Task Solution

Verifying the accuracy/ completeness/ reliability of the datasets shared. This is done using a mix approach via python & sql. The accuracy & completeness validation is done using python [pandas & re] while reliability checks are done on SQL.

Accuracy & completeness

This python script `[verify_accuracy.py]` validates the dataset across three sources i.e. (Customer / Order / Shipping). The python script is intended to work with functions created.

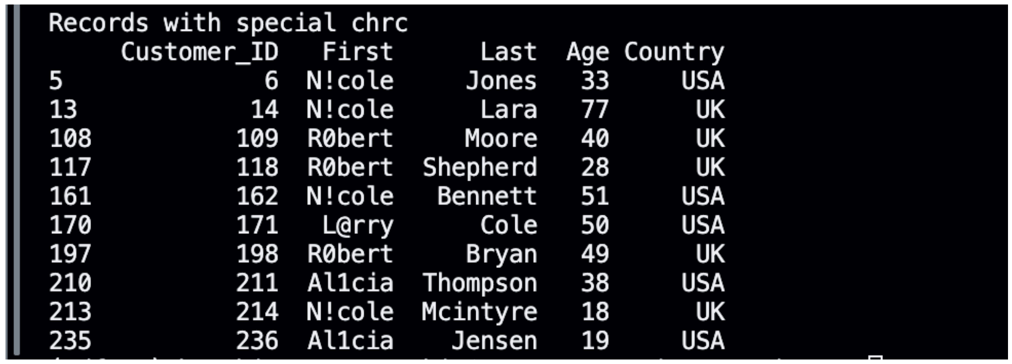
- load_customer_csv : using `pd.read_csv` it loads the two datasets [Customer & Order] into respective dataframes. For shipping data sitting inside a json file `pd.read_json` was used & loaded into a df
- check_special_chars : returns the records where special / non-alphabet characters are present in pandas dataframe . This function finds and returns rows where a given column contains anything other than letters (A–Z, a–z)
    - numbers (`0–9`)
    - spaces
    - special characters (`@, #, $,` etc.)

Showing Results

- Customer (dataset)

For the `First` column in the customer dataset, the following records are inaccurate, as customer names should not contain special characters. It violates expected domain rules for a customer name.

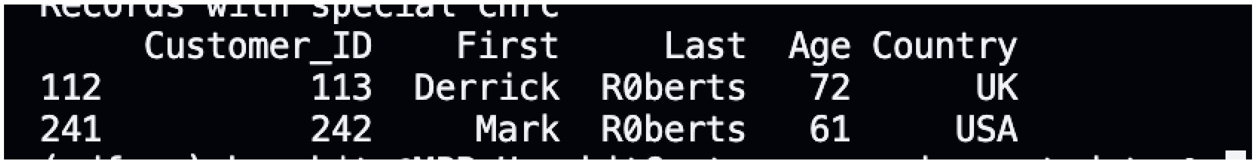
```
check_special_chars(df1,'First')
```



```
Records with special chrc
     Customer_ID   First      Last  Age Country
5              6  N!cole     Jones   33     USA
13            14  N!cole      Lara   77      UK
108          109  R0bert     Moore   40      UK
117          118  R0bert  Shepherd   28      UK
161          162  N!cole   Bennett   51     USA
170          171   L@rry      Cole   50     USA
197          198  R0bert     Bryan   49      UK
210          211  Al1cia  Thompson   38     USA
213          214  N!cole  Mcintyre   18      UK
235          236  Al1cia    Jensen   19     USA
```

Across the field `Last`, having the last_names of customers only 2 records fail the accuracy checks.

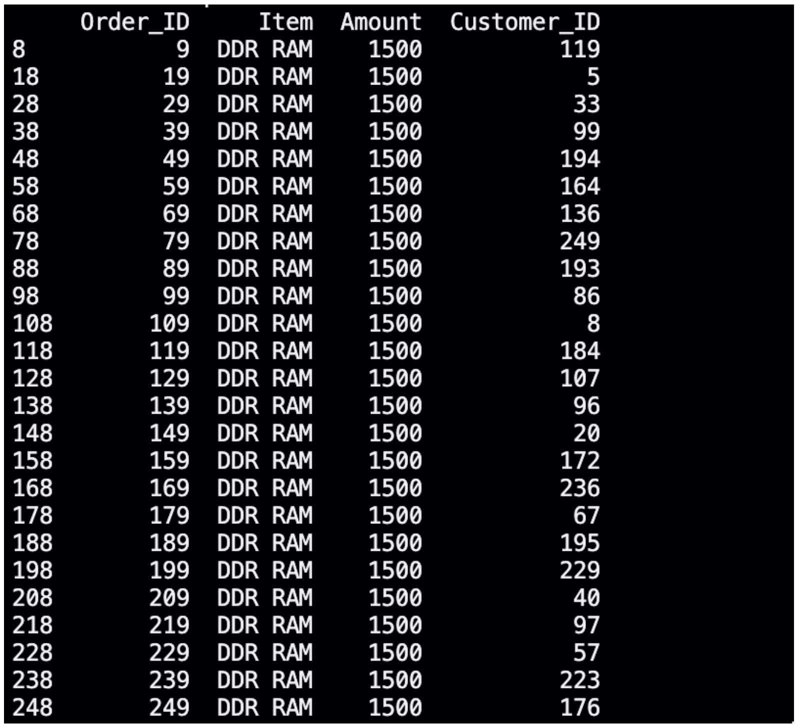
```
check_special_chars(df1,'Last')
```



```
       Customer_ID    First      Last  Age Country
112            113  Derrick  R0berts   72       UK
241            242     Mark  R0berts   61      USA
```

- Order (dataset)

```
check_special_chars(df2,'Item')
```



```
     Order_ID     Item  Amount  Customer_ID
8           9  DDR RAM    1500          119
18         19  DDR RAM    1500            5
28         29  DDR RAM    1500           33
38         39  DDR RAM    1500           99
48         49  DDR RAM    1500          194
58         59  DDR RAM    1500          164
68         69  DDR RAM    1500          136
78         79  DDR RAM    1500          249
88         89  DDR RAM    1500          193
98         99  DDR RAM    1500           86
108       109  DDR RAM    1500            8
118       119  DDR RAM    1500          184
128       129  DDR RAM    1500          107
138       139  DDR RAM    1500           96
148       149  DDR RAM    1500           20
158       159  DDR RAM    1500          172
168       169  DDR RAM    1500          236
178       179  DDR RAM    1500           67
188       189  DDR RAM    1500          195
198       199  DDR RAM    1500          229
208       209  DDR RAM    1500           40
218       219  DDR RAM    1500           97
228       229  DDR RAM    1500           57
238       239  DDR RAM    1500          223
248       249  DDR RAM    1500          176
```

We observe that these records are flagged due to spaces between “DDR” and “RAM” in the *Item* field. Since this formatting is expected for this dataset, these can be treated as false positives and safely ignored.

Additionally,for **data completeness** I've added a function to check for fields having nulls or 0 as values.

```
def check_nulls_or_zeroes(df, column_name):
    mask = df[column_name].isnull() | (df[column_name] == 0)
    issues = df[mask]

    if issues.empty:
        print(f"No NULL or ZERO values found in '{column_name}'")
    else:
        print(f"Records with NULL or ZERO in '{column_name}':")
        print(issues)

    return issues
```

Showing Results
No NULL or ZERO values found in 'First', 'Last', 'Age', 'Country' - Customer dataset

```
check_nulls_or_zeroes(df2,'Customer_ID')
```

No NULL or ZERO values found in 'Item', 'Amount', 'Customer_ID' - Order dataset
The null check on the **Customer_ID** field confirms that every order is properly associated with a customer, ensuring that each **Order_ID** (primary key) has a valid **Customer_ID** mapped to it.
The Order fact table successfully passed completeness and referential integrity checks, with no NULL or zero values identified in the **Item**, **Amount**, or **Customer_ID** fields. All order records maintain valid foreign-key relationships with the customer dimension.

Reliability

Because I have executed reliability checks on sql please refer file reliability.sql

Outline Requirements

Verification of source data for accuracy , completeness & reliability has resulted in few findings. Few **domain violations** like invalid characters in names were found. The same would be considered while laying out the specifications of the proposed model.

Proposed domain model - I would go ahead with a proposal of OLAP based design where order table acts as the fact table & other tables like - customer , shipping as dimensions table. Since the dataset is not multi-dimensional & hence a denormalised(star-schema) approach would be feasible here.

While order_id uniquely identifies each order as a transaction the customer_id links these order to customer attributes.

order (Fact)	Customer (Dim)	Shipping (Dim)
-----------	-------------	-------------
order_id (PK)	customer_id (PK)	shipping_id (PK)
customer_id (FK)	first_name	shipping_status
item	last_name	customer_id
Amount	age	
	country	
	is_valid	

Story & Technical Specifications

This model will support analytical use cases like examining country-level spend analysis for pending deliveries, identification of top-selling products by country and age category. The use of foreign keys in the proposed domain model ensures the maintenance of referential integrity across related tables.

1. Create order as fact table and customer, shipping as dimension tables
2. Separation of raw vs Cleaned Data - Ingesting of data into staging as received from the source. This needs to be separated from cleaned data
3. Transformation Layer - We shall retain the raw values (source values) & create set of cleaned records (ex. names for first & last field for dim_customer)
4. Cleansing & Validation Rules
    - Using a flag for special characters using regex (records found with non-alphabet characters in first & last field of customer dataset)
    - Allow only alphabets and spaces (spaces are ok)
    - Is_valid : If original values contains special characters then false else true

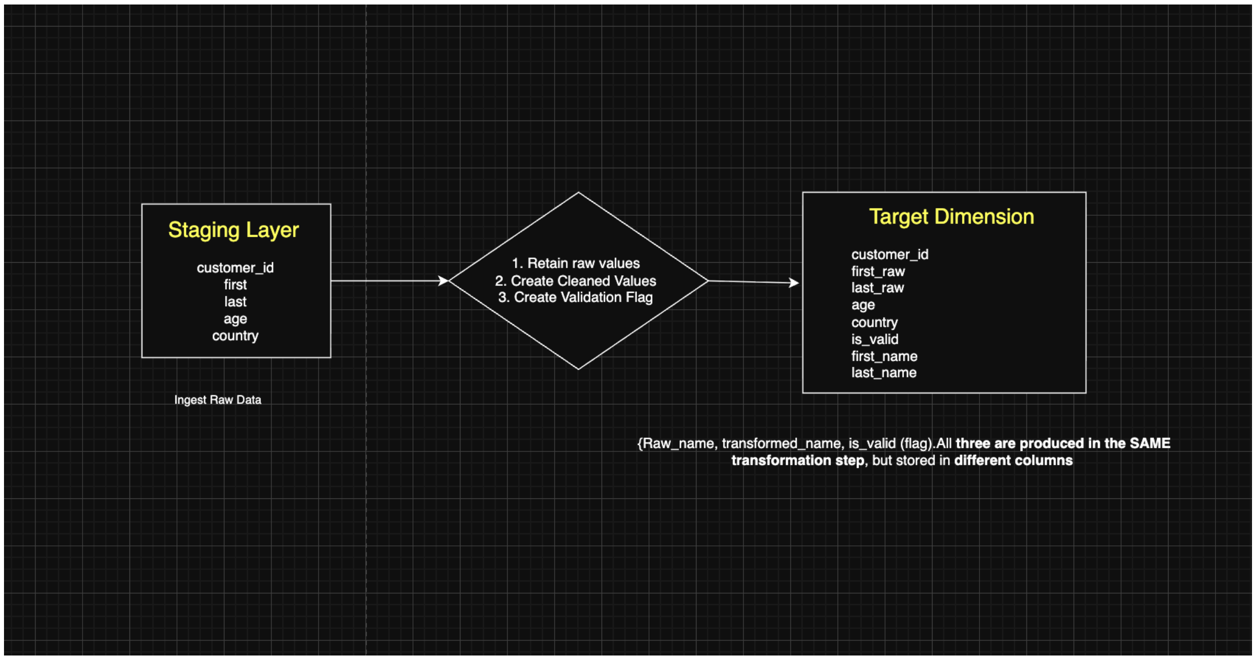
```
is_valid = CASE
        WHEN first_name_raw ~ '[^A-Za-z ]'
```

```
    OR last_name_raw  ~ '[^A-Za-z ]'
  THEN false
  ELSE true
END
```

5. Load Strategy Recommendation
   - Do not drop records due to invalid names
   - Load all customers into dim_customer
   - Use is_valid flag for:
6. Result -

   For example, In the dim_customer: first_name_raw = N!cole, is_valid = False & first_name = Nicole

   flow_diagram



7. QA testing. So with the is_valid field testing on transformed values needed to be done to ensure that all transformations have been applied correctly and as per the defined logic.