

```
In [1]: #imports
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import scale
```

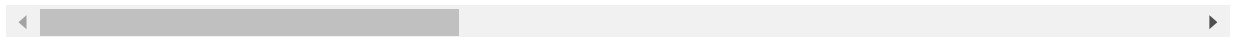
```
In [4]: #carregando o dataset
df = pd.read_csv('ml_project1_data.csv', sep=';', encoding='utf-8', low_memory=False,
```

```
In [5]: #verificando formato das linhas/columnas
df.head(3)
```

```
Out[5]:
```

	Year_Birth	Education	Marital_Status	Income	Kidhome	Teenhome	Dt_Customer	Recency
ID								
5524	1957	Graduation	Single	58138.0	0	0	04/09/2012	58
2174	1954	Graduation	Single	46344.0	1	1	08/03/2014	38
4141	1965	Graduation	Together	71613.0	0	0	21/08/2013	26

3 rows × 28 columns



```
In [8]: #verificando as dimensões
df.shape
```

```
Out[8]: (2240, 28)
```

```
In [61]: # Cria cópia do dataset
df1 = df.copy()
```

```
In [62]: # Transformando variáveis categóricas
cat = [var for var in df.columns if df[var].dtype=='object']
for col in cat:
    print(f'A variável "{col}" possui {df[col].nunique()} valores únicos: {df[col].uni
```

A variável "Education" possui 5 valores únicos: ['Graduation' 'PhD' 'Master' 'Basic' '2n Cycle']

A variável "Marital_Status" possui 8 valores únicos: ['Single' 'Together' 'Married' 'Divorced' 'Widow' 'Alone' 'Absurd' 'YOLO']

A variável "Dt_Customer" possui 663 valores únicos: ['04/09/2012' '08/03/2014' '21/08/2013' '10/02/2014' '19/01/2014'

'09/09/2013' '13/11/2012' '08/05/2013' '06/06/2013' '13/03/2014'
 '15/11/2013' '10/10/2012' '24/11/2012' '24/12/2012' '31/08/2012'
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 '28/04/2014' '17/06/2013' '03/03/2014' '04/07/2013' '07/09/2012']

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'19/03/2014'	'27/09/2013'	'08/04/2013'	'11/09/2012'	'14/09/2012'
'17/03/2013'	'05/04/2013'	'30/04/2014'	'19/12/2012'	'27/08/2012'
'12/10/2012'	'04/09/2013'	'29/08/2012'	'23/06/2013'	'03/07/2013'
'25/02/2014'	'11/08/2013'	'16/07/2013'	'28/05/2014'	'21/01/2014'
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'11/10/2012' '20/12/2012' '09/01/2014']
```

In [63]:

#transformando os valores da variável em numéricos

```
df1['Education'] = df1.Education.map({'Graduation':1, 'PhD':2, 'Master':3, 'Basic':4}
df1['Marital_Status'] = df1.Marital_Status.map({'Single':1, 'Together':2, 'Married':3})
```

```
df1['Dt_Customer'] = df1.Dt_Customer.map({'04/09/2012':1, '08/03/2014':2, '21/08/2013':3, '09/09/2013':6, '13/11/2012':7, '08/05/2013':8, '06/06/2013':9, '13/03/2014':10, '15/11/2013':11, '10/10/2012':12, '24/11/2012':12, '24/12/2012':13, '31/08/2012':14, '28/03/2013':15, '03/11/2012':16, '08/08/2012':17, '06/01/2013':18, '23/12/2012':19, '11/01/2014':20, '18/03/2013':21, '02/01/2013':22, '27/05/2013':23, '20/02/2013':24, '31/05/2013':25, '22/11/2013':26, '22/05/2014':27, '11/05/2013':28, '29/10/2012':29, '29/08/2013':30, '31/12/2013':31, '02/09/2013':32, '11/02/2014':33, '01/02/2013':34, '29/04/2013':35, '12/03/2013':36, '05/11/2013':37, '02/10/2013':38, '28/06/2014':39, '09/11/2012':40, '24/05/2013':41, '01/01/2014':42, '08/11/2012':43, '12/05/2014':44, '11/08/2012':45, '07/06/2014':46, '12/06/2013':47, '19/11/2012':48, '02/04/2013':49, '28/04/2014':50, '17/06/2013':51, '03/03/2014':52, '04/07/2013':53, '07/09/2012':54, '18/02/2013':55, '11/06/2013':56, '06/12/2013':57, 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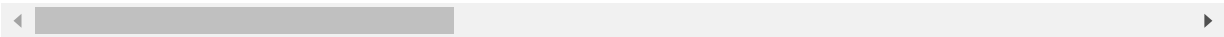
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```

```
In [64]: df1.head(20)
```

Out[64]:

	Year_Birth	Education	Marital_Status	Income	Kidhome	Teenhome	Dt_Customer	Recency	ID
5524	1957	1	1	58138.0	0	0	1	58	
2174	1954	1	1	46344.0	1	1	2	38	
4141	1965	1	2	71613.0	0	0	3	26	
6182	1984	1	2	26646.0	1	0	4	26	
5324	1981	2	3	58293.0	1	0	5	94	
7446	1967	3	2	62513.0	0	1	6	16	
965	1971	1	4	55635.0	0	1	7	34	
6177	1985	2	3	33454.0	1	0	8	32	
4855	1974	2	2	30351.0	1	0	9	19	
5899	1950	2	2	5648.0	1	1	10	68	
1994	1983	1	3	NaN	1	0	11	11	
387	1976	4	3	7500.0	0	0	7	59	
2125	1959	1	4	63033.0	0	0	11	82	
8180	1952	3	4	59354.0	1	1	11	53	
2569	1987	1	3	17323.0	0	0	12	38	
2114	1946	2	1	82800.0	0	0	12	23	
9736	1980	1	3	41850.0	1	1	13	51	
4939	1946	1	2	37760.0	0	0	14	20	
6565	1949	3	3	76995.0	0	1	15	91	
2278	1985	5	1	33812.0	1	0	16	86	

20 rows × 28 columns



```
In [ ]: # Importar metrica
from sklearn.feature_selection import chi2
```

```
In [65]: # Removendo valores nulos
df1.dropna(inplace=True)
```

```
In [66]: # Split dataset
X = df1.drop(['Education', 'Kidhome', 'Teenhome', 'Recency', 'MntWines'], axis=1)
```

```
y = df1.Education
```

```
In [67]: # Calculando Chi-Squared
chi_scores = chi2(X,y)
```

```
In [68]: # Colocando label nos resultados para posterior plot
scores = pd.Series(chi_scores[0], index=X.columns)
pvalues = pd.Series(chi_scores[1], index=X.columns)
```

```
In [72]: # Results
pd.DataFrame({'Chi2':scores, 'p-Value':pvalues})
```

```
Out[72]:
```

	Chi2	p-Value
Year_Birth	6.006074e+00	1.986951e-01
Marital_Status	4.931166e+00	2.944334e-01
Income	1.283756e+06	0.000000e+00
Dt_Customer	4.406156e+02	4.640174e-94
MntFruits	2.451498e+03	0.000000e+00
MntMeatProducts	1.030154e+04	0.000000e+00
MntFishProducts	4.018883e+03	0.000000e+00
MntSweetProducts	2.948162e+03	0.000000e+00
MntGoldProds	3.313768e+03	0.000000e+00
NumDealsPurchases	8.750217e+00	6.765528e-02
NumWebPurchases	8.344877e+01	3.235977e-17
NumCatalogPurchases	1.264965e+02	2.185247e-26
NumStorePurchases	8.987562e+01	1.399351e-18
NumWebVisitsMonth	2.672028e+01	2.264249e-05
AcceptedCmp3	2.149984e+00	7.081957e-01
AcceptedCmp4	9.498610e+00	4.977582e-02
AcceptedCmp5	6.069409e+00	1.940244e-01
AcceptedCmp1	5.840598e+00	2.113730e-01
AcceptedCmp2	4.588051e+00	3.322342e-01
Complain	7.350570e+00	1.184819e-01
Z_CostContact	6.176677e-29	1.000000e+00
Z_Revenue	2.695277e-28	1.000000e+00
Response	1.967184e+01	5.796701e-04

O resultado acima nos indica que existe uma dependência entre a categoria Education e as categorias "Year_Birth" e "Marital_Status"

O resultado também nos indica que não há quaisquer associações entre as categoria "Income", "MntFruits", "MntMeatProducts", "MntFishProducts" "MntSweetProducts" e "MntGoldProds" e a categoria Education.

In []: