GROUP NAME: DATA ALCHEMIST

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SPECIALIZATION: DATA ANALYST

Problem description

We are determined to help XYZ Bank improve its cross-selling strategies and enhance customer engagement. The bank offers a wide array of financial products and services, including savings accounts, credit cards, mortgages, loans, and investment options. However, we've observed that many of our customers have limited product adoption and aren't fully utilizing the range of services available to them.

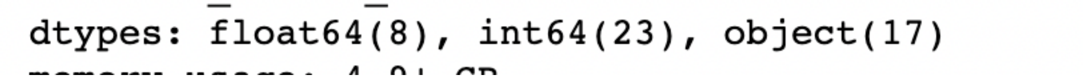
To tackle this challenge head-on, we plan to implement customer segmentation techniques to gain deeper insights into our customer base. By dividing our customers into distinct groups based on their demographics, financial behavior, and product usage patterns, we hope to identify specific customer segments that are more likely to use products and services. Armed with this valuable information, we aim to create personalized marketing strategies and tailored cross-selling initiatives to boost customer satisfaction and encourage higher product adoption.

As part of our data analysis team, the objective is to thoroughly analyze the extensive customer dataset provided by XYZ Bank and conduct a comprehensive customer segmentation analysis. The dataset includes detailed information about each customer, such as age, gender, income, transaction history, product holdings, and tenure with our bank.

Data understanding

- Customer demographics: Age, gender, location, and purchase history.
- Website interactions: Clickstream data, session duration, and product views.
- Purchase behavior: Cart abandonment, order history, and customer feedback.
- Customer support interactions: Queries, response times, and issue resolution.
- Different products for sale: Credit Card, particular Account, loans and deposits.

What type of data you have got for analysis

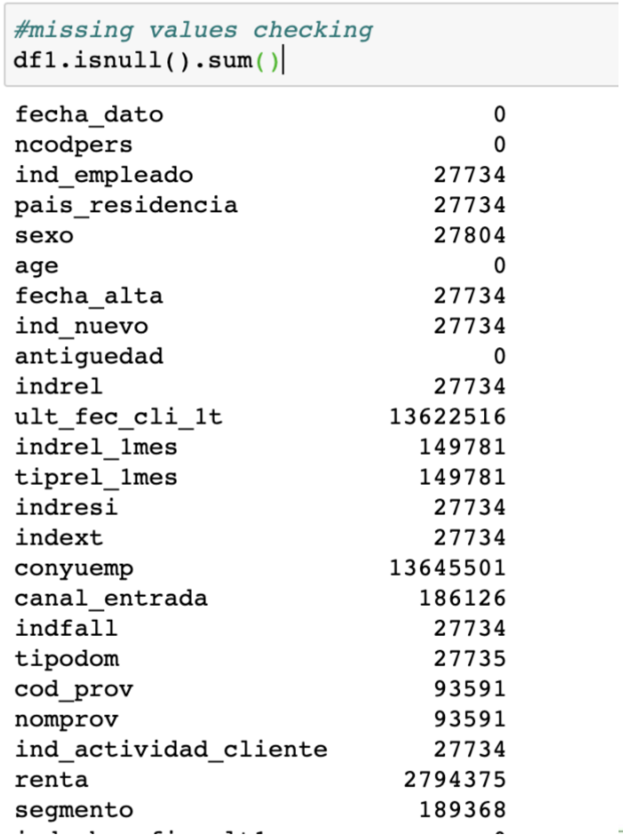


```
dtypes: float64(8), int64(23), object(17)
```

Floats, integers, and objects

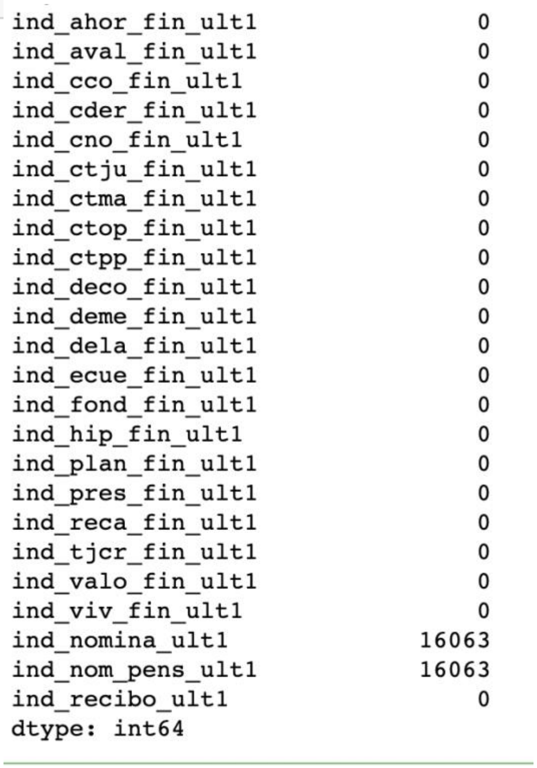
What are the problems in the data (number of NA values, outliers , skewed etc)

Missing values in training dataset:



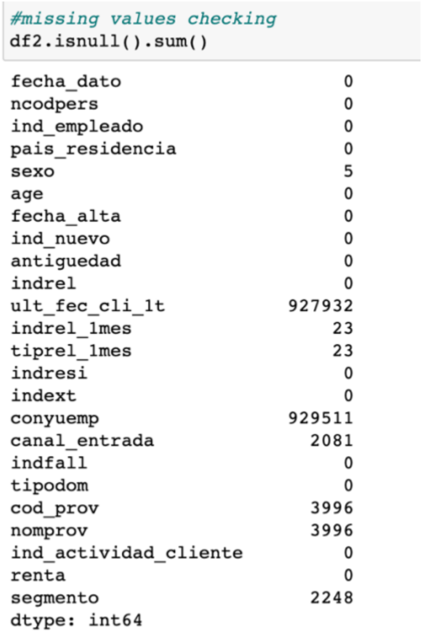
```
#missing values checking
df1.isnull().sum()

fecha_dato                      0
ncodpers                        0
ind_empleado                27734
pais_residencia             27734
sexo                        27804
age                             0
fecha_alta                  27734
ind_nuevo                   27734
antiguedad                      0
indrel                      27734
ult_fec_cli_1t           13622516
indrel_1mes                149781
tiprel_1mes                149781
indresi                     27734
indext                      27734
conyuemp                 13645501
canal_entrada              186126
indfall                     27734
tipodom                     27735
cod_prov                    93591
nomprov                     93591
ind_actividad_cliente       27734
renta                     2794375
segmento                   189368
```



```
ind_ahor_fin_ult1               0
ind_aval_fin_ult1               0
ind_cco_fin_ult1                0
ind_cder_fin_ult1               0
ind_cno_fin_ult1                0
ind_ctju_fin_ult1               0
ind_ctma_fin_ult1               0
ind_ctop_fin_ult1               0
ind_ctpp_fin_ult1               0
ind_deco_fin_ult1               0
ind_deme_fin_ult1               0
ind_dela_fin_ult1               0
ind_ecue_fin_ult1               0
ind_fond_fin_ult1               0
ind_hip_fin_ult1                0
ind_plan_fin_ult1               0
ind_pres_fin_ult1               0
ind_reca_fin_ult1               0
ind_tjcr_fin_ult1               0
ind_valo_fin_ult1               0
ind_viv_fin_ult1                0
ind_nomina_ult1             16063
ind_nom_pens_ult1           16063
ind_recibo_ult1                 0
dtype: int64
```

missing values in testing dataset:

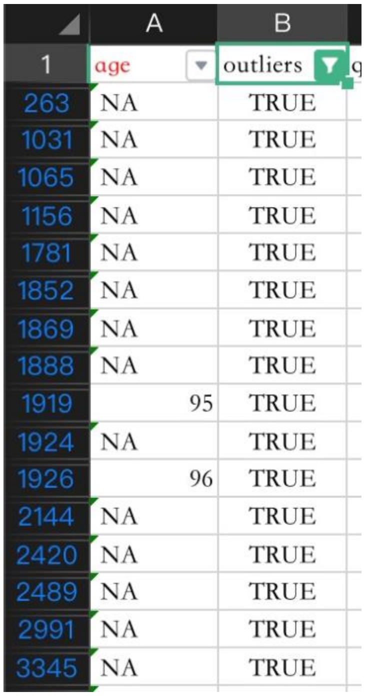


```
#missing values checking
df2.isnull().sum()

fecha_dato                    0
ncodpers                      0
ind_empleado                  0
pais_residencia               0
sexo                          5
age                           0
fecha_alta                    0
ind_nuevo                     0
antiguedad                    0
indrel                        0
ult_fec_cli_1t           927932
indrel_1mes                  23
tiprel_1mes                  23
indresi                       0
indext                        0
conyuemp                 929511
canal_entrada              2081
indfall                       0
tipodom                       0
cod_prov                   3996
nomprov                    3996
ind_actividad_cliente         0
renta                         0
segmento                   2248
dtype: int64
```

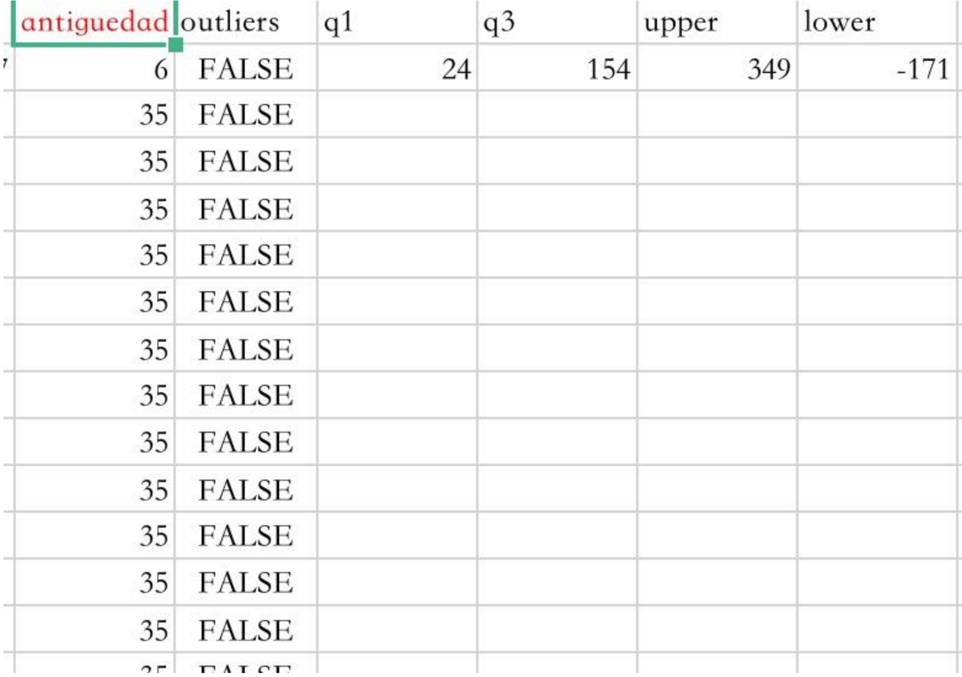
Outliers in the training dataset:

For age: There are 15891-11370 outliers, which is 4521.



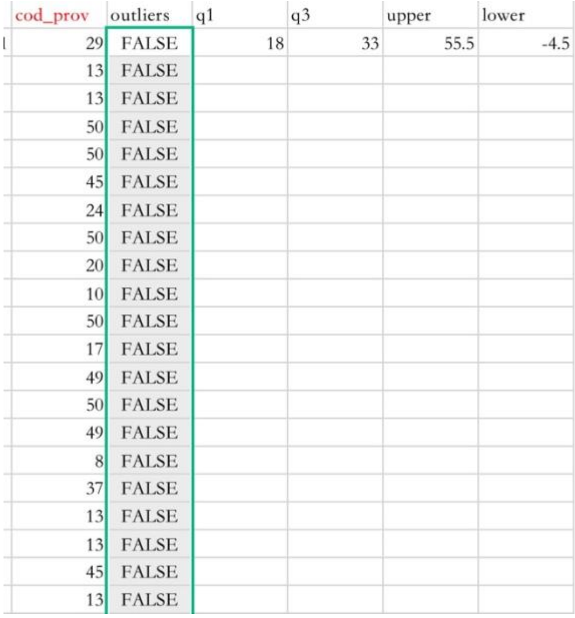
	A	B
1	age	outliers
263	NA	TRUE
1031	NA	TRUE
1065	NA	TRUE
1156	NA	TRUE
1781	NA	TRUE
1852	NA	TRUE
1869	NA	TRUE
1888	NA	TRUE
1919	95	TRUE
1924	NA	TRUE
1926	96	TRUE
2144	NA	TRUE
2420	NA	TRUE
2489	NA	TRUE
2991	NA	TRUE
3345	NA	TRUE

For antigucdad: There are 11374-11370 outliers, which is 4.



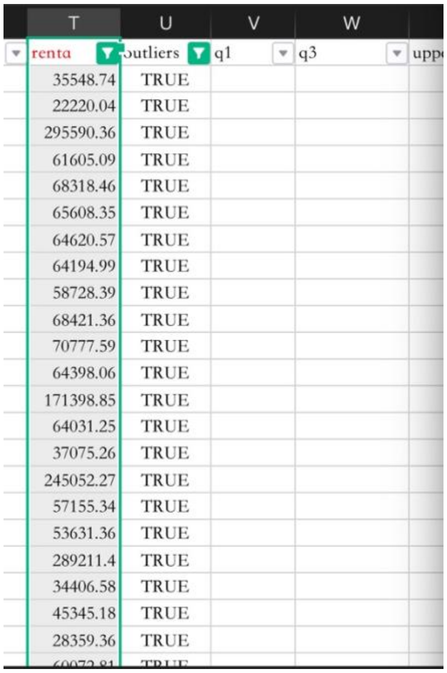
antiguedad	outliers	q1	q3	upper	lower
6	FALSE	24	154	349	-171
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				
35	FALSE				

For cod_prov: There are 18332 outliers outcome but they are all from NA values so no outliers.



cod_prov	outliers	q1	q3	upper	lower
29	FALSE	18	33	55.5	-4.5
13	FALSE				
13	FALSE				
50	FALSE				
50	FALSE				
45	FALSE				
24	FALSE				
50	FALSE				
20	FALSE				
10	FALSE				
50	FALSE				
17	FALSE				
49	FALSE				
50	FALSE				
49	FALSE				
8	FALSE				
37	FALSE				
13	FALSE				
13	FALSE				
45	FALSE				
13	FALSE				

For renta: There are 431706 outliers.



T	U	V	W	
renta	outliers	q1	q3	upp
35548.74	TRUE			
22220.04	TRUE			
295590.36	TRUE			
61605.09	TRUE			
68318.46	TRUE			
65608.35	TRUE			
64620.57	TRUE			
64194.99	TRUE			
58728.39	TRUE			
68421.36	TRUE			
70777.59	TRUE			
64398.06	TRUE			
171398.85	TRUE			
64031.25	TRUE			
37075.26	TRUE			
245052.27	TRUE			
57155.34	TRUE			
53631.36	TRUE			
289211.4	TRUE			
34406.58	TRUE			
45345.18	TRUE			
28359.36	TRUE			

What approaches you are trying to apply on your data set to overcome problems like NA value, outlier etc and why?

For missing object values in the dataset, we will delete them by removing rows directly. This approach is straightforward but maybe lead to a loss of valuable data. For those columns that contain floats and integers, we will fill in the missing values with estimated or substituted values. Common methods include using mean, median, or mode for numerical variables, or using the most frequent category for categorical variables. And for outliers in the dataset, first, we would handle missing values and then we deal with outliers. There are some columns that have outliers because of NA values, and there are fewer outliers that are real outliers in the dataset, so we would deal with the real outliers in the same way as missing values, whatever substitute them with median, mean, or else.