ANOVA F Test

ANOVa (Analysis of Variance) é um teste estatístico que calcula a variância entre as médias de grupos de dados. A Ho (p-value alto) é de que os grupos tem a mesma variância e, portanto, não tem impacto para treinamento de modelo. Halt (p-value baixo) de que existe diferença significativa e o atributo é bom para treinamento de modelo.

In [3]:
```python
# 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]:
```python
#carregando o dataset
df = pd.read_csv('ml_project1_data.csv',sep=';',encoding='utf-8', low_memory=False,
```

In [5]:
```python
# Visualizando o dataset
df.head(3)
```

Out[5]:

ID	Year_Birth	Education	Marital_Status	Income	Kidhome	Teenhome	Dt_Customer	Recency
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
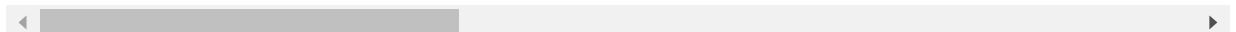
In [6]:
```python
# Verificando dimensões
df.shape
```

Out[6]:
```
(2240, 28)
```

In [7]:
```python
# Removendo valores nulos
df.dropna(inplace=True)
```

In [8]:
```python
# Cria cópia do dataset
df1 = df.copy()
```

In [9]:
```python
# 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].u
```

```
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 662 valores únicos: ['04/09/2012' '08/03/2014' '21/0
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'20/12/2012' '09/01/2014']
```

In [10]:
```python
#transformando os valore 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':
df1['Dt_Customer'] = df1.Dt_Customer.map({'04/09/2012':1,'08/03/2014':2, '21/08/2013
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```

In [10]:
```python
df1.head(10)
```

Out[10]:

ID	Year_Birth	Education	Marital_Status	Income	Kidhome	Teenhome	Dt_Customer	Recency
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

10 rows × 28 columns
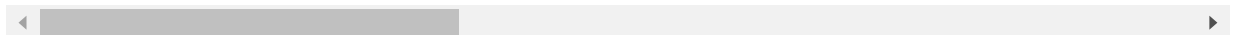
In [1]:
```python
# Importando library
import pingouin as pg
```

In [35]:
```python
# Calculando a estatística com ANOVA
aov = []
for variance in df1.columns[2:20]:
  v = pg.anova(data=df1, dv='Education', between=variance, detailed=True).round(9)
  aov.append(v)
```

In [36]:
```python
pd.concat(aov)
```

Out[36]:

	Source	SS	DF	MS	F	p-unc	np2
0	Marital_Status	2.315802	7	0.330829	0.209073	0.983507	0.000662
1	Within	3493.849812	2208	1.582360	NaN	NaN	NaN
0	Income	3419.165614	1973	1.732978	5.446502	0.000000	0.977976
1	Within	77.000000	242	0.318182	NaN	NaN	NaN
0	Kidhome	5.839000	2	2.919500	1.851074	0.157311	0.001670
1	Within	3490.326614	2213	1.577192	NaN	NaN	NaN
0	Teenhome	8.868298	2	4.434149	2.813861	0.060188	0.002537
1	Within	3487.297316	2213	1.575823	NaN	NaN	NaN
0	Dt_Customer	1164.160022	660	1.763879	1.176169	0.006138	0.332982
1	Within	2332.005592	1555	1.499682	NaN	NaN	NaN
0	Recency	168.143044	99	1.698415	1.079874	0.281485	0.048094
1	Within	3328.022570	2116	1.572789	NaN	NaN	NaN
0	MntWines	1182.100972	775	1.525292	0.949161	0.793735	0.338114
1	Within	2314.064642	1440	1.606989	NaN	NaN	NaN
0	MntFruits	279.723695	157	1.781680	1.139985	0.120380	0.080009
1	Within	3216.441918	2058	1.562897	NaN	NaN	NaN
0	MntMeatProducts	891.576656	553	1.612254	1.028787	0.336794	0.255016
1	Within	2604.588958	1662	1.567141	NaN	NaN	NaN
0	MntFishProducts	386.905373	181	2.137599	1.398363	0.000612	0.110666
1	Within	3109.260240	2034	1.528643	NaN	NaN	NaN
0	MntSweetProducts	382.557364	175	2.186042	1.432269	0.000310	0.109422
1	Within	3113.608249	2040	1.526279	NaN	NaN	NaN
0	MntGoldProds	403.755633	211	1.913534	1.240043	0.014236	0.115485
1	Within	3092.409981	2004	1.543119	NaN	NaN	NaN
0	NumDealsPurchases	18.721414	14	1.337244	0.846390	0.618359	0.005355
1	Within	3477.444200	2201	1.579938	NaN	NaN	NaN
0	NumWebPurchases	33.505636	14	2.393260	1.521248	0.095328	0.009584
1	Within	3462.659978	2201	1.573221	NaN	NaN	NaN
0	NumCatalogPurchases	35.524706	13	2.732670	1.738793	0.047469	0.010161
1	Within	3460.640908	2202	1.571590	NaN	NaN	NaN
0	NumStorePurchases	52.520358	13	4.040028	2.583350	0.001477	0.015022
1	Within	3443.645256	2202	1.563872	NaN	NaN	NaN
0	NumWebVisitsMonth	24.083888	15	1.605593	1.017345	0.433396	0.006889
1	Within	3472.081726	2200	1.578219	NaN	NaN	NaN
0	AcceptedCmp3	0.251515	1	0.251515	0.159287	0.689852	0.000072
1	Within	3495.914098	2214	1.579004	NaN	NaN	NaN

In [37]:
```python
data = pd.concat(aov)
data = data[data.Source!='Within'][['Source','F']]
data
```

Out[37]:

	Source	F
0	Marital_Status	0.209073
0	Income	5.446502
0	Kidhome	1.851074
0	Teenhome	2.813861
0	Dt_Customer	1.176169
0	Recency	1.079874
0	MntWines	0.949161
0	MntFruits	1.139985
0	MntMeatProducts	1.028787
0	MntFishProducts	1.398363
0	MntSweetProducts	1.432269
0	MntGoldProds	1.240043
0	NumDealsPurchases	0.846390
0	NumWebPurchases	1.521248
0	NumCatalogPurchases	1.738793
0	NumStorePurchases	2.583350
0	NumWebVisitsMonth	1.017345
0	AcceptedCmp3	0.159287

In [41]:
```python
plt.figure(figsize=(35,6))
sns.barplot('Source', 'F', data=data)
plt.show()
```

```
C:\Users\Micro\AppData\Local\Programs\Python\Python310\lib\site-packages\seaborn\_de
corators.py:36: FutureWarning: Pass the following variables as keyword args: x, y. F
rom version 0.12, the only valid positional argument will be `data`, and passing oth
er arguments without an explicit keyword will result in an error or misinterpretatio
n.
  warnings.warn(
```
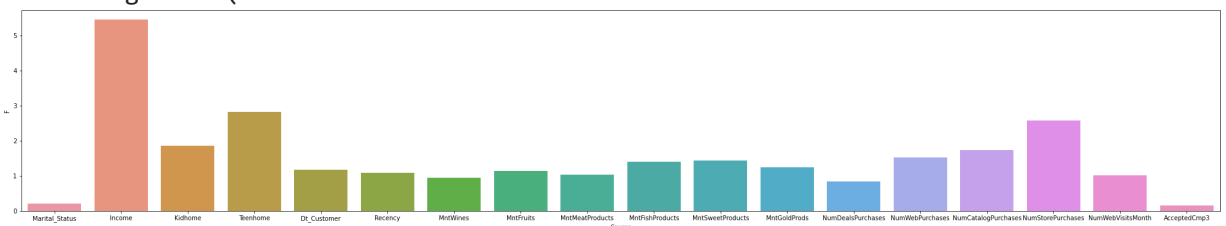

Verificando o resultado das análises de variância, chegamos ao resultado: As variáveis mais relevantes para construção de um modelo seriam "Income", "Teenhome",

"NumStorePurchsases", "NumCatalogPurchases" e "Kidhome", sendo as suas compras e seu status de casamento menos relevantes para descobrir seu nível de escolaridade.