AI & ML-Mostafa Elfaggal-Task1

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0.1 Full Repo

https://github.com/MostafaBelo/Konecta_Assignments/tree/main

0.2 Imports

[1]:
```python
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
```

[2]:
```python
# Prints all unique items per column as well as how many different unique items␣
 ↪are there
def print_uniques(df):
    for key in df:
        uq_items = df[key].unique()
        if (len(uq_items) > 20):
            print(f"{key} - {len(uq_items)}\t|\tMany Items")
        else:
            print(f"{key} - {len(uq_items)}\t|\t{uq_items}")

# Counts how many empty values are there per column
def count_empty(df):
    return ((df == "ERROR") | (df == "UNKNOWN") | (df.isnull()) | (df ==␣
 ↪"unknown") | (df == "error")).sum()
```

0.3 1) Initial Exploration

[3]:
```python
df = pd.read_csv("dirty_cafe_sales.csv")
```

[4]:
```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 8 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   Transaction ID    10000 non-null  object
 1   Item              9667 non-null   object
 2   Quantity          9862 non-null   object
 3   Price Per Unit    9821 non-null   object
 4   Total Spent       9827 non-null   object
 5   Payment Method    7421 non-null   object
 6   Location          6735 non-null   object
 7   Transaction Date  9841 non-null   object
dtypes: object(8)
memory usage: 625.1+ KB
```

[5]:
```
df.describe()
```

[5]:
```
       Transaction ID   Item Quantity Price Per Unit Total Spent  \
count           10000   9667     9862           9821        9827
unique          10000     10        7              8          19
top       TXN_1961373  Juice        5            3.0         6.0
freq                1   1171     2013           2429         979

        Payment Method  Location Transaction Date
count             7421      6735             9841
unique               5         4              367
top     Digital Wallet  Takeaway          UNKNOWN
freq              2291      3022              159
```

[6]:
```
df.head()
```

[6]:
```
  Transaction ID    Item Quantity Price Per Unit Total Spent  Payment Method  \
0    TXN_1961373  Coffee        2            2.0         4.0     Credit Card
1    TXN_4977031    Cake        4            3.0        12.0            Cash
2    TXN_4271903  Cookie        4            1.0       ERROR     Credit Card
3    TXN_7034554   Salad        2            5.0        10.0         UNKNOWN
4    TXN_3160411  Coffee        2            2.0         4.0  Digital Wallet

   Location Transaction Date
0  Takeaway       2023-09-08
1  In-store       2023-05-16
2  In-store       2023-07-19
3   UNKNOWN       2023-04-27
4  In-store       2023-06-11
```

[7]:
```
df.isnull().sum()
```

[7]:
```
Transaction ID         0
Item                 333
Quantity             138
Price Per Unit       179
Total Spent          173
Payment Method      2579
Location            3265
Transaction Date     159
```

```
dtype: int64
```

[8]:
```
print_uniques(df)
```

```
Transaction ID - 10000  |       Many Items
Item - 11       |       ['Coffee' 'Cake' 'Cookie' 'Salad' 'Smoothie' 'UNKNOWN'
'Sandwich' nan
 'ERROR' 'Juice' 'Tea']
Quantity - 8    |       ['2' '4' '5' '3' '1' 'ERROR' 'UNKNOWN' nan]
Price Per Unit - 9      |       ['2.0' '3.0' '1.0' '5.0' '4.0' '1.5' nan 'ERROR'
'UNKNOWN']
Total Spent - 20        |       ['4.0' '12.0' 'ERROR' '10.0' '20.0' '9.0' '16.0'
'15.0' '25.0' '8.0' '5.0'
 '3.0' '6.0' nan 'UNKNOWN' '2.0' '1.0' '7.5' '4.5' '1.5']
Payment Method - 6      |       ['Credit Card' 'Cash' 'UNKNOWN' 'Digital Wallet'
'ERROR' nan]
Location - 5    |       ['Takeaway' 'In-store' 'UNKNOWN' nan 'ERROR']
Transaction Date - 368  |       Many Items
```

[9]:
```
count_empty(df)
```

[9]:
```
Transaction ID         0
Item                 969
Quantity             479
Price Per Unit       533
Total Spent          502
Payment Method      3178
Location            3961
Transaction Date     460
dtype: int64
```

0.4 2) Handle Missing or Placeholder Entries

[10]:
```
df2 = df.copy()

df2[df2 == "ERROR"] = np.nan
df2[df2 == "UNKNOWN"] = np.nan
df2[df2.isnull()] = np.nan

print_uniques(df2)
```

```
Transaction ID - 10000  |       Many Items
Item - 9        |       ['Coffee' 'Cake' 'Cookie' 'Salad' 'Smoothie' nan
'Sandwich' 'Juice' 'Tea']
Quantity - 6    |       ['2' '4' '5' '3' '1' nan]
Price Per Unit - 7      |       ['2.0' '3.0' '1.0' '5.0' '4.0' '1.5' nan]
Total Spent - 18        |       ['4.0' '12.0' nan '10.0' '20.0' '9.0' '16.0'
'15.0' '25.0' '8.0' '5.0'
```

```
 '3.0' '6.0' '2.0' '1.0' '7.5' '4.5' '1.5']
Payment Method - 4      |       ['Credit Card' 'Cash' nan 'Digital Wallet']
Location - 3    |       ['Takeaway' 'In-store' nan]
Transaction Date - 366  |       Many Items
```

0.5 3) Impute Logical Relationships

[11]:
```
df2["Quantity"] = df2["Quantity"].astype("Int32")
df2["Price Per Unit"] = df2["Price Per Unit"].astype("Float32")
df2["Total Spent"] = df2["Total Spent"].astype("Float32")

df2 = df2.convert_dtypes()

df2.loc[df2["Total Spent"].isnull(), "Total Spent"] = df2["Quantity"] *␣
 ↪df2["Price Per Unit"]
df2.loc[df2["Quantity"].isnull(), "Quantity"] = df2["Total Spent"] / df2["Price␣
 ↪Per Unit"]
df2.loc[df2["Price Per Unit"].isnull(), "Price Per Unit"] = df2["Total Spent"] /
 ↪ df2["Quantity"]

df3 = df2.dropna(subset=["Total Spent", "Quantity", "Price Per Unit"]).copy()

count_empty(df2), len(df2), len(df3)
```

[11]:
```
(Transaction ID        0
 Item                969
 Quantity             38
 Price Per Unit       38
 Total Spent          40
 Payment Method     3178
 Location           3961
 Transaction Date    460
 dtype: Int64,
 10000,
 9942)
```

0.6 4) Normalize Date Column

[12]:
```
# Step 1: Convert to datetime, coerce errors (invalid formats → NaT)
df3["Transaction Date"] = pd.to_datetime(df3["Transaction Date"],␣
 ↪errors="coerce")

# Step 2: Sort by Transaction Date
df3.sort_values("Transaction Date", inplace=True)

# Step 3: Fill missing dates using forward-fill, then backward-fill (for␣
 ↪leading NaNs)
```

```
df3["Transaction Date"] = df3["Transaction Date"].ffill().bfill()

df3.dtypes
```

[12]:
```
Transaction ID      string[python]
Item                string[python]
Quantity                     Int32
Price Per Unit             Float32
Total Spent                Float32
Payment Method      string[python]
Location            string[python]
Transaction Date    datetime64[ns]
dtype: object
```

0.7 5) Standardize Categorical Columns

[13]:
```
df3.dtypes
```

[13]:
```
Transaction ID      string[python]
Item                string[python]
Quantity                     Int32
Price Per Unit             Float32
Total Spent                Float32
Payment Method      string[python]
Location            string[python]
Transaction Date    datetime64[ns]
dtype: object
```

[14]:
```
df3["Item"] = df3["Item"].str.lower()
df3["Payment Method"] = df3["Payment Method"].str.lower()
df3["Location"] = df3["Location"].str.lower()

df3["Item"] = df3["Item"].str.strip()
df3["Payment Method"] = df3["Payment Method"].str.strip()
df3["Location"] = df3["Location"].str.strip()

df3.loc[df3["Item"].isnull(), "Item"] = "unknown"
df3.loc[df3["Payment Method"] == "digital wallet", "Payment Method"] = "card"
df3.loc[df3["Payment Method"] == "credit card", "Payment Method"] = "card"
df3.loc[df3["Payment Method"].isnull(), "Payment Method"] = "unknown"
df3.loc[df3["Location"].isnull(), "Location"] = "unknown"

print_uniques(df3), len(df3)
```

```
Transaction ID - 9942   |       Many Items
Item - 9        |       <StringArray>
['sandwich',      'tea',   'coffee',     'cake',    'juice',     'salad',
   'cookie', 'smoothie',  'unknown']
```

```
Length: 9, dtype: string
Quantity - 5    |       <IntegerArray>
[5, 2, 1, 3, 4]
Length: 5, dtype: Int32
Price Per Unit - 6      |       <FloatingArray>
[4.0, 1.5, 2.0, 3.0, 5.0, 1.0]
Length: 6, dtype: Float32
Total Spent - 17        |       <FloatingArray>
[20.0,  7.5,  4.0,  9.0,  8.0,  3.0, 12.0, 10.0, 15.0,  4.5,  2.0,  5.0,  6.0,
  1.5, 16.0, 25.0,  1.0]
Length: 17, dtype: Float32
Payment Method - 3      |       <StringArray>
['card', 'unknown', 'cash']
Length: 3, dtype: string
Location - 3    |       <StringArray>
['in-store', 'takeaway', 'unknown']
Length: 3, dtype: string
Transaction Date - 365  |       Many Items
```

[14]:
```
(None, 9942)
```

0.8 6) Remove Duplicates

[15]:
```python
df3.drop_duplicates(inplace=True)

print_uniques(df3), len(df3)
```

```
Transaction ID - 9942   |       Many Items
Item - 9        |       <StringArray>
['sandwich',      'tea',   'coffee',     'cake',    'juice',    'salad',
   'cookie', 'smoothie',  'unknown']
Length: 9, dtype: string
Quantity - 5    |       <IntegerArray>
[5, 2, 1, 3, 4]
Length: 5, dtype: Int32
Price Per Unit - 6      |       <FloatingArray>
[4.0, 1.5, 2.0, 3.0, 5.0, 1.0]
Length: 6, dtype: Float32
Total Spent - 17        |       <FloatingArray>
[20.0,  7.5,  4.0,  9.0,  8.0,  3.0, 12.0, 10.0, 15.0,  4.5,  2.0,  5.0,  6.0,
  1.5, 16.0, 25.0,  1.0]
Length: 17, dtype: Float32
Payment Method - 3      |       <StringArray>
['card', 'unknown', 'cash']
Length: 3, dtype: string
Location - 3    |       <StringArray>
['in-store', 'takeaway', 'unknown']
Length: 3, dtype: string
```

```
Transaction Date - 365  |       Many Items
```

[15]:
```
(None, 9942)
```

0.9 7) Type Conversion & Validation

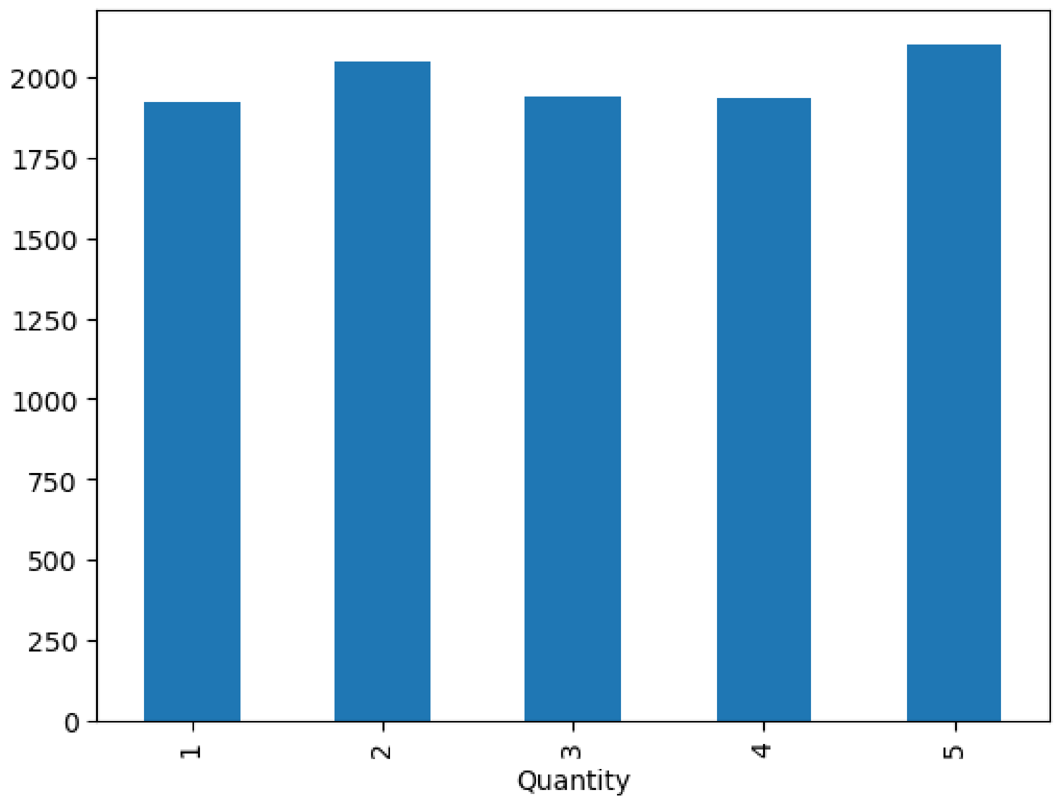
[16]:
```
df3["Transaction ID"] = df3["Transaction ID"].astype("string")
df3["Item"] = df3["Item"].astype("string")

df3["Quantity"] = df3["Quantity"].astype("int32")
df3["Price Per Unit"] = df3["Price Per Unit"].astype("float32")
df3["Total Spent"] = df3["Total Spent"].astype("float32")

df3["Payment Method"] = df3["Payment Method"].astype("string")
df3["Location"] = df3["Location"].astype("string")

df3["Transaction Date"] = pd.to_datetime(df3["Transaction Date"],␣
 ↪errors="coerce")

df3.dtypes
```

[16]:
```
Transaction ID      string[python]
Item                string[python]
Quantity                     int32
Price Per Unit             float32
Total Spent                float32
Payment Method      string[python]
Location            string[python]
Transaction Date    datetime64[ns]
dtype: object
```

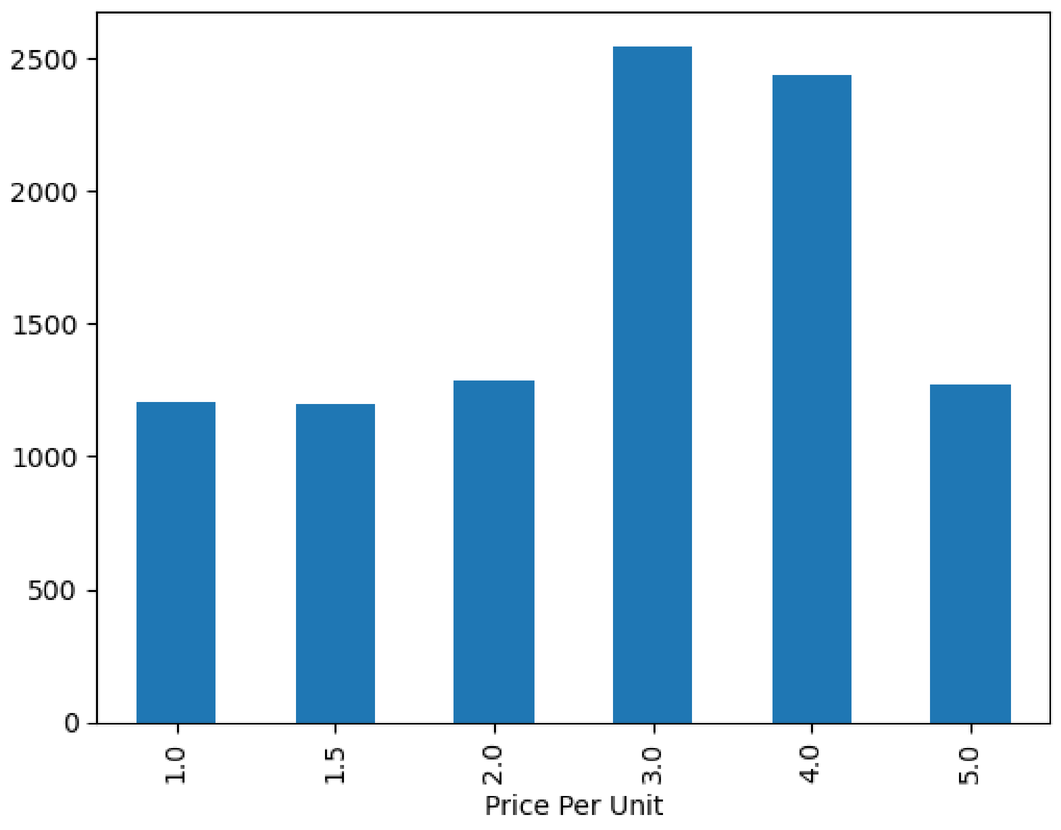
0.10 8) Outlier Detection

Quantity, and Price Per Unit both seem to not have any outliers. Since Total Spent is the product of the other two columns, the variety in the Total Spent doesn't seem that large or abnormal

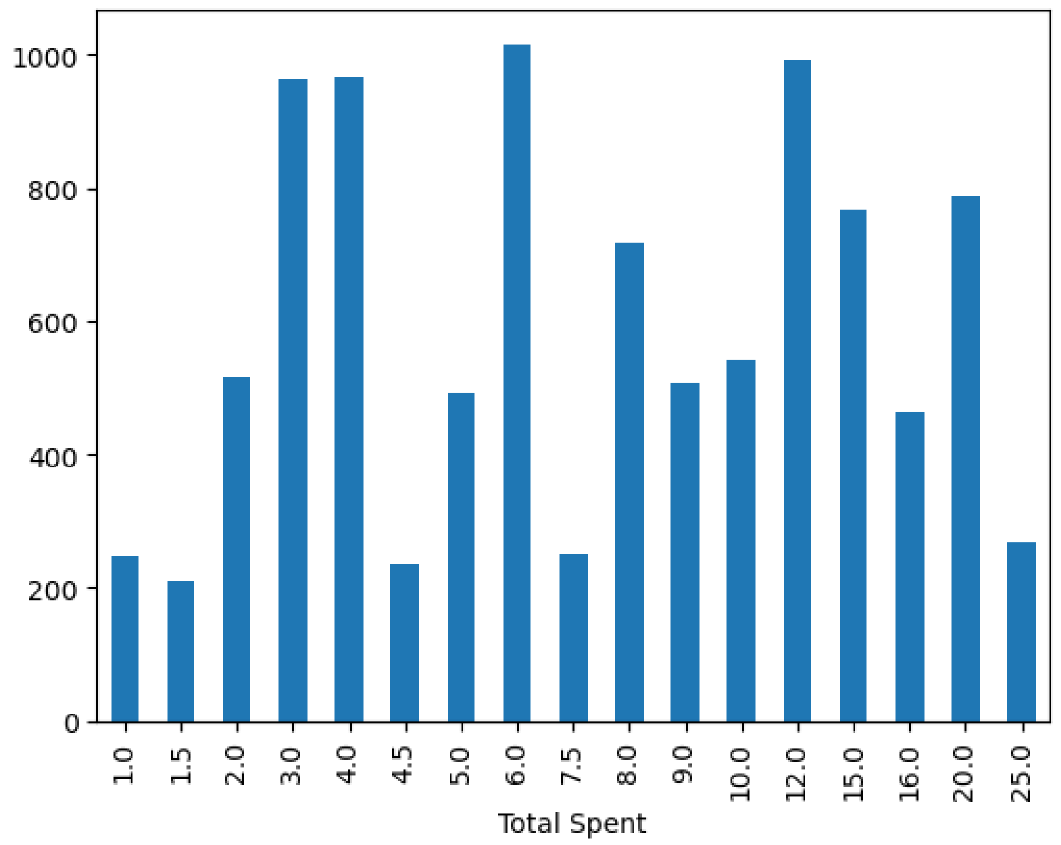
[17]:
```
# Count frequency of values
value_counts = df3["Quantity"].value_counts()

value_counts.sort_index(inplace=True)

# Plot as bar chart
value_counts.plot(kind="bar");
```



[18]:
```
# Count frequency of values
value_counts = df3["Price Per Unit"].value_counts()

value_counts.sort_index(inplace=True)

# Plot as bar chart
value_counts.plot(kind="bar");
```



[19]:
```
# Count frequency of values
value_counts = df3["Total Spent"].value_counts()

value_counts.sort_index(inplace=True)

# Plot as bar chart
value_counts.plot(kind="bar");
```



0.11 9) Feature Engineering & Derived Columns

```
[20]: df3["Transaction Month"] = df3["Transaction Date"].dt.month
df3["Transaction Weekday"] = df3["Transaction Date"].dt.day_name()

# No Hour since the original data only comprised the date (day/month/year), so .
 ↪hour is just zeros
# df3["Transaction Hour"] = df3["Transaction Date"].dt.hour

print_uniques(df3)
```

```
Transaction ID - 9942   |       Many Items
Item - 9        |       <StringArray>
['sandwich',      'tea',   'coffee',     'cake',    'juice',    'salad',
   'cookie', 'smoothie',  'unknown']
Length: 9, dtype: string
Quantity - 5    |       [5 2 1 3 4]
Price Per Unit - 6      |       [4.  1.5 2.  3.  5.  1. ]
Total Spent - 17        |       [20.   7.5  4.   9.   8.   3.  12.  10.  15.
4.5  2.   5.   6.   1.5
```

```
 16.  25.   1. ]
Payment Method - 3      |       <StringArray>
['card', 'unknown', 'cash']
Length: 3, dtype: string
Location - 3    |       <StringArray>
['in-store', 'takeaway', 'unknown']
Length: 3, dtype: string
Transaction Date - 365  |       Many Items
Transaction Month - 12  |       [ 1  2  3  4  5  6  7  8  9 10 11 12]
Transaction Weekday - 7 |       ['Sunday' 'Monday' 'Tuesday' 'Wednesday'
'Thursday' 'Friday' 'Saturday']
```

[21]:
```
avg_item_price = df3.groupby("Item")["Price Per Unit"].mean()

avg_item_price
```

[21]:
```
Item
cake        3.00000
coffee      2.00000
cookie      1.00000
juice       3.00000
salad       5.00000
sandwich    4.00000
smoothie    4.00000
tea         1.50000
unknown     2.92731
Name: Price Per Unit, dtype: float32
```

[22]:
```
location_freq = df3.groupby("Item")["Location"].value_counts().
 ↪unstack(fill_value=0)
location_freq
```

[22]:
```
Location  in-store  takeaway  unknown
Item
cake           319       341      474
coffee         318       350      490
cookie         328       361      395
juice          361       338      468
salad          367       343      434
sandwich       367       340      415
smoothie       321       300      468
tea            326       334      421
unknown        291       297      375
```

[23]:
```
avg_spent_per_location = df3.groupby("Location")["Total Spent"].mean()

avg_spent_per_location
```

```
[23]: Location
      in-store    9.030354
      takeaway    8.804094
      unknown     8.954315
      Name: Total Spent, dtype: float32
```