Importing libraries

In [178…

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
import plotly.express as px
warnings.filterwarnings('ignore')
```

Reading data

In [179…

```
df=pd.read_csv('hotel_bookings 2.csv')
```

In [180…

```
df
```

Out[180…

	hotel	is_canceled	lead_time	arrival_date_year	arrival_date_month	arrival_date_
0	Resort Hotel	0	342	2015	July	
1	Resort Hotel	0	737	2015	July	
2	Resort Hotel	0	7	2015	July	
3	Resort Hotel	0	13	2015	July	
4	Resort Hotel	0	14	2015	July	
...	...	...	...	...	...	
119385	City Hotel	0	23	2017	August	
119386	City Hotel	0	102	2017	August	
119387	City Hotel	0	34	2017	August	
119388	City Hotel	0	109	2017	August	
119389	City Hotel	0	205	2017	August	

119390 rows × 32 columns

Exploratory and Data analysis and Data Cleaning

In [181…
```
df.shape
```

Out[181… (119390, 32)

In [182…
```
for i in df.columns:
    print(i)
```

```
hotel
is_canceled
lead_time
arrival_date_year
arrival_date_month
arrival_date_week_number
arrival_date_day_of_month
stays_in_weekend_nights
stays_in_week_nights
adults
children
babies
meal
country
market_segment
distribution_channel
is_repeated_guest
previous_cancellations
previous_bookings_not_canceled
reserved_room_type
assigned_room_type
booking_changes
deposit_type
agent
company
days_in_waiting_list
customer_type
adr
required_car_parking_spaces
total_of_special_requests
reservation_status
reservation_status_date
```

In [183…

```
df.dtypes
```

Out[183…
```
hotel                             object
is_canceled                        int64
lead_time                          int64
arrival_date_year                  int64
arrival_date_month                object
arrival_date_week_number           int64
arrival_date_day_of_month          int64
stays_in_weekend_nights            int64
stays_in_week_nights               int64
adults                             int64
children                         float64
babies                             int64
meal                              object
country                           object
market_segment                    object
distribution_channel              object
is_repeated_guest                  int64
previous_cancellations             int64
previous_bookings_not_canceled     int64
reserved_room_type                object
assigned_room_type                object
booking_changes                    int64
deposit_type                      object
agent                            float64
company                          float64
days_in_waiting_list               int64
customer_type                     object
adr                              float64
required_car_parking_spaces        int64
total_of_special_requests          int64
reservation_status                object
reservation_status_date           object
dtype: object
```

In [184…
```
#reservation_status_date  is an object we need to convert it into a Date 
df['reservation_status_date']=pd.to_datetime(df['reservation_status_date'
```

In [185…
```
df.reservation_status_date.dtype
```

Out[185…
```
dtype('<M8[ns]')
```

In [186…
```
#Looking at the data's statistical info
df.describe()
```

Out[186…

	is_canceled	lead_time	arrival_date_year	arrival_date_week_number	arrival_
count	119390.000000	119390.000000	119390.000000	119390.000000	
mean	0.370416	104.011416	2016.156554	27.165173	
std	0.482918	106.863097	0.707476	13.605138	
min	0.000000	0.000000	2015.000000	1.000000	
25%	0.000000	18.000000	2016.000000	16.000000	
50%	0.000000	69.000000	2016.000000	28.000000	
75%	1.000000	160.000000	2017.000000	38.000000	
max	1.000000	737.000000	2017.000000	53.000000	

In [187…

```
#we can see that there is a outliers in adr column so we need to get rid
#Removing outliers
# Calculate the first and third quartiles of the data
q1, q3 = df['adr'].quantile([0.25, 0.75])

# Calculate the IQR
iqr = q3 - q1

# Define the lower and upper bounds for outliers
lower_bound = q1 - 1.5 * iqr
upper_bound = q3 + 1.5 * iqr

# Identify the data points outside the bounds
outliers = (df['adr'] < lower_bound) | (df['adr'] > upper_bound)

# Remove the outliers from the DataFrame
df = df[~outliers]
```

In [188…

```
len(df['days_in_waiting_list'].unique())
```

Out[188… 127

In [189…

```
#Deleting outlier for waiting days
# Calculate the first and third quartiles of the data
q1, q3 = df['days_in_waiting_list'].quantile([0.01, 0.99])

# Calculate the IQR
iqr = q3 - q1

# Define the lower and upper bounds for outliers
lower_bound = q1 - 1.5 * iqr
upper_bound = q3 + 1.5 * iqr

# Identify the data points outside the bounds
outliers = (df['days_in_waiting_list'] < lower_bound) | (df['days_in_wait

# Remove the outliers from the DataFrame
df = df[~outliers]
```

In [190…
```
len(df['days_in_waiting_list'].unique())
```

Out[190… 117

In [191…
```
#looking at freq and unique values for the catigorical info
df.describe(include='object')
```

Out[191…

	hotel	arrival_date_month	meal	country	market_segment	distribution_channel
count	115369	115369	115369	114889	115369	115369
unique	2	12	5	175	8	5
top	City Hotel	August	BB	PRT	Online TA	TA/TO
freq	77812	11971	89772	47147	53786	94793

In [192…
```
#dealing with null values
#we wanna see what columns include null values and percentage of the miss
for col,val in df.isnull().sum().items():
    if val>0:
        print(f'{col}, {val/df.shape[0]:.4f}')
```

```
children, 0.0000
country, 0.0042
agent, 0.1385
company, 0.9412
```

In [193…
```
#we can remove agent and country columns and we remove the rows with null
df.drop(['company','agent'],axis=1,inplace=True)
```

In [194…
```
df.dropna(inplace=True)
```

In [195…
```
#we can see that we don't have any null values
df.isnull().sum()
```

Out[195…

```
hotel                           0
is_canceled                     0
lead_time                       0
arrival_date_year               0
arrival_date_month              0
arrival_date_week_number        0
arrival_date_day_of_month       0
stays_in_weekend_nights         0
stays_in_week_nights            0
adults                          0
children                        0
babies                          0
meal                            0
country                         0
market_segment                  0
distribution_channel            0
is_repeated_guest               0
previous_cancellations          0
previous_bookings_not_canceled  0
reserved_room_type              0
assigned_room_type              0
booking_changes                 0
deposit_type                    0
days_in_waiting_list            0
customer_type                   0
adr                             0
required_car_parking_spaces     0
total_of_special_requests       0
reservation_status              0
reservation_status_date         0
dtype: int64
```

In [196…

```
#and we have no outliers that we can notice from this table too
df.describe()
```

Out[196…

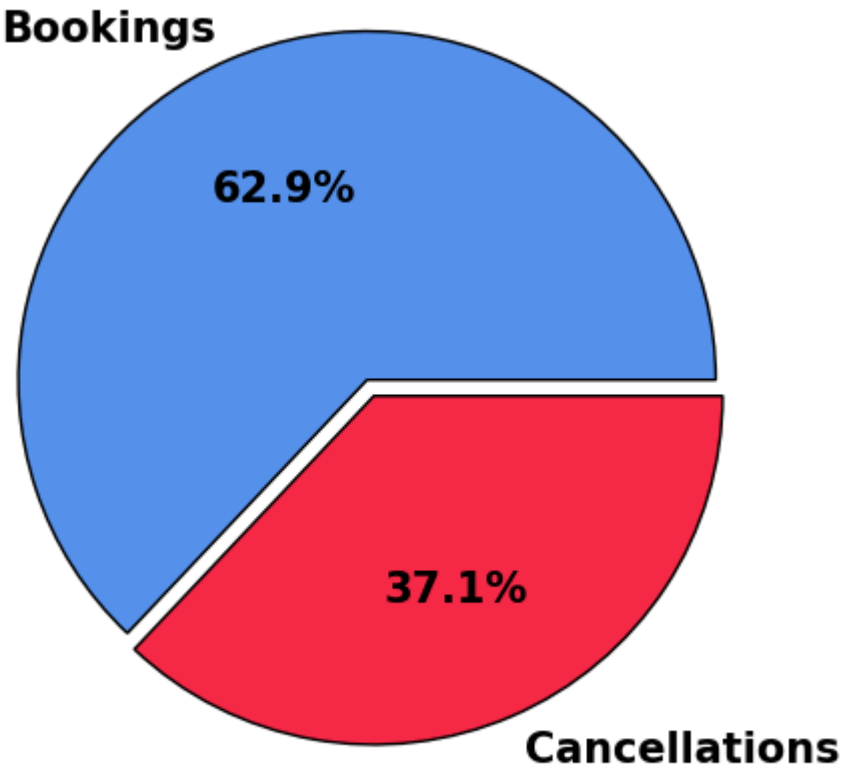
	is_canceled	lead_time	arrival_date_year	arrival_date_week_number	arrival_
count	114885.000000	114885.000000	114885.000000	114885.000000	
mean	0.370571	104.795369	2016.146103	27.037951	
std	0.482960	107.125215	0.707640	13.740513	
min	0.000000	0.000000	2015.000000	1.000000	
25%	0.000000	18.000000	2016.000000	16.000000	
50%	0.000000	70.000000	2016.000000	27.000000	
75%	1.000000	162.000000	2017.000000	38.000000	
max	1.000000	737.000000	2017.000000	53.000000	

Data Analysis and visualization

In [208…

```
plt.figure(figsize=(14, 5))
colors= ['#5991eb', '#f52a48']
ax=plt.pie(data=df, x=df.is_canceled.value_counts().values ,
           labels = ['Bookings', 'Cancellations'], colors = colors
           , autopct='%.1f%%',
           wedgeprops = {"edgecolor" : "black",},
          explode = (0.05, 0),
         textprops={'fontsize':15, 'weight':'bold'})

plt.xlabel('Overall Bookings and Cancellations%',fontsize=15,weight='bold
plt.rcParams['font.size'] = 13.0
plt.xticks()
plt.yticks()
plt.tight_layout()
plt.show()
```

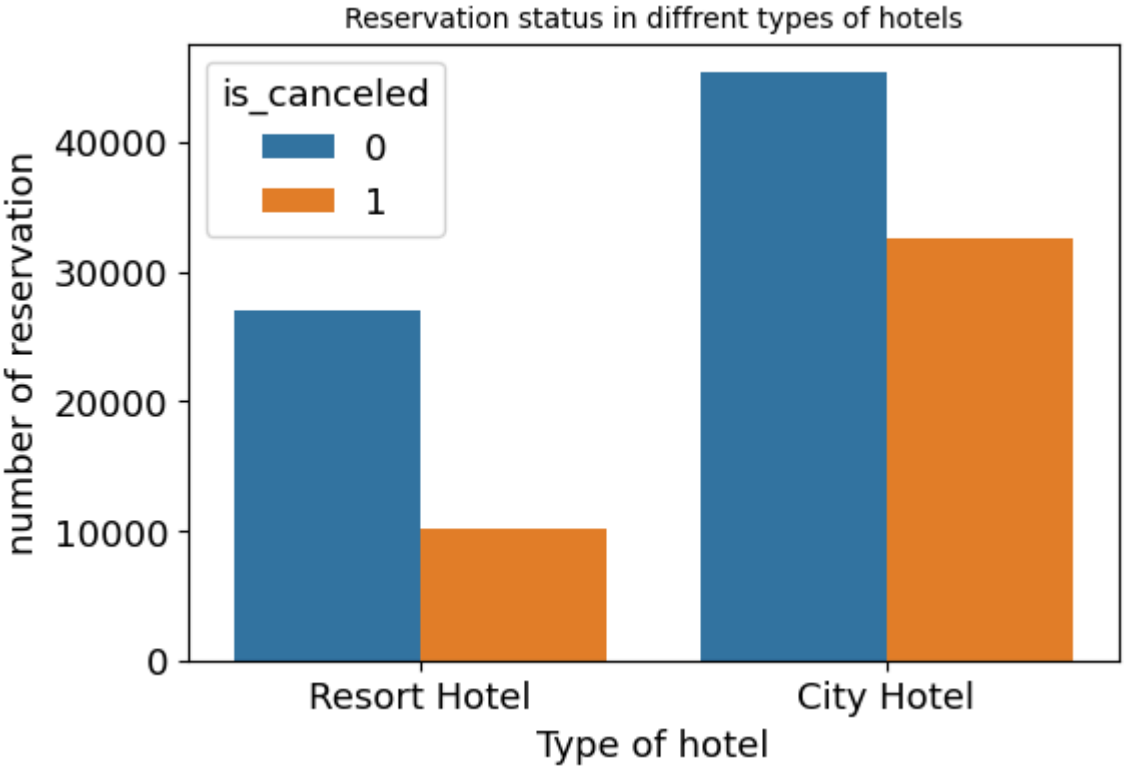


Overall Bookings and Cancellations%

1-type of the hotel and cancelation numbers

In [198…

```
plt.figure(figsize=(6,4))
ax1=sns.countplot(x='hotel',hue='is_canceled',data=df)
leg_labels,_=ax1.get_legend_handles_labels()
plt.title('Reservation status in diffrent types of hotels',size=10)
plt.xlabel('Type of hotel')
plt.ylabel('number of reservation')
plt.show()
```



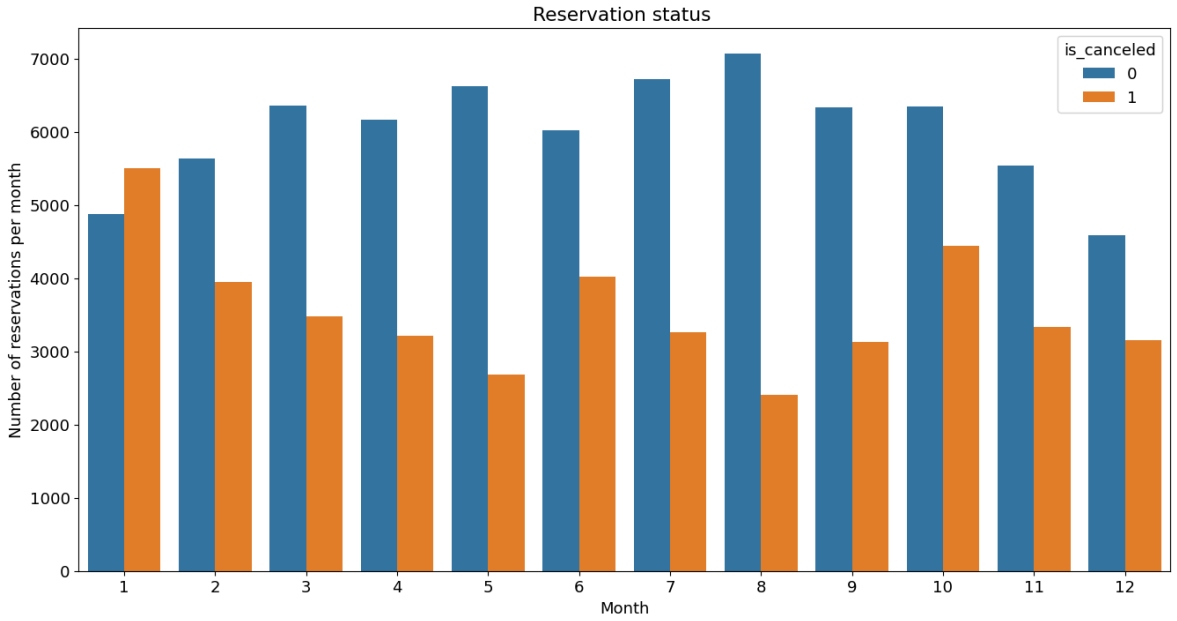
What we can understand from the figure above:

*We can see that the number of cancelation is way higher in city hotels

2-checking cancellation numbers each month and adr for each month

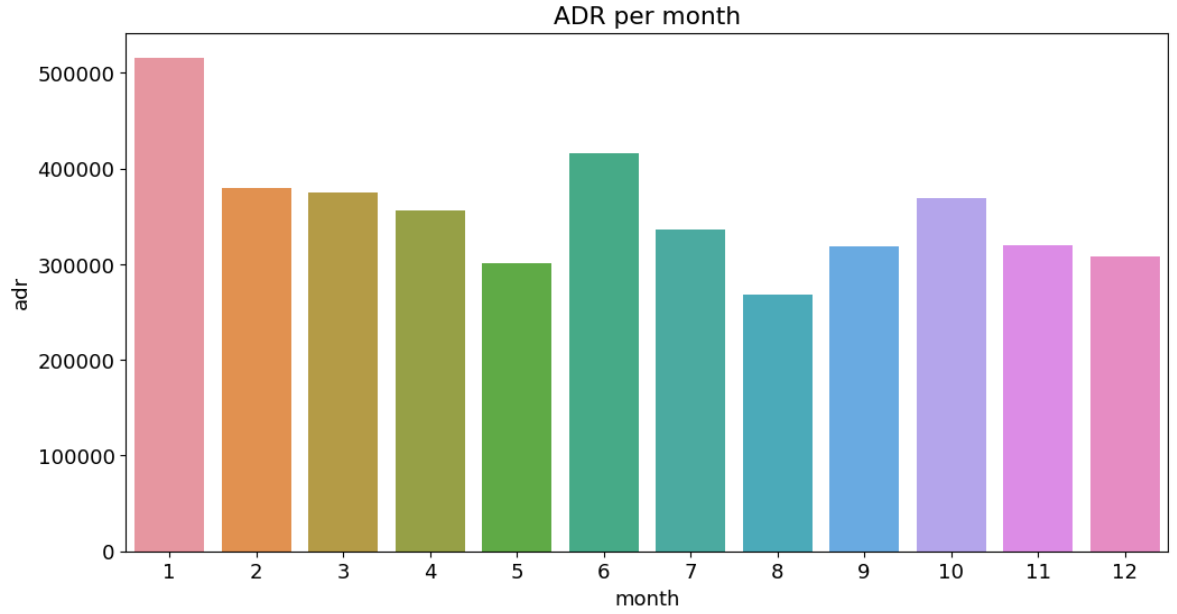
In [199…

```
df['month']=df.reservation_status_date.dt.month
plt.figure(figsize=(16,8))
ax1=sns.countplot(x='month',hue='is_canceled',data=df,width=0.8)
plt.title('Reservation status ')
plt.xlabel('Month')
plt.ylabel('Number of reservations per month')
plt.show()
```



In [200…

```
plt.figure(figsize=(12,6))
df_cancelled = df[df['is_canceled'] == 1]
df_cancelled_by_month = df_cancelled.groupby('month')[['adr']].sum().rese
sns.barplot(x='month', y='adr', data=df_cancelled_by_month)
plt.title('ADR per month')
plt.show()
```



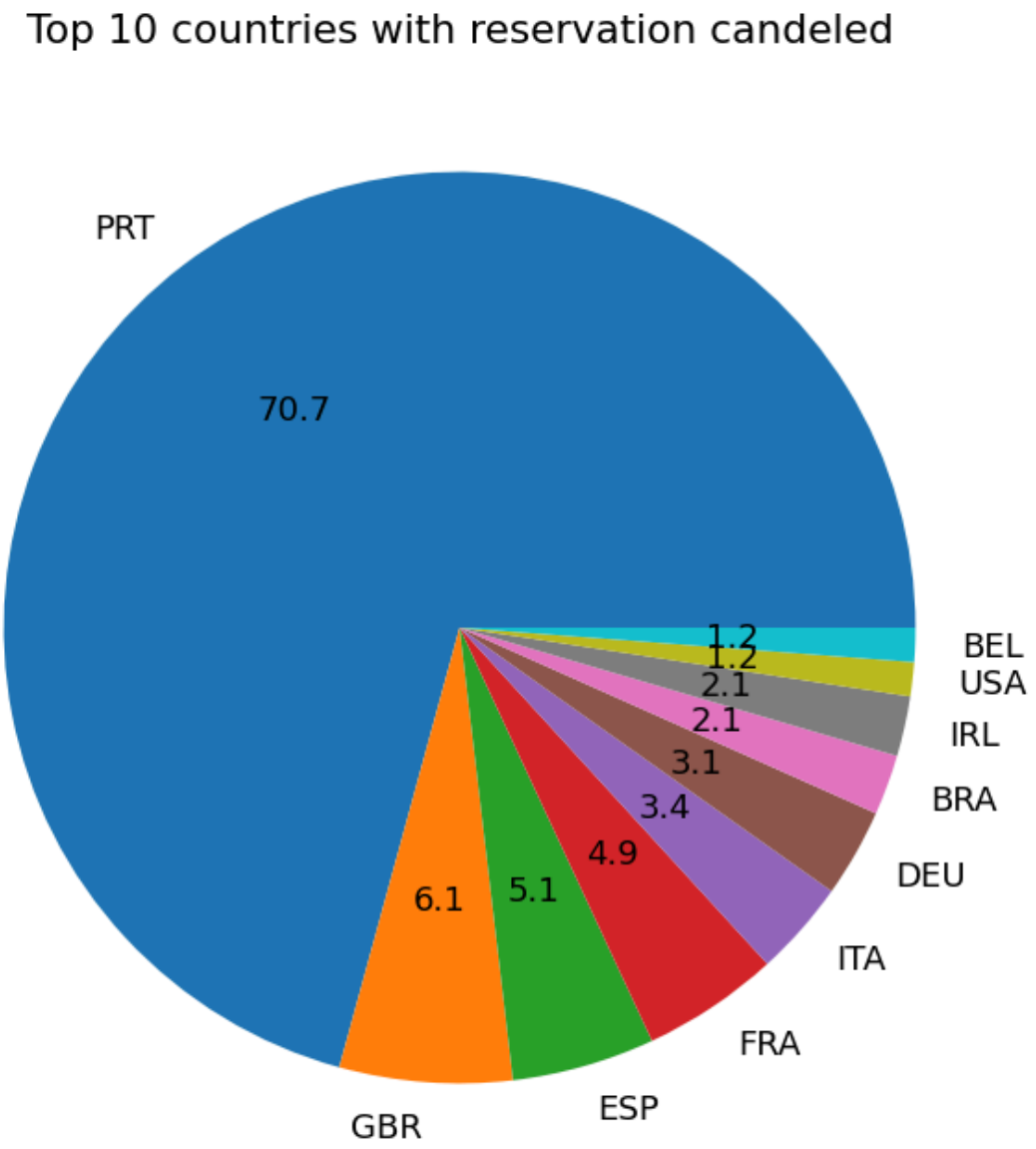
3-checking the top 10 countries that cancel the reservation

In [252…

```
country_cancel=df[df['is_canceled']==1]
top_10_country=country_cancel['country'].value_counts()[:10]
country_count=top_10_country.values
country_name=top_10_country.index
#plotting the top 10 countries
fig=px.scatter_geo(data_frame=top_10_country,locations=country_name,size=
color='country', hover_data={'country':False})
fig.show()
```

In [251…

```
country_cancel=df[df['is_canceled']==1]
top_10_country=country_cancel['country'].value_counts()[:10]
#plotting the top 10 countries
plt.figure(figsize=(8,8))
plt.title('Top 10 countries with reservation candeled')
plt.pie(top_10_country,autopct='%.1f',labels=top_10_country.index)
plt.show()
```

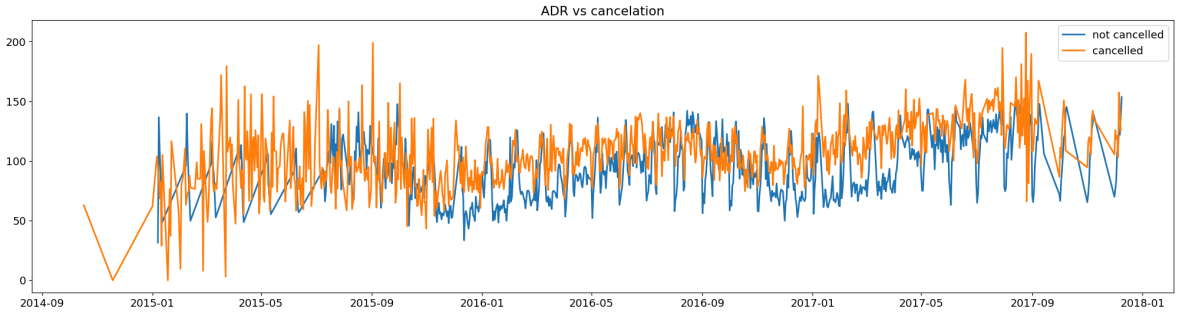


4-checking if higher prices cause more cancellations

In [203…
```
canceled=df[df['is_canceled']==1]
adr_canceled=canceled.groupby('reservation_status_date')[['adr']].mean()
adr_canceled=adr_canceled.sort_values('reservation_status_date',ascending=
not_canceled=df[df['is_canceled']==0]
adr_not_canceled=not_canceled.groupby('reservation_status_date')[['adr']]
adr_not_canceled=adr_not_canceled.sort_values('reservation_status_date',as
```

In [204…
```
#plotting
plt.figure(figsize=(25,6))
plt.title('ADR vs cancelation')
plt.plot(adr_not_canceled.index,adr_not_canceled['adr'],label='not cancel
plt.plot(adr_canceled.index,adr_canceled['adr'],linewidth=2,label='cancel
plt.legend()
```

Out[204…
```
<matplotlib.legend.Legend at 0x1b5364fe440>
```



Market Segment

In [253…
```
d = df['market_segment'].value_counts()
plt.figure(figsize=(10,10))
p = plt.pie(d, labels=d.index, autopct="%.0f%%")
plt.title("Bookings by market segment")
```

Out[253… `Text(0.5, 1.0, 'Bookings by market segment')`