0.0 IMPORTS

In [1]:
```
import pandas as pd
import inflection
import math
import numpy as np
import seaborn as sns

from matplotlib import pyplot as plt
from IPython.core.display import HTML
from IPython.display import Image
```

0.1. Helper Functions

In [2]:
```
# Função para ampliar area de edição do jupyter notebook
def jupyter_settings():
    %matplotlib inline
    %pylab inline

    plt.style.use( 'bmh' )
    plt.rcParams['figure.figsize'] = [25, 12]
    plt.rcParams['font.size'] =24

    display( HTML( '<style>.container {width:100% !important; }</style>') )
    pd.options.display.max_columns = None
    pd.options.display.max_rows = None
    pd.set_option( 'display.expand_frame_repr', False )

    sns.set()
```

In [3]:
```
jupyter_settings()
```

```
Populating the interactive namespace from numpy and matplotlib
```

0.2. Loading data

In [4]:
```
# leitura dos dados fornecidos
df_sales_raw = pd.read_csv('../data/train.csv', low_memory=False)
df_store_raw = pd.read_csv('../data/store.csv', low_memory=False)

# merge de datasets
df_raw = pd.merge(df_sales_raw, df_store_raw, how='left', on='Store')
```

In [5]:
```
# teste de leitura simples
df_raw.sample()
```

Out[5]:

	Store	DayOfWeek	Date	Sales	Customers	Open	Promo	StateHoliday	SchoolHoliday	StoreType	Assortment	CompetitionDistance	CompetitionOpenSinceMonth	CompetitionOpenSinceYear	Promo2	Promo2SinceWeek
116457	498	6	2015-04-18	8579	1001	1	0	0	0	a	a	990.0	NaN	NaN	1	40.0

1.0. PASSO 01 - DESCRICAO DOS DADOS

In [6]:
```
# fazer uma cópia do dataset quando muda de seção, somente para manter os dados , caso seja necessário recomeçar
df1 = df_raw.copy()
```

In [7]:
```
# visualizando os nomes das colunas do dataset
df1.columns
```

Out[7]:
```
Index(['Store', 'DayOfWeek', 'Date', 'Sales', 'Customers', 'Open', 'Promo',
       'StateHoliday', 'SchoolHoliday', 'StoreType', 'Assortment',
       'CompetitionDistance', 'CompetitionOpenSinceMonth',
       'CompetitionOpenSinceYear', 'Promo2', 'Promo2SinceWeek',
       'Promo2SinceYear', 'PromoInterval'],
      dtype='object')
```

1.1. Rename Columns

In [8]:
```
# renomenado as colunas para facilitar analise dos dados
cols_old = ['Store', 'DayOfWeek', 'Date', 'Sales', 'Customers', 'Open', 'Promo', 'StateHoliday', 'SchoolHoliday', 'StoreType',
            'Assortment', 'CompetitionDistance', 'CompetitionOpenSinceMonth', 'CompetitionOpenSinceYear', 'Promo2',
            'Promo2SinceWeek', 'Promo2SinceYear', 'PromoInterval']

snakecase = lambda x: inflection.underscore( x)
cols_new = list( map(snakecase, cols_old))

#rename
df1.columns = cols_new
#visualizando as colunas renomeadas
df1.columns
```

Out[8]:
```
Index(['store', 'day_of_week', 'date', 'sales', 'customers', 'open', 'promo',
       'state_holiday', 'school_holiday', 'store_type', 'assortment',
       'competition_distance', 'competition_open_since_month',
       'competition_open_since_year', 'promo2', 'promo2_since_week',
       'promo2_since_year', 'promo_interval'],
      dtype='object')
```

1.2. Data Dimensions

In [9]:
```
# leitura de colunas/linhas do dataset para dimensionar os dados
print('Number of Rows: {}'.format(df1.shape[0]))
print('Number of Cols: {}'.format(df1.shape[1]))
```

```
Number of Rows: 1017209
Number of Cols: 18
```

1.3. Data Types

In [10]:
```
# leitura do tipos de dados de cada coluna
df1['date'] = pd.to_datetime(df1['date'])
df1.dtypes
```

Out[10]:
```
store                                    int64
day_of_week                              int64
date                            datetime64[ns]
sales                                    int64
customers                                int64
open                                     int64
promo                                    int64
state_holiday                           object
school_holiday                           int64
store_type                              object
assortment                              object
competition_distance                   float64
competition_open_since_month           float64
competition_open_since_year            float64
promo2                                   int64
promo2_since_week                      float64
promo2_since_year                      float64
promo_interval                          object
dtype: object
```

1.4. Ckeck NA

In [11]:
```
# Verificando colunas com registros vazios
df1.isna().sum()
```

Out[11]:
```
store                            0
day_of_week                      0
date                             0
sales                            0
customers                        0
open                             0
promo                            0
state_holiday                    0
school_holiday                   0
store_type                       0
assortment                       0
competition_distance          2642
competition_open_since_month    323348
competition_open_since_year     323348
promo2                           0
promo2_since_week               508031
promo2_since_year               508031
promo_interval                  508031
dtype: int64
```

1.5. Fillout NA

In [12]:
```
#competition_distance --> 2642 registros vazios
# Verificando qual a maior distancia de um concorrente  -> 75860.0
# SOLUÇÃO para popular registros vazios-> Vou aplicar uma distancia maxima = 200000.0 para os registros NAN desta coluna
df1['competition_distance'] = df1['competition_distance'].apply(lambda x: 200000.0 if math.isnan(x) else x)

#=========================================================================================================
#competition_open_since_month --> 323348 registros vazios
# mes que o concorrente mais proximo foi aberto. Pq este campo esta vazio? a loja ja estava aberta quando instalou a nossa loja ou ninguem resgistrou esta informação
# SOLUÇÃO para popular registros vazios-> APLICAR A DATA (mes) DE VENDA NESTE CAMPO, PARA DEPOIS TESTAR USANDO CRISP E AVALIAR O ALGORITMO
df1['competition_open_since_month'] = df1.apply(lambda x: x['date'].month if math.isnan( x['competition_open_since_month']) else x['competition_open_since_month'], axis=1)

#=========================================================================================================
#competition_open_since_year --> 323348 registros vazios
# IDEM solução do item anterior
# SOLUÇÃO para popular registros vazios-> APLICAR A DATA (ano) DE VENDA NESTE CAMPO, PARA DEPOIS TESTAR USANDO CRISP E AVALIAR O ALGORITMO
df1['competition_open_since_year'] = df1.apply(lambda x: x['date'].year if math.isnan( x['competition_open_since_year']) else x['competition_open_since_year'], axis=1)


#=========================================================================================================
#promo2_since_week --> 508031 registros vazios
# SOLUÇÃO para popular registros vazios-> APLICAR A DATA (semana) DE VENDA NESTE CAMPO, PARA DEPOIS TESTAR USANDO CRISP E AVALIAR O ALGORITMO
df1['promo2_since_week'] = df1.apply(lambda x: x['date'].week if math.isnan( x['promo2_since_week']) else x['promo2_since_week'], axis=1)

#=========================================================================================================
#promo2_since_year --> 508031 registros vazios
# SOLUÇÃO para popular registros vazios-> APLICAR A DATA (ano) DE VENDA NESTE CAMPO, PARA DEPOIS TESTAR USANDO CRISP E AVALIAR O ALGORITMO
df1['promo2_since_year'] = df1.apply(lambda x: x['date'].year if math.isnan( x['promo2_since_year']) else x['promo2_since_year'], axis=1)

#=========================================================================================================
#promo_interval --> 508031 registros vazios
#criando um mapa de mês
month_map = {1: 'Jan', 2: 'Fev', 3: 'Mar', 4: 'Apr', 5: 'May', 6: 'Jun', 7: 'Jul', 8: 'Aug', 9: 'Sep', 10: 'Oct', 11: 'Nov', 12: 'Dec'}

# Colocando 0 nos registros que possui a coluna promo_interval = 0
df1['promo_interval'].fillna( 0, inplace=True )

# Criei uma coluna month_map onde será gravado o mes da coluna 'date' do registro, já convertido de acordo com a biblioteca criada
df1['month_map'] = df1['date'].dt.month.map( month_map )

# Criei uma nova coluna que vai registrar 1 para quem tem promoção no mes de venda e 0 data de venda fora da promoçao
df1['is_promo'] = df1[['promo_interval', 'month_map']].apply( lambda x: 0 if x['promo_interval'] == 0 else 1 if x['month_map'] in x['promo_interval'].split( ',' ) else 0, axis=1 )
```

In [13]:
```
# releitura para conferir se ainda temos registros vazios
df1.isna().sum()
```

Out[13]:
```
store                           0
day_of_week                     0
date                            0
sales                           0
customers                       0
open                            0
promo                           0
state_holiday                   0
school_holiday                  0
store_type                      0
assortment                      0
competition_distance            0
competition_open_since_month    0
competition_open_since_year     0
promo2                          0
promo2_since_week               0
promo2_since_year               0
promo_interval                  0
month_map                       0
is_promo                        0
dtype: int64
```

1.6. Change types

In [14]:
```
# competiton
df1['competition_open_since_month'] = df1['competition_open_since_month'].astype(int)
df1['competition_open_since_year'] = df1['competition_open_since_year'].astype(int)

# promo2
df1['promo2_since_week'] = df1['promo2_since_week'].astype(int)
df1['promo2_since_year'] = df1['promo2_since_year'].astype(int)
```

In [15]:
```
# releitura dos tipos de dados para conferencia
df1.dtypes
```

Out[15]:
```
store                                    int64
day_of_week                              int64
date                            datetime64[ns]
sales                                    int64
customers                                int64
open                                     int64
promo                                    int64
state_holiday                           object
school_holiday                           int64
store_type                              object
assortment                              object
competition_distance                   float64
competition_open_since_month             int64
competition_open_since_year              int64
promo2                                   int64
promo2_since_week                        int64
promo2_since_year                        int64
promo_interval                          object
month_map                               object
is_promo                                 int64
dtype: object
```

1.7. Descriptive Statistical

In [16]:
```
# Criando dataframes de acordo com o typo da coluna
num_attributes = df1.select_dtypes( include=['int64', 'int32', 'float64'])
cat_attributes = df1.select_dtypes( exclude=['int64', 'int32', 'float64', 'datetime64[ns]'])
```

1.7.1 Numerical Attributes

In [17]:
```
# Dividindo o datafame em dados numéricos e categóricos
# Realizar calculos basicos para cada coluna, para ter uma noção dos dados

# Central Tendency - mean, median
ct1 = pd.DataFrame( num_attributes.apply( np.mean ) ).T
ct2 = pd.DataFrame( num_attributes.apply( np.median ) ).T

#Dispersion - std, min, max, range, skew, kurtosis
d1 = pd.DataFrame( num_attributes.apply( np.std ) ).T
d2 = pd.DataFrame( num_attributes.apply( min ) ).T
d3 = pd.DataFrame( num_attributes.apply( max ) ).T
d4 = pd.DataFrame( num_attributes.apply( lambda x: x.max() - x.min() ) ).T
d5 = pd.DataFrame( num_attributes.apply( lambda x: x.skew() ) ).T
d6 = pd.DataFrame( num_attributes.apply( lambda x: x.kurtosis() ) ).T

# Concatenate
m = pd.concat( [d2, d3, d4, ct1, ct2, d1, d5, d6] ).T.reset_index()
#Rename columns
m.columns = ['attributes', 'min', 'max', 'range', 'mean', 'median', 'std', 'skew', 'kurtosis']
m
```

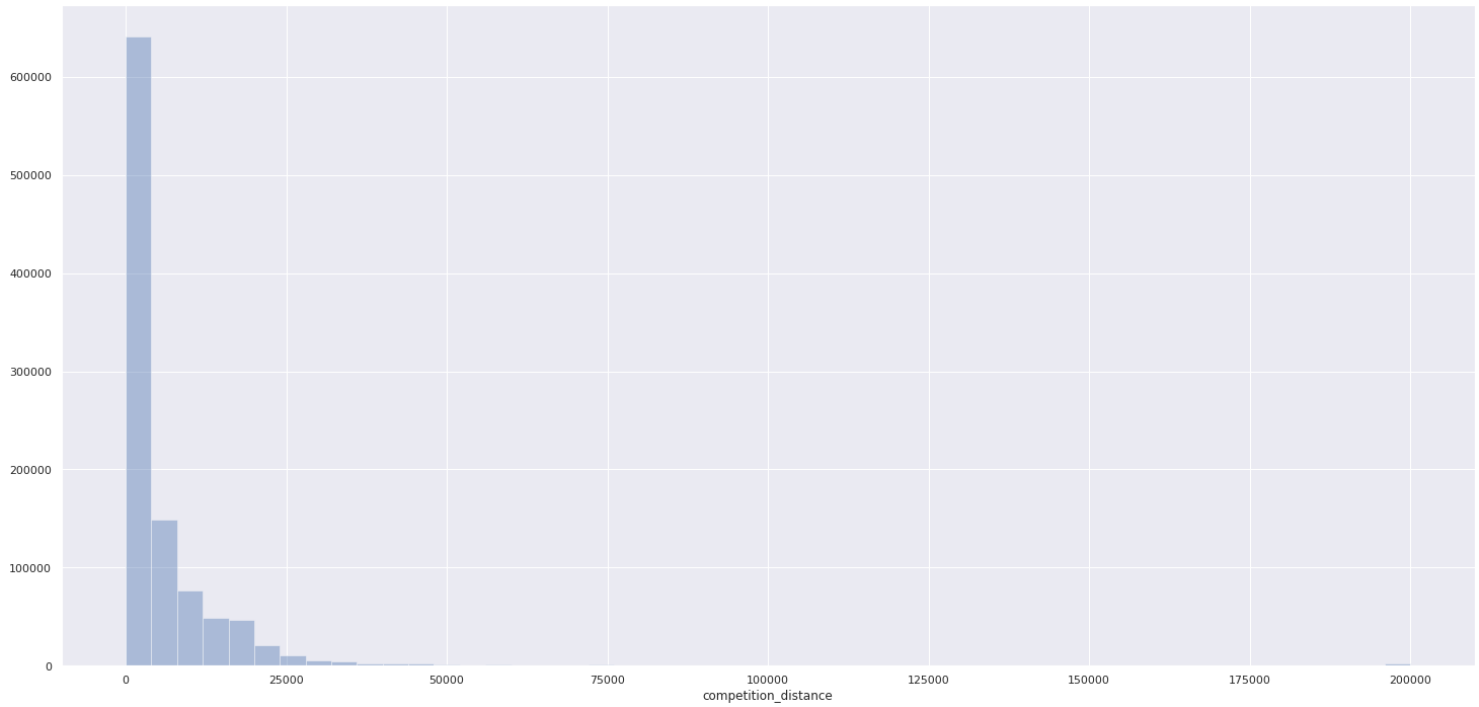
Out[17]:

	attributes	min	max	range	mean	median	std	skew	kurtosis
0	store	1.0	1115.0	1114.0	558.429727	558.0	321.908493	-0.000955	-1.200524
1	day_of_week	1.0	7.0	6.0	3.998341	4.0	1.997390	0.001593	-1.246873
2	sales	0.0	41551.0	41551.0	5773.818972	5744.0	3849.924283	0.641460	1.778375
3	customers	0.0	7388.0	7388.0	633.145946	609.0	464.411506	1.598650	7.091773
4	open	0.0	1.0	1.0	0.830107	1.0	0.375539	-1.758045	1.090723
5	promo	0.0	1.0	1.0	0.381515	0.0	0.485758	0.487838	-1.762018
6	school_holiday	0.0	1.0	1.0	0.178647	0.0	0.383056	1.677842	0.815154
7	competition_distance	20.0	200000.0	199980.0	5935.442677	2330.0	12547.646829	10.242344	147.789712
8	competition_open_since_month	1.0	12.0	11.0	6.786849	7.0	3.311085	-0.042076	-1.232607
9	competition_open_since_year	1900.0	2015.0	115.0	2010.324840	2012.0	5.515591	-7.235657	124.071304
10	promo2	0.0	1.0	1.0	0.500564	1.0	0.500000	-0.002255	-1.999999
11	promo2_since_week	1.0	52.0	51.0	23.619033	22.0	14.310057	0.178723	-1.184046
12	promo2_since_year	2009.0	2015.0	6.0	2012.793297	2013.0	1.662657	-0.784436	-0.210075
13	is_promo	0.0	1.0	1.0	0.155231	0.0	0.362124	1.904152	1.625796

In [18]:
```
sns.distplot( df1['competition_distance'], kde=False )
```

```
/home/leandro/.local/lib/python3.9/site-packages/seaborn/distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please a
dapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[18]:
```
<AxesSubplot:xlabel='competition_distance'>
```



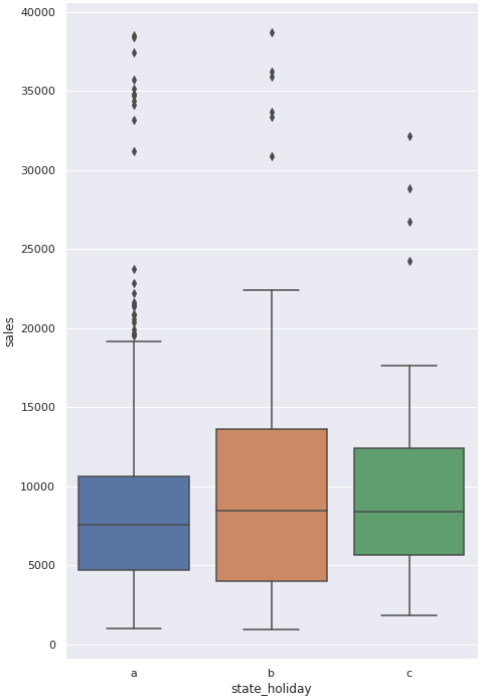
1.7.2 Caterigal Attributes

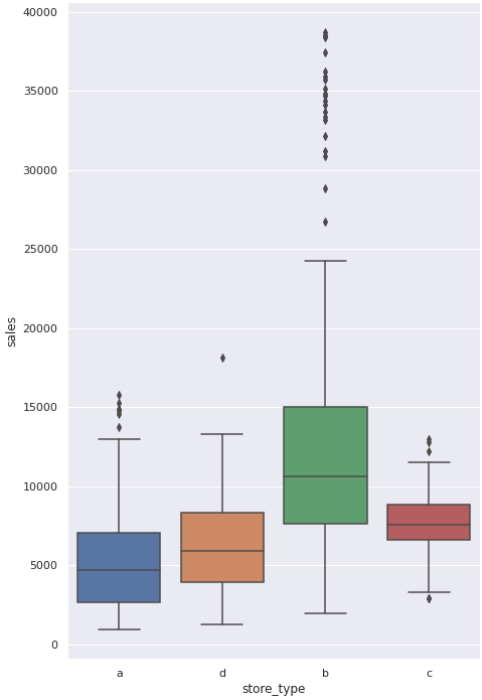
In [19]:
```
cat_attributes.apply( lambda x: x.unique().shape[0] )
```

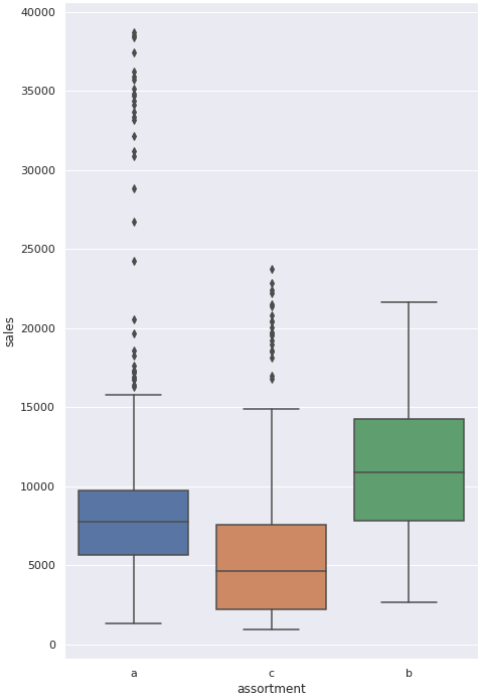
Out[19]:
```
state_holiday      4
store_type         4
assortment         3
promo_interval     4
month_map         12
dtype: int64
```

In [20]:
```
aux1 = df1[(df1['state_holiday'] != '0' ) & (df1['sales'] > 0)]

plt.subplot( 1, 3, 1)
sns.boxplot( x='state_holiday', y='sales', data=aux1 )

plt.subplot( 1, 3, 2)
sns.boxplot( x='store_type', y='sales', data=aux1 )

plt.subplot( 1, 3, 3)
sns.boxplot( x='assortment', y='sales', data=aux1 )
```

Out[20]:
```
<AxesSubplot:xlabel='assortment', ylabel='sales'>
```


sales
state_holiday
a
b
c


sales
store_type
a
d
b
c


sales
assortment
a
c
b