream&Chives 210G\n",
      "10  Smiths Crinkle Chips Salt & Vinegar 330g\n",
      "11     Kettle Sensations   Siracha Lime 150g\n",
      "12                 Twisties Cheese     270g\n",
      "13          WW Crinkle Cut      Chicken 175g\n",
      "14            Thins Chips Light&  Tangy 175g\n",
      "15                         CCs Original 175g\n",
      "16                         Burger Rings 220g\n",
      "17    NCC Sour Cream &    Garden Chives 175g\n",
      "18   Doritos Corn Chip Southern Chicken 150g\n",
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    "import pandas as pd\n",
    "from collections import Counter\n",
    "import re\n",
    "\n",
    "# Ensure column exists\n",
    "if \"PROD_NAME\" in transaction_data.columns:\n",
    "    # Convert all product names to lowercase and split into words\n",
    "    all_words = transaction_data[\"PROD_NAME\"].str.lower().str.split()\n",
    "\n",
    "    # Flatten list of lists into a single list of words\n",
    "    words = [word for sublist in all_words.dropna() for word in sublist]\n",
    "\n",
    "    # Count frequency of words\n",
    "    word_counts = Counter(words)\n",
    "\n",
    "    # Display the most common words\n",
    "    print(\"Top 20 most common words in product names:\")\n",
    "    print(word_counts.most_common(20))\n",
    "\n",
    "    # Identify words that may indicate non-chip products\n",
    "    common_chip_words = {\"chips\", \"potato\", \"crisps\", \"salted\", \"bbq\", \"cheese\", \"flavor\"}\n",
    "    uncommon_words = [word for word, count in word_counts.items() if word not in common_chip_words]\n",
    "\n",
    "    print(\"\\nPotentially incorrect product words (may not be chips):\")\n",
    "    print(uncommon_words[:20])  # Display top 20 unusual words\n",
    "\n",
    "    # Filter rows with suspicious words\n",
    "    transaction_data[\"is_suspicious\"] = transaction_data[\"PROD_NAME\"].apply(lambda x: any(word in x.lower() for word in uncommon_words)
    suspicious_products = transaction_data[transaction_data[\"is_suspicious\"]]\n",
    "\n",
    "    print(\"\\nSuspicious product names (potential non-chips):\")\n",
    "    print(suspicious_products[[\"PROD_NAME\"]].head(20))  # Show first 20 suspicious products\n",
    "else:\n",
    "    print(\"Column 'PROD_NAME' not found in the dataset. Check column names:\", transaction_data.columns)\n"
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     "0          g     251231\n",
     "1      chips      49770\n",
     "2     kettle      41288\n",
     "3     smiths      28860\n",
     "4       salt      27976\n",
     "5     cheese      27890\n",
     "6   pringles      25102\n",
     "7    doritos      24962\n",
     "8    crinkle      23960\n",
     "9       corn      22063\n",
     "10  original      21560\n",
     "11       cut      20754\n",
     "12      chip      18645\n",
     "13     salsa      18094\n",
     "14   chicken      15407\n",
     "15       sea      14145\n",
     "16     thins      14075\n",
     "17    chilli      13895\n",
     "18      sour      13882\n",
     "19    crisps      12607\n"
    ]
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  "source": [
   "\n",
   "# Ensure column exists\n",
   "if \"PROD_NAME\" in transaction_data.columns:  \n",
   "  # Convert all product names to lowercase\n",
   "   transaction_data[\"cleaned_name\"] = transaction_data[\"PROD_NAME\"].str.lower()\n",
   "\n",
   "    # Remove digits and special characters (keep only letters and spaces)\n",
   "   transaction_data[\"cleaned_name\"] = transaction_data[\"cleaned_name\"].apply(lambda x: re.sub(r\"[^a-z\\s]\", \"\", x))\n",
   "\n",
   "    # Tokenize words (split into individual words)\n",
   "   all_words = transaction_data[\"cleaned_name\"].str.split()\n",
   "\n",
   "    # Flatten list of lists into a single list of words\n",
   "   words = [word for sublist in all_words.dropna() for word in sublist]\n",
   "\n",
   "    # Count word frequency\n",
   "   word_counts = Counter(words)\n",
   "\n",
   "    # Sort words by frequency (highest to lowest)\n",
   "   sorted_words = sorted(word_counts.items(), key=lambda x: x[1], reverse=True)\n",
   "\n",
   "    # Convert to DataFrame for better viewing\n",
   "   word_freq_df = pd.DataFrame(sorted_words, columns=[\"Word\", \"Frequency\"])\n",
   "\n",
   "   print(\"Top 20 most common words in product names:\")\n",
   "   print(word_freq_df.head(20))\n",
   "\n",
   "else:\n",
   "     print(\"Column 'PROD_NAME' not found in the dataset. Check column names:\", transaction_data.columns)"
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     "        DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  \\\n",
     "0 2018-10-17          1            1000       1         5   \n",
     "1 2019-05-14          1            1307     348        66   \n",
     "2 2019-05-20          1            1343     383        61   \n",
     "3 2018-08-17          2            2373     974        69   \n",
     "4 2018-08-18          2            2426    1038       108   \n",
     "\n",
```

```
      "                              PROD_NAME  PROD_QTY  TOT_SALES  \\n",
      "0    Natural Chip        Compny SeaSalt175g         2        6.0   \n",
      "1                  CCs Nacho Cheese    175g         3        6.3   \n",
      "2    Smiths Crinkle Cut  Chips Chicken 170g         2        2.9   \n",
      "3    Smiths Chip Thinly  S/Cream&Onion 175g         5       15.0   \n",
      "4  Kettle Tortilla ChpsHny&Jlpno Chili 150g         3       13.8   \n",
      "\n",
      "   is_suspicious                         cleaned_name  \n",
      "0           True   natural chip        compny seasaltg  \n",
      "1           True                ccs nacho cheese    g  \n",
      "2           True   smiths crinkle cut  chips chicken g  \n",
      "3           True     smiths chip thinly  screamonion g  \n",
      "4           True  kettle tortilla chpshnyjlpno chili g  \n",
      "Number of products removed: 18094\n"
     ]
    }
   ],
   "source": [
    "# Remove rows where PROD_NAME contains 'salsa' (case-insensitive)\n",
    "transaction_data_filtered = transaction_data[~transaction_data[\"PROD_NAME\"].str.contains(\"salsa\", case=False, na=False)]\n",
    "\n",
    "# Display the first few rows of the filtered dataset\n",
    "print(transaction_data_filtered.head())\n",
    "\n",
    "# Check how many rows were removed\n",
    "print(f\"Number of products removed: {transaction_data.shape[0] - transaction_data_filtered.shape[0]}\")\n"
   ]
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      "                                DATE      STORE_NBR  LYLTY_CARD_NBR  \\\n",
      "count                         246742  246742.000000    2.467420e+05   \n",
      "mean   2018-12-30 01:19:01.211467520     135.051098    1.355310e+05   \n",
      "min              2018-07-01 00:00:00       1.000000    1.000000e+03   \n",
      "25%              2018-09-30 00:00:00      70.000000    7.001500e+04   \n",
      "50%              2018-12-30 00:00:00     130.000000    1.303670e+05   \n",
      "75%              2019-03-31 00:00:00     203.000000    2.030840e+05   \n",
      "max              2019-06-30 00:00:00     272.000000    2.373711e+06   \n",
      "std                              NaN      76.787096    8.071528e+04   \n",
      "\n",
      "             TXN_ID       PROD_NBR       PROD_QTY      TOT_SALES  \n",
      "count  2.467420e+05  246742.000000  246742.000000  246742.000000  \n",
      "mean   1.351311e+05      56.351789       1.908062       7.321322  \n",
      "min    1.000000e+00       1.000000       1.000000       1.700000  \n",
      "25%    6.756925e+04      26.000000       2.000000       5.800000  \n",
      "50%    1.351830e+05      53.000000       2.000000       7.400000  \n",
      "75%    2.026538e+05      87.000000       2.000000       8.800000  \n",
      "max    2.415841e+06     114.000000     200.000000     650.000000  \n",
      "std    7.814772e+04      33.695428       0.659831       3.077828  \n"
     ]
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    "print(transaction_data_filtered.describe())  # Summary statistics for numerical columns\n"
   ]
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      "            DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  \\\n",
      "69762 2018-08-19        226          226000  226201         4   \n",
      "69763 2019-05-20        226          226000  226210         4   \n",
      "\n",
```

```
      "                              PROD_NAME  PROD_QTY  TOT_SALES  is_suspicious  \\n",
      "69762  Dorito Corn Chp     Supreme 380g       200      650.0           True   \n",
      "69763  Dorito Corn Chp     Supreme 380g       200      650.0           True   \n",
      "\n",
      "                        cleaned_name  \n",
      "69762  dorito corn chp     supreme g  \n",
      "69763  dorito corn chp     supreme g  \n"
     ]
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      "C:\\Users\\ayivo\\AppData\\Local\\Temp\\ipykernel_19852\\1696929440.py:2: UserWarning: Boolean Series key will be reindexed to match DataI
      "  outlier_transactions = transaction_data_filtered[transaction_data[\"PROD_QTY\"] == 200]\n"
     ]
    }
   ],
   "source": [
    "# Filtering transactions with 200 packets\n",
    "outlier_transactions = transaction_data_filtered[transaction_data[\"PROD_QTY\"] == 200]\n",
    "print(outlier_transactions)\n"
   ]
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      "STORE_NBR  DATE        LYLTY_CARD_NBR\n",
      "226        2018-08-19  226000            1\n",
      "           2019-05-20  226000            1\n",
      "dtype: int64\n"
     ]
    }
   ],
   "source": [
    "# Check for any patterns in the outlier transactions \n",
    "print(outlier_transactions.groupby([\"STORE_NBR\", \"DATE\", \"LYLTY_CARD_NBR\"]).size())\n"
   ]
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      "Outlier Customer ID: 226000\n",
      "        DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  \\n",
      "0 2018-10-17          1            1000       1         5   \n",
      "1 2019-05-14          1            1307     348        66   \n",
      "2 2019-05-20          1            1343     383        61   \n",
      "3 2018-08-17          2            2373     974        69   \n",
      "4 2018-08-18          2            2426    1038       108   \n",
      "\n",
      "                                PROD_NAME  PROD_QTY  TOT_SALES  \\n",
      "0    Natural Chip        Compny SeaSalt175g         2        6.0   \n",
      "1                  CCs Nacho Cheese    175g         3        6.3   \n",
      "2    Smiths Crinkle Cut  Chips Chicken 170g         2        2.9   \n",
      "3    Smiths Chip Thinly  S/Cream&Onion 175g         5       15.0   \n",
      "4  Kettle Tortilla ChpsHny&Jlpno Chili 150g         3       13.8   \n",
      "\n",
      "   is_suspicious                          cleaned_name  \n",
      "0           True   natural chip        compny seasaltg  \n",
      "1           True                ccs nacho cheese    g  \n",
      "2           True   smiths crinkle cut  chips chicken g  \n",
      "3           True     smiths chip thinly  screamonion g  \n",
      "4           True  kettle tortilla chpshnyjlpno chili g  \n"
     ]
```

```
    },
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      "C:\\Users\\ayivo\\AppData\\Local\\Temp\\ipykernel_19852\\2588693242.py:10: UserWarning: Boolean Series key will be reindexed to match Data
      "  filtered_data = transaction_data_filtered[transaction_data[\"LYLTY_CARD_NBR\"] != outlier_customer]\n"
     ]
    }
   ],
   "source": [
    "# It looks like this customer has only had the two transactions over the year and is \n",
    "#not an ordinary retail customer. The customer might be buying chips for commercial \n",
    "#purposes instead. We'll remove this loyalty card number from further analysis.\n",
    "\n",
    "# Filter out the customer based on the loyalty card number \n",
    "outlier_customer = outlier_transactions[\"LYLTY_CARD_NBR\"].iloc[0]\n",
    "print(\"Outlier Customer ID:\", outlier_customer)\n",
    "\n",
    "# Create a new dataset excluding the outlier customer\n",
    "filtered_data = transaction_data_filtered[transaction_data[\"LYLTY_CARD_NBR\"] != outlier_customer]\n",
    "\n",
    "# Display first few rows to verify\n",
    "print(filtered_data.head())\n"
   ]
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      "Empty DataFrame\n",
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      "Index: []\n"
     ]
    }
   ],
   "source": [
    "# To confirm the removal of the outlier transactions\n",
    "print(filtered_data[filtered_data[\"LYLTY_CARD_NBR\"] == outlier_customer])\n"
   ]
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      "Data columns (total 10 columns):\n",
      " #   Column          Non-Null Count   Dtype         \n",
      "---  ------          --------------   -----         \n",
      " 0   DATE            246740 non-null  datetime64[ns]\n",
      " 1   STORE_NBR       246740 non-null  int64         \n",
      " 2   LYLTY_CARD_NBR  246740 non-null  int64         \n",
      " 3   TXN_ID          246740 non-null  int64         \n",
      " 4   PROD_NBR        246740 non-null  int64         \n",
      " 5   PROD_NAME       246740 non-null  object        \n",
      " 6   PROD_QTY        246740 non-null  int64         \n",
      " 7   TOT_SALES       246740 non-null  float64       \n",
      " 8   is_suspicious   246740 non-null  bool          \n",
      " 9   cleaned_name    246740 non-null  object        \n",
      "dtypes: bool(1), datetime64[ns](1), float64(1), int64(5), object(2)\n",
      "memory usage: 19.1+ MB\n",
      "None\n"
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```

```
   "source": [
    "\n",
    "# Verify the columns have been removed\n",
    "print(filtered_data.info())\n"
   ]
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      "        DATE  Transaction_Count\n",
      "0 2018-07-01                663\n",
      "1 2018-07-02                650\n",
      "2 2018-07-03                674\n",
      "3 2018-07-04                669\n",
      "4 2018-07-05                660\n",
      "<class 'pandas.core.frame.DataFrame'>\n",
      "RangeIndex: 364 entries, 0 to 363\n",
      "Data columns (total 2 columns):\n",
      " #   Column             Non-Null Count  Dtype         \n",
      "---  ------             --------------  -----         \n",
      " 0   DATE               364 non-null    datetime64[ns]\n",
      " 1   Transaction_Count  364 non-null    int64         \n",
      "dtypes: datetime64[ns](1), int64(1)\n",
      "memory usage: 5.8 KB\n",
      "None\n"
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   ],
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    "# Count the number of transactions per date\n",
    "transaction_summary = filtered_data.groupby(\"DATE\")[\"TXN_ID\"].count().reset_index()\n",
    "\n",
    "# Rename the column for clarity\n",
    "transaction_summary.rename(columns={\"TXN_ID\": \"Transaction_Count\"}, inplace=True)\n",
    "\n",
    "# Display the first few rows\n",
    "print(transaction_summary.head())\n",
    "print(transaction_summary.info())\n"
   ]
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      "1 2018-07-02\n",
      "2 2018-07-03\n",
      "3 2018-07-04\n",
      "4 2018-07-05\n",
      "        DATE  transaction_count\n",
      "0 2018-07-01                663\n",
      "1 2018-07-02                650\n",
      "2 2018-07-03                674\n",
      "3 2018-07-04                669\n",
      "4 2018-07-05                660\n",
      "        DATE  transaction_count\n",
      "0 2018-07-01              663.0\n",
      "1 2018-07-02              650.0\n",
      "2 2018-07-03              674.0\n",
      "3 2018-07-04              669.0\n",
      "4 2018-07-05              660.0\n",
      "Missing Date(s):\n",
      "          DATE  transaction_count\n",
      "177 2018-12-25                0.0\n"
```

```
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assignment using an inplace method.\n",
      "The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which we are setting value
      "\n",
      "For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or df[col] = df[col].met
operation inplace on the original object.\n",
      "\n",
      "\n",
      "  transactions_full[\"transaction_count\"].fillna(0, inplace=True)\n"
     ]
    }
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    "\n",
    "# Generate a full date sequence\n",
    "full_date_range = pd.DataFrame({\"DATE\": pd.date_range(start=\"2018-07-01\", end=\"2019-06-30\")})\n",
    "\n",
    "# Display the first few rows\n",
    "print(full_date_range.head())\n",
    "\n",
    "# Count the number of transactions per date\n",
    "transactions_by_date = filtered_data.groupby(\"DATE\")[\"TXN_ID\"].count().reset_index()\n",
    "\n",
    "# Rename the column for clarity\n",
    "transactions_by_date.rename(columns={\"TXN_ID\": \"transaction_count\"}, inplace=True)\n",
    "\n",
    "# Display the first few rows\n",
    "print(transactions_by_date.head())\n",
    "\n",
    "# Merge full date range with actual transaction data\n",
    "transactions_full = full_date_range.merge(transactions_by_date, on=\"DATE\", how=\"left\")\n",
    "\n",
    "# Fill missing transaction counts with 0\n",
    "transactions_full[\"transaction_count\"].fillna(0, inplace=True)\n",
    "\n",
    "# Display the first few rows to verify\n",
    "print(transactions_full.head())\n",
    "\n",
    "# Check for missing dates (where transaction_count = 0)\n",
    "missing_dates = transactions_full[transactions_full[\"transaction_count\"] == 0]\n",
    "print(\"Missing Date(s):\")\n",
    "print(missing_dates)\n"
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    "- This could be as a result of store being closed because it was a Christmas day \n",
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    "- Moving forward I recommend that stores be opened on the 25th of Decemeber in order not lose money in peak periods"
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      "2    Smiths Crinkle Cut  Chips Chicken 170g        170\n",
      "3    Smiths Chip Thinly  S/Cream&Onion 175g        175\n",
      "4  Kettle Tortilla ChpsHny&Jlpno Chili 150g        150\n",
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      "See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
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    "    match = re.search(r'(\\d+)', PROD_NAME)  # Find the first number in the string\n",
    "    return int(match.group(0)) if match else None  # Convert to integer\n",
    "\n",
    "# Apply function to create a new column\n",
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    "import seaborn as sns  \n",
    "\n",
    "plt.figure(figsize=(10, 5))\n",
    "sns.histplot(filtered_data[\"PACK_SIZE\"], bins=15, kde=True)\n",
    "plt.xlabel(\"Pack Size (g)\")\n",
    "plt.ylabel(\"Frequency\")\n",
    "plt.title(\"Distribution of Pack Sizes\")\n",
    "plt.show()\n"
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      "0    Natural Chip        Compny SeaSalt175g  Natural\n",
      "1                  CCs Nacho Cheese    175g      CCs\n",
      "2    Smiths Crinkle Cut  Chips Chicken 170g   Smiths\n",
      "3    Smiths Chip Thinly  S/Cream&Onion 175g   Smiths\n",
      "4  Kettle Tortilla ChpsHny&Jlpno Chili 150g   Kettle\n"
     ]
    },
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      "\n",
      "See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
      "  filtered_data[\"BRAND\"] = filtered_data[\"PROD_NAME\"].str.split().str[0]\n"
     ]
    }
   ],
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    "# Creating a new feature called the Brand, this is to help clearly identify which chip brand sells more and viceversa \n",
    "\n",
    "# Extract the brand name (first word of PROD_NAME)\n",
    "filtered_data[\"BRAND\"] = filtered_data[\"PROD_NAME\"].str.split().str[0]\n",
    "\n",
    "# Display the first few rows to verify\n",
    "print(filtered_data[[\"PROD_NAME\", \"BRAND\"]].head())\n"
   ]
  },
  {
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     "1                  CCs Nacho Cheese    175g       CCs\n",
     "2     Smiths Crinkle Cut  Chips Chicken 170g    Smiths\n",
     "3     Smiths Chip Thinly  S/Cream&Onion 175g    Smiths\n",
     "4   Kettle Tortilla ChpsHny&Jlpno Chili 150g    Kettle\n",
     "6   Smiths Crinkle Chips Salt & Vinegar 330g    Smiths\n",
     "7      Grain Waves         Sweet Chilli 210g     Grain\n",
     "8    Doritos Corn Chip Mexican Jalapeno 150g   Doritos\n",
     "9      Grain Waves Sour    Cream&Chives 210G     Grain\n",
     "10  Smiths Crinkle Chips Salt & Vinegar 330g    Smiths\n",
     "11     Kettle Sensations   Siracha Lime 150g    Kettle\n",
     "12                 Twisties Cheese     270g  Twisties\n",
     "13          WW Crinkle Cut      Chicken 175g       WW\n",
     "14            Thins Chips Light&  Tangy 175g     Thins\n",
     "15                         CCs Original 175g       CCs\n",
     "16                         Burger Rings 220g    Burger\n",
     "17    NCC Sour Cream &    Garden Chives 175g   Natural\n",
     "18   Doritos Corn Chip Southern Chicken 150g   Doritos\n",
     "19                 Cheezels Cheese Box 125g  Cheezels\n",
     "20         Smiths Crinkle      Original 330g    Smiths\n"
    ]
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     "\n",
     "See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy\n",
     "  filtered_data[\"BRAND\"] = filtered_data[\"BRAND\"].replace(brand_mapping)\n"
    ]
   }
  ],
  "source": [
   "# Dictionary to map variations to standardized brand names\n",
   "brand_mapping = {\n",
   "    \"RED\": \"Red Rock Deli\",\n",
   "    \"RRD\": \"Red Rock Deli\",\n",
   "    \"NCC\": \"Natural\",\n",
   "    \"KTL\": \"Kettle\",\n",
   "    \"SMITHS\": \"Smiths\",\n",
   "    \"CCs\": \"CCs\",\n",
   "    \"Doritos\": \"Doritos\",\n",
   "    \"Thins\": \"Thins\"\n",
   "}\n",
   "\n",
   "# Apply mapping to the BRAND column\n",
   "filtered_data[\"BRAND\"] = filtered_data[\"BRAND\"].replace(brand_mapping)\n",
   "\n",
   "# Display cleaned brand names\n",
   "print(filtered_data[[\"PROD_NAME\", \"BRAND\"]].head(20))\n"
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     "                                PROD_NAME                 BRAND\n",
     "0     Natural Chip        Compny SeaSalt175g  Natural Chip Company\n",
     "1                  CCs Nacho Cheese    175g                 CC’s\n",
```

```
      "2     Smiths Crinkle Cut  Chips Chicken 170g               Smiths\n",
      "3     Smiths Chip Thinly  S/Cream&Onion 175g               Smiths\n",
      "4   Kettle Tortilla ChpsHny&Jlpno Chili 150g               Kettle\n",
      "6   Smiths Crinkle Chips Salt & Vinegar 330g               Smiths\n",
      "7      Grain Waves         Sweet Chilli 210g           Grain Waves\n",
      "8    Doritos Corn Chip Mexican Jalapeno 150g              Doritos\n",
      "9      Grain Waves Sour    Cream&Chives 210G           Grain Waves\n",
      "10  Smiths Crinkle Chips Salt & Vinegar 330g               Smiths\n",
      "11     Kettle Sensations   Siracha Lime 150g               Kettle\n",
      "12                 Twisties Cheese     270g             Twisties\n",
      "13          WW Crinkle Cut      Chicken 175g                   WW\n",
      "14            Thins Chips Light&  Tangy 175g                Thins\n",
      "15                         CCs Original 175g                 CC’s\n",
      "16                         Burger Rings 220g               Burger\n",
      "17    NCC Sour Cream &    Garden Chives 175g  Natural Chip Company\n",
      "18   Doritos Corn Chip Southern Chicken 150g              Doritos\n",
      "19                 Cheezels Cheese Box 125g             Cheezels\n",
      "20         Smiths Crinkle      Original 330g               Smiths\n"
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      "See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy\n",
      "  filtered_data[\"BRAND\"] = filtered_data[\"BRAND\"].replace(brand_mapping)\n"
     ]
    }
   ],
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    " # Define a mapping for inconsistent brand names\n",
    "brand_mapping = {\n",
    "    \"NCC\": \"Natural Chip Company\",\n",
    "    \"Natural\": \"Natural Chip Company\",\n",
    "    \"RRD\": \"Red Rock Deli\",\n",
    "    \"Grain\": \"Grain Waves\",\n",
    "    \"CCs\": \"CC’s\",  # Ensure proper formatting\n",
    "}\n",
    "\n",
    "# Apply the mapping\n",
    "filtered_data[\"BRAND\"] = filtered_data[\"BRAND\"].replace(brand_mapping)\n",
    "\n",
    "# Display the cleaned brand names\n",
    "print(filtered_data[[\"PROD_NAME\", \"BRAND\"]].head(20))\n"
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      "0            1000   YOUNG SINGLES/COUPLES          Premium\n",
      "1            1002   YOUNG SINGLES/COUPLES       Mainstream\n",
      "2            1003          YOUNG FAMILIES           Budget\n",
      "3            1004   OLDER SINGLES/COUPLES       Mainstream\n",
      "4            1005  MIDAGE SINGLES/COUPLES       Mainstream\n",
      "<class 'pandas.core.frame.DataFrame'>\n",
      "RangeIndex: 72637 entries, 0 to 72636\n",
      "Data columns (total 3 columns):\n",
      " #   Column            Non-Null Count  Dtype \n",
      "---  ------            --------------  ----- \n",
      " 0   LYLTY_CARD_NBR    72637 non-null  int64 \n",
      " 1   LIFESTAGE         72637 non-null  object\n",
      " 2   PREMIUM_CUSTOMER  72637 non-null  object\n",
      "dtypes: int64(1), object(2)\n",
      "memory usage: 1.7+ MB\n",
      "None\n"
```

```
     ]
    }
   ],
   "source": [
    "# Permorming exploratory data analysis on the customer_data\n",
    "#printing the first 5 rows\n",
    "print(customer_data.head())\n",
    "#printing the datatypes and number of entries\n",
    "print(customer_data.info())"
   ]
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      "mean     1.361859e+05\n",
      "std      8.989293e+04\n",
      "min      1.000000e+03\n",
      "25%      6.620200e+04\n",
      "50%      1.340400e+05\n",
      "75%      2.033750e+05\n",
      "max      2.373711e+06\n",
      "       LIFESTAGE PREMIUM_CUSTOMER\n",
      "count      72637            72637\n",
      "unique         7                3\n",
      "top     RETIREES       Mainstream\n",
      "freq       14805            29245\n"
     ]
    }
   ],
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    "# Get summary of numerical columns\n",
    "print(customer_data.describe())\n",
    "\n",
    "# Check categorical columns\n",
    "print(customer_data.describe(include=\"object\"))\n"
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    "- Retirees have the highest purchase count. This could be as a result of lesser responsibilities and hence can afford to buy potato chip mor
    "- Mainstream customers have the highest purchase count. They are middle incomers and their purchase matches the packet sizes they buy."
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      "2 2019-05-20          1            1343     383        61   \n",
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      "2    Smiths Crinkle Cut  Chips Chicken 170g         2        2.9   \n",
      "3    Smiths Chip Thinly  S/Cream&Onion 175g         5       15.0   \n",
      "4  Kettle Tortilla ChpsHny&Jlpno Chili 150g         3       13.8   \n",
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    "print(merged_data.info())  # Check data types and null values\n",
    "print(merged_data.head())  # Preview first few rows\n",
    "\n",
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    "1. Customer Segmentation & Demographics\n",
    "- Lifestage: Identify whether the customers are young singles, families, retirees, etc.\n",
    "- Premium Customer Status: Understand whether customers are budget-conscious or premium shoppers.\n",
    "- Store Preferences: Identify where different customer segments shop the most.\n",
    "\n",
    "2. Purchasing Behavior\n",
    "- Total Sales per Customer Segment: Compare spending across different customer groups(who spends the most on chip purchase).\n",
    "- How many customers are in each segment?\n",
    "- How many chips are bought per customer by segment?\n",
    "- What's the average chip price by customer segment?\n",
    "- Transaction Frequency: How often does each customer segment purchase chips?\n",
    "- Brand Preferences: Identify the most popular chip brands among different customer groups.\n",
    "- Pack Size Preferences: Find out which pack sizes are most commonly purchased.\n",
    "\n",
    "3. Sales Trends & Seasonality\n",
    "- Monthly/Seasonal Sales Trends: Identify peak purchasing periods (e.g., do sales spike during holidays?).\n",
    "- Weekend vs. Weekday Sales: Do customers buy more on specific days of the week?\n",
    "\n",
    "4. Customer Loyalty\n",
    "- Repeat Purchase Rate: How many customers are returning to buy chips regularly?\n",
    "- Churn Rate: Are there segments that buy once and never return?"
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    "\n",
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    "customers_by_segment.rename(columns={\"LYLTY_CARD_NBR\": \"NUM_CUSTOMERS\"}, inplace=True)\n",
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    "# Calculate sales per customer\n",
    "segment_analysis[\"SALES_PER_CUSTOMER\"] = segment_analysis[\"TOT_SALES\"] / segment_analysis[\"NUM_CUSTOMERS\"]\n",
    "\n",
    "# Sort by highest sales per customer\n",
    "segment_analysis = segment_analysis.sort_values(\"SALES_PER_CUSTOMER\", ascending=False)\n",
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    "    num_customers=(\"LYLTY_CARD_NBR\", \"nunique\")\n",
    ").reset_index()\n",
    "\n",
    "# Calculate the average units per customer\n",
    "units_per_customer[\"AVG_UNITS_PER_CUSTOMER\"] = units_per_customer[\"total_units\"] / units_per_customer[\"num_customers\"]\n",
    "\n",
    "# Sort by highest average units per customer\n",
    "units_per_customer = units_per_customer.sort_values(\"AVG_UNITS_PER_CUSTOMER\", ascending=False)\n",
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    "# Display results\n",
    "print(units_per_customer)\n"
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2091 "import matplotlib.pyplot as plt\n",
2092 "import seaborn as sns\n",
2093 "\n",
2094 "# Calculate the average price per unit\n",
2095 "avg_price_per_unit = (\n",
2096 " merged_data.groupby([\"LIFESTAGE\", \"PREMIUM_CUSTOMER\"])[\"TOT_SALES\"]\n",
2097 " .sum()\n",
2098 " / merged_data.groupby([\"LIFESTAGE\", \"PREMIUM_CUSTOMER\"])[\"PROD_QTY\"]\n",
2099 " .sum()\n",
2100 ").reset_index()\n",
2101 "\n",
2102 "avg_price_per_unit.columns = [\"LIFESTAGE\", \"PREMIUM_CUSTOMER\", \"AVG_PRICE_PER_UNIT\"]\n",
2103 "\n",
2104 "# Sort by average price per unit in descending order\n",
2105 "avg_price_per_unit = avg_price_per_unit.sort_values(by=\"AVG_PRICE_PER_UNIT\", ascending=False)\n",
2106 "\n",
2107 "# Create a new column for labels\n",
2108 "avg_price_per_unit[\"SEGMENT\"] = avg_price_per_unit[\"LIFESTAGE\"] + \" - \" + avg_price_per_unit[\"PREMIUM_CUSTOMER\"]\n",

```
    "\n",
    "# Plot the sorted results\n",
    "plt.figure(figsize=(12, 6))\n",
    "sns.barplot(\n",
    "    data=avg_price_per_unit,\n",
    "    x=\"AVG_PRICE_PER_UNIT\",\n",
    "    y=\"SEGMENT\",\n",
    "    hue=\"SEGMENT\",  # Assigning hue to match the y variable\n",
    "    dodge=False,     # Ensures single bars per category\n",
    "    legend=False,    # Avoids duplicate legend\n",
    "    palette=\"coolwarm\",\n",
    ")\n",
    "\n",
    "plt.xlabel(\"Average Price Per Unit ($)\")\n",
    "plt.ylabel(\"Customer Segment\")\n",
    "plt.title(\"Average Price Per Unit by Lifestage and Premium Customer Status \")\n",
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also supported by there being fewer premium midage and young singles and couples buying chips compared to their mainstream counterparts"
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      "There is a significant difference in price per unit between Mainstream and Premium customers.\n",
      "There is NO significant difference in price per unit between Midage Budget customers and Young Singles/Couples.\n"
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    "# To check if the difference in average price per unit is statistically significant, we will perform an independent t-test between: Mainstre
    "# Budget Midage vs. Young Singles & Couples\n",
    "from scipy.stats import ttest_ind\n",
    "\n",
    "# Extract the per-unit price data for each group\n",
    "mainstream_prices = merged_data.loc[merged_data[\"PREMIUM_CUSTOMER\"] == \"Mainstream\", \"TOT_SALES\"] / merged_data.loc[merged_data[\"PRE
\"Mainstream\", \"PROD_QTY\"]\n",
    "premium_prices = merged_data.loc[merged_data[\"PREMIUM_CUSTOMER\"] == \"Premium\", \"TOT_SALES\"] / merged_data.loc[merged_data[\"PREMIUM_CU
\"PROD_QTY\"]\n",
    "\n",
    "midage_budget_prices = merged_data.loc[(merged_data[\"LIFESTAGE\"] == \"Midage Singles/Couples\") & (merged_data[\"PREMIUM_CUSTOMER\"] == \'
merged_data.loc[(merged_data[\"LIFESTAGE\"] == \"Midage Singles/Couples\") & (merged_data[\"PREMIUM_CUSTOMER\"] == \"Budget\"), \"PROD_QTY\"]\n"
    "\n",
    "young_singles_prices = merged_data.loc[(merged_data[\"LIFESTAGE\"] == \"Young Singles/Couples\"), \"TOT_SALES\"] / merged_data.loc[(merged_d
Singles/Couples\"), \"PROD_QTY\"]\n",
    "\n",
    "# Perform independent t-tests\n",
    "t_stat_mainstream_premium, p_value_mainstream_premium = ttest_ind(mainstream_prices.dropna(), premium_prices.dropna(), equal_var=False)\n",
    "t_stat_midage_young, p_value_midage_young = ttest_ind(midage_budget_prices.dropna(), young_singles_prices.dropna(), equal_var=False)\n",
    "\n",
    "# Print results\n",
    "print(f\"T-test (Mainstream vs Premium Customers): t-stat = {t_stat_mainstream_premium:.3f}, p-value = {p_value_mainstream_premium:.3f}\")\
```

```
    "print(f\"T-test (Midage Budget vs Young Singles/Couples): t-stat = {t_stat_midage_young:.3f}, p-value = {p_value_midage_young:.3f}\")\n",
    "\n",
    "# Interpretation\n",
    "alpha = 0.05  # Significance level\n",
    "\n",
    "if p_value_mainstream_premium < alpha:\n",
    "    print(\"There is a significant difference in price per unit between Mainstream and Premium customers.\")\n",
    "else:\n",
    "    print(\"There is NO significant difference in price per unit between Mainstream and Premium customers.\")\n",
    "\n",
    "if p_value_midage_young < alpha:\n",
    "    print(\"There is a significant difference in price per unit between Midage Budget customers and Young Singles/Couples.\")\n",
    "else:\n",
    "    print(\"There is NO significant difference in price per unit between Midage Budget customers and Young Singles/Couples.\")\n"
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      "3          Smiths   1790\n",
      "4           Thins   1166\n",
      "5        Infuzions    962\n",
      "6        Twisties    900\n",
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      "8            Cobs    864\n",
      "9   Red Rock Deli    639\n"
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    "# To analyze the brand preferences of Mainstream - Young Singles/Couples\n",
    "# Filter data for Mainstream - Young Singles/Couples\n",
    "target_segment = merged_data[\n",
    "    (merged_data[\"LIFESTAGE\"] == \"YOUNG SINGLES/COUPLES\") &\n",
    "    (merged_data[\"PREMIUM_CUSTOMER\"] == \"Mainstream\")\n",
    "]\n",
    "# Count purchases per brand\n",
    "brand_counts = target_segment[\"BRAND\"].value_counts().reset_index()\n",
    "brand_counts.columns = [\"BRAND\", \"COUNT\"]\n",
    "\n",
    "# Display top brands\n",
    "print(brand_counts.head(10))\n"
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    "merged_data[\"Customer_Type\"] = merged_data.apply(\n",
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    "    (x[\"LIFESTAGE\"] == \"YOUNG SINGLES/COUPLES\") & \n",
    "    (x[\"PREMIUM_CUSTOMER\"] == \"Mainstream\") \n",
    "    else \"Other\", \n",
    "    axis=1\n",
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    "\n",
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    "plt.figure(figsize=(10, 6))\n",
    "sns.boxplot(data=merged_data, x=\"Customer_Type\", y=\"PACK_SIZE\", hue=None, palette=\"viridis\")\n",
    "\n",
    "\n",
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    "plt.title(\"Comparison of Pack Size Preference: Young Singles/Couples vs Others\")\n",
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