

```
In [3]: import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

C:\Users\Kartik\anaconda3\Lib\site-packages\pandas\core\arrays\masked.py:60: UserWarning: Pandas requires version '1.3.6' or newer of 'bottleneck' (version '1.3.5' currently installed).

```
    from pandas.core import (
```

```
In [4]: df=pd.read_csv('hotel_bookings_2.csv')
```

```
In [5]: df.head()
```

```
Out[5]:   hotel  is_canceled  lead_time  arrival_date_year  arrival_date_month  arrival_date_week_number
```

<b>0</b>	Resort Hotel	0	342	2015	July	27
<b>1</b>	Resort Hotel	0	737	2015	July	27
<b>2</b>	Resort Hotel	0	7	2015	July	27
<b>3</b>	Resort Hotel	0	13	2015	July	27
<b>4</b>	Resort Hotel	0	14	2015	July	27

5 rows × 32 columns

```
In [6]: df.tail()
```

```
Out[6]:   hotel  is_canceled  lead_time  arrival_date_year  arrival_date_month  arrival_date_week_num
```

<b>119385</b>	City Hotel	0	23	2017	August
<b>119386</b>	City Hotel	0	102	2017	August
<b>119387</b>	City Hotel	0	34	2017	August
<b>119388</b>	City Hotel	0	109	2017	August
<b>119389</b>	City Hotel	0	205	2017	August

5 rows × 32 columns

```
In [7]: df.shape
```

```
Out[7]: (119390, 32)
```

In [8]: `df.columns`

```
Out[8]: Index(['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'],
      dtype='object')
```

In [9]: `df.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 119390 entries, 0 to 119389
Data columns (total 32 columns):
 #   Column           Non-Null Count  Dtype  
 --- 
 0   hotel            119390 non-null   object 
 1   is_canceled      119390 non-null   int64  
 2   lead_time         119390 non-null   int64  
 3   arrival_date_year 119390 non-null   int64  
 4   arrival_date_month 119390 non-null   object 
 5   arrival_date_week_number 119390 non-null   int64  
 6   arrival_date_day_of_month 119390 non-null   int64  
 7   stays_in_weekend_nights 119390 non-null   int64  
 8   stays_in_week_nights   119390 non-null   int64  
 9   adults            119390 non-null   int64  
 10  children          119386 non-null   float64 
 11  babies             119390 non-null   int64  
 12  meal               119390 non-null   object 
 13  country            118902 non-null   object 
 14  market_segment      119390 non-null   object 
 15  distribution_channel 119390 non-null   object 
 16  is_repeated_guest    119390 non-null   int64  
 17  previous_cancellations 119390 non-null   int64  
 18  previous_bookings_not_canceled 119390 non-null   int64  
 19  reserved_room_type    119390 non-null   object 
 20  assigned_room_type     119390 non-null   object 
 21  booking_changes       119390 non-null   int64  
 22  deposit_type          119390 non-null   object 
 23  agent                103050 non-null   float64 
 24  company              6797 non-null    float64 
 25  days_in_waiting_list 119390 non-null   int64  
 26  customer_type         119390 non-null   object 
 27  adr                  119390 non-null   float64 
 28  required_car_parking_spaces 119390 non-null   int64  
 29  total_of_special_requests 119390 non-null   int64  
 30  reservation_status     119390 non-null   object 
 31  reservation_status_date 119390 non-null   object 

dtypes: float64(4), int64(16), object(12)
memory usage: 29.1+ MB
```

In [10]: `df['reservation_status_date'] = pd.to_datetime(df['reservation_status_date'], format`

In [11]: `df.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 119390 entries, 0 to 119389
Data columns (total 32 columns):
 #   Column           Non-Null Count  Dtype  
--- 
 0   hotel            119390 non-null   object  
 1   is_canceled      119390 non-null   int64  
 2   lead_time         119390 non-null   int64  
 3   arrival_date_year 119390 non-null   int64  
 4   arrival_date_month 119390 non-null   object  
 5   arrival_date_week_number 119390 non-null   int64  
 6   arrival_date_day_of_month 119390 non-null   int64  
 7   stays_in_weekend_nights 119390 non-null   int64  
 8   stays_in_week_nights 119390 non-null   int64  
 9   adults            119390 non-null   int64  
 10  children          119386 non-null   float64 
 11  babies             119390 non-null   int64  
 12  meal               119390 non-null   object  
 13  country            118902 non-null   object  
 14  market_segment     119390 non-null   object  
 15  distribution_channel 119390 non-null   object  
 16  is_repeated_guest 119390 non-null   int64  
 17  previous_cancellations 119390 non-null   int64  
 18  previous_bookings_not_canceled 119390 non-null   int64  
 19  reserved_room_type 119390 non-null   object  
 20  assigned_room_type 119390 non-null   object  
 21  booking_changes    119390 non-null   int64  
 22  deposit_type       119390 non-null   object  
 23  agent               103050 non-null   float64 
 24  company             6797 non-null    float64 
 25  days_in_waiting_list 119390 non-null   int64  
 26  customer_type       119390 non-null   object  
 27  adr                 119390 non-null   float64 
 28  required_car_parking_spaces 119390 non-null   int64  
 29  total_of_special_requests 119390 non-null   int64  
 30  reservation_status  119390 non-null   object  
 31  reservation_status_date 119390 non-null   datetime64[ns]
dtypes: datetime64[ns](1), float64(4), int64(16), object(11)
memory usage: 29.1+ MB
```

In [12]: `df.describe(include='object')`

	hotel	arrival_date_month	meal	country	market_segment	distribution_channel	reser
<b>count</b>	119390	119390	119390	118902	119390	119390	
<b>unique</b>	2	12	5	177	8		5
<b>top</b>	City Hotel	August	BB	PRT	Online TA		TA/TO
<b>freq</b>	79330	13877	92310	48590	56477		97870

In [13]: `for col in df.describe(include='object').columns:  
 print(col)  
 print(df[col].unique())  
 print('-'*50)`

```

hotel
['Resort Hotel' 'City Hotel']

arrival_date_month
['July' 'August' 'September' 'October' 'November' 'December' 'January'
 'February' 'March' 'April' 'May' 'June']

meal
['BB' 'FB' 'HB' 'SC' 'Undefined']

country
['PRT' 'GBR' 'USA' 'ESP' 'IRL' 'FRA' nan 'ROU' 'NOR' 'OMN' 'ARG' 'POL'
 'DEU' 'BEL' 'CHE' 'CN' 'GRC' 'ITA' 'NLD' 'DNK' 'RUS' 'SWE' 'AUS' 'EST'
 'CZE' 'BRA' 'FIN' 'MOZ' 'BWA' 'LUX' 'SVN' 'ALB' 'IND' 'CHN' 'MEX' 'MAR'
 'UKR' 'SMR' 'LVA' 'PRI' 'SRB' 'CHL' 'AUT' 'BLR' 'LTU' 'TUR' 'ZAF' 'AGO'
 'ISR' 'CYM' 'ZMB' 'CPV' 'ZWE' 'DZA' 'KOR' 'CRI' 'HUN' 'ARE' 'TUN' 'JAM'
 'HRV' 'HKG' 'IRN' 'GEO' 'AND' 'GIB' 'URY' 'JEY' 'CAF' 'CYP' 'COL' 'GGY'
 'KWT' 'NGA' 'MDV' 'VEN' 'SVK' 'FJI' 'KAZ' 'PAK' 'IDN' 'LBN' 'PHL' 'SEN'
 'SYC' 'AZE' 'BHR' 'NZL' 'THA' 'DOM' 'MKD' 'MYS' 'ARM' 'JPN' 'LKA' 'CUB'
 'CMR' 'BIH' 'MUS' 'COM' 'SUR' 'UGA' 'BGR' 'CIV' 'JOR' 'SYR' 'SGP' 'BDI'
 'SAU' 'VNM' 'PLW' 'QAT' 'EGY' 'PER' 'MLT' 'MWI' 'ECU' 'MDG' 'ISL' 'UZB'
 'NPL' 'BHS' 'MAC' 'TGO' 'TWN' 'DJI' 'STP' 'KNA' 'ETH' 'IRQ' 'HND' 'RWA'
 'KHM' 'MCO' 'BGD' 'IMN' 'TJK' 'NIC' 'BEN' 'VGB' 'TZA' 'GAB' 'GHA' 'TMP'
 'GLP' 'KEN' 'LIE' 'GNB' 'MNE' 'UMI' 'MYT' 'FRO' 'MMR' 'PAN' 'BFA' 'LBY'
 'MLI' 'NAM' 'BOL' 'PRY' 'BRB' 'ABW' 'AIA' 'SLV' 'DMA' 'PYF' 'GUY' 'LCA'
 'ATA' 'GTM' 'ASM' 'MRT' 'NCL' 'KIR' 'SDN' 'ATF' 'SLE' 'LAO']

market_segment
['Direct' 'Corporate' 'Online TA' 'Offline TA/TO' 'Complementary' 'Groups'
 'Undefined' 'Aviation']

distribution_channel
['Direct' 'Corporate' 'TA/TO' 'Undefined' 'GDS']

reserved_room_type
['C' 'A' 'D' 'E' 'G' 'F' 'H' 'L' 'P' 'B']

assigned_room_type
['C' 'A' 'D' 'E' 'G' 'F' 'I' 'B' 'H' 'P' 'L' 'K']

deposit_type
['No Deposit' 'Refundable' 'Non Refund']

customer_type
['Transient' 'Contract' 'Transient-Party' 'Group']

reservation_status
['Check-Out' 'Canceled' 'No-Show']

```

In [14]: df.isnull().sum()

```
Out[14]: 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           4
         babies             0
         meal               0
         country           488
         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
         agent              16340
         company            112593
         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 [15]: df.drop(['company', 'agent'], axis=1, inplace=True)
df.dropna(inplace=True)
```

```
In [16]: df.isnull().sum()
```

```
Out[16]: 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 [17]: `df.describe()`

	<b>is_canceled</b>	<b>lead_time</b>	<b>arrival_date_year</b>	<b>arrival_date_week_number</b>	<b>arrival_date_day_</b>
<b>count</b>	118898.000000	118898.000000	118898.000000	118898.000000	118898.000000
<b>mean</b>	0.371352	104.311435	2016.157656	27.166555	118898.000000
<b>min</b>	0.000000	0.000000	2015.000000	1.000000	1.000000
<b>25%</b>	0.000000	18.000000	2016.000000	16.000000	16.000000
<b>50%</b>	0.000000	69.000000	2016.000000	28.000000	28.000000
<b>75%</b>	1.000000	161.000000	2017.000000	38.000000	38.000000
<b>max</b>	1.000000	737.000000	2017.000000	53.000000	53.000000
<b>std</b>	0.483168	106.903309	0.707459	13.589971	13.589971

In [18]: `df=df[df['adr']<5000]`

In [19]: `df.describe()`

Out[19]:

	is_canceled	lead_time	arrival_date_year	arrival_date_week_number	arrival_date_day
<b>count</b>	118897.000000	118897.000000	118897.000000	118897.000000	118897.000000
<b>mean</b>	0.371347	104.312018	2016.157657	27.166674	
<b>min</b>	0.000000	0.000000	2015.000000	1.000000	
<b>25%</b>	0.000000	18.000000	2016.000000	16.000000	
<b>50%</b>	0.000000	69.000000	2016.000000	28.000000	
<b>75%</b>	1.000000	161.000000	2017.000000	38.000000	
<b>max</b>	1.000000	737.000000	2017.000000	53.000000	
<b>std</b>	0.483167	106.903570	0.707462	13.589966	

◀ ▶

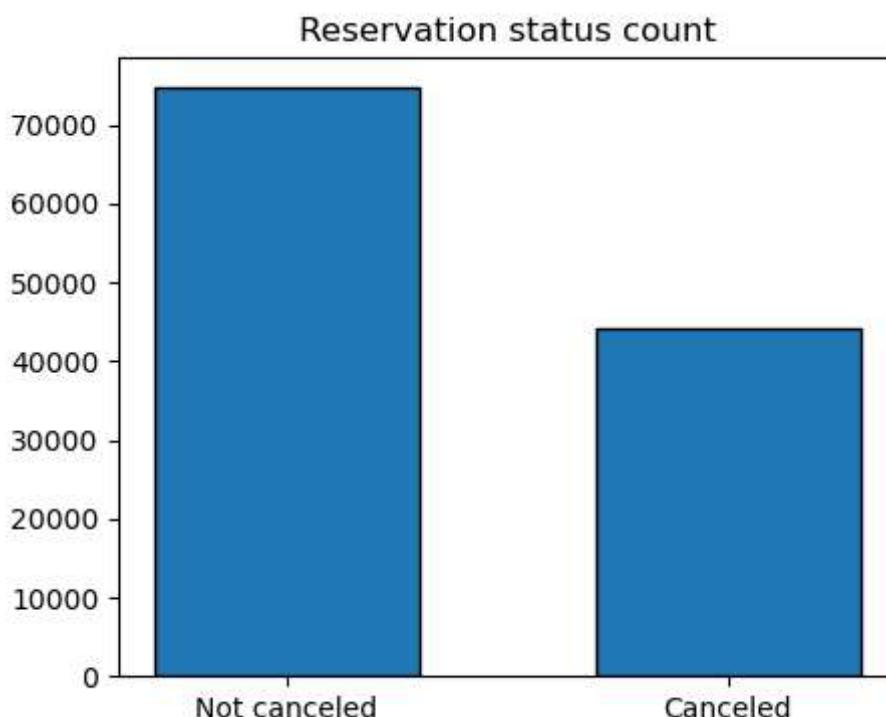
## Data Analysis and Visualizations

In [20]:

```
cancelled_perc=df['is_canceled'].value_counts(normalize=True)
print(cancelled_perc)

plt.figure(figsize=(5,4))
plt.title('Reservation status count')
plt.bar(['Not canceled','Canceled'],df['is_canceled'].value_counts(),edgecolor='k')
plt.show()
```

```
is_canceled
0    0.628653
1    0.371347
Name: proportion, dtype: float64
```



In [26]:

```
import matplotlib.transforms as transforms
```

In [27]:

```
plt.figure(figsize=(8, 4))
ax1 = sns.countplot(x='hotel', hue='is_canceled', data=df, palette='Blues')
```

```
legend_labels, _ = ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['not canceled', 'canceled'], bbox_to_anchor=(1, 1))
plt.title('Reservation status in different hostels', size=20)
plt.xlabel('hostel')
plt.ylabel('number of reservations')
plt.show()
```



```
In [29]: resort_hotel=df[df['hotel']=='Resort Hotel']
resort_hotel['is_canceled'].value_counts(normalize=True)
```

```
Out[29]: is_canceled
0    0.72025
1    0.27975
Name: proportion, dtype: float64
```

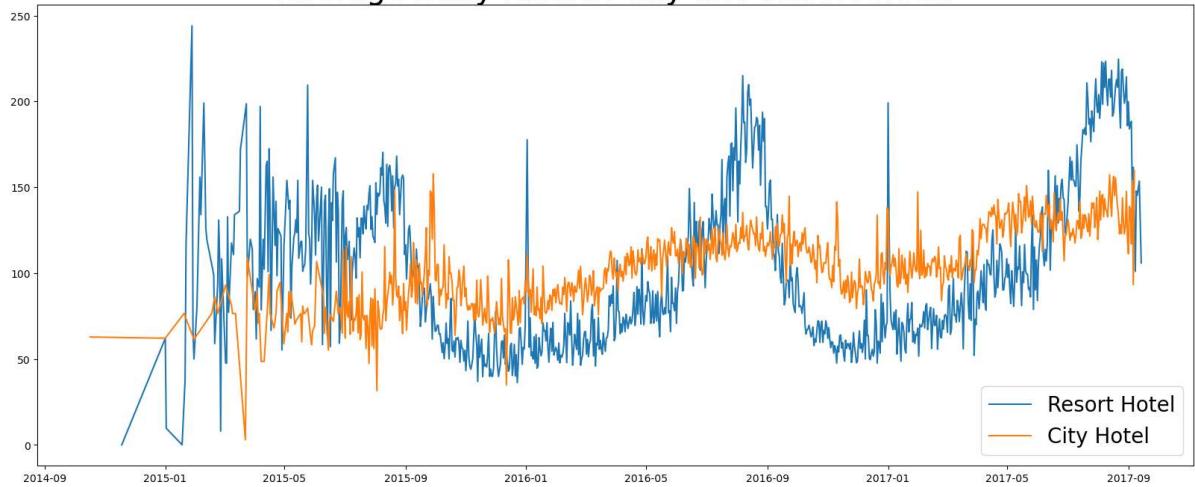
```
In [31]: city_hotel=df[df['hotel']=='City Hotel']
city_hotel['is_canceled'].value_counts(normalize=True)
```

```
Out[31]: is_canceled
0    0.582918
1    0.417082
Name: proportion, dtype: float64
```

```
In [32]: resort_hotel= resort_hotel.groupby('reservation_status_date')[['adr']].mean()
city_hotel=city_hotel.groupby('reservation_status_date')[['adr']].mean()
```

```
In [35]: plt.figure(figsize=(20,8))
plt.title('Average Daily Rate in City and Resort Hotel', fontsize=30)
plt.plot(resort_hotel.index,resort_hotel['adr'],label='Resort Hotel')
plt.plot(city_hotel.index,city_hotel['adr'],label='City Hotel')
plt.legend(fontsize=20)
plt.show()
```

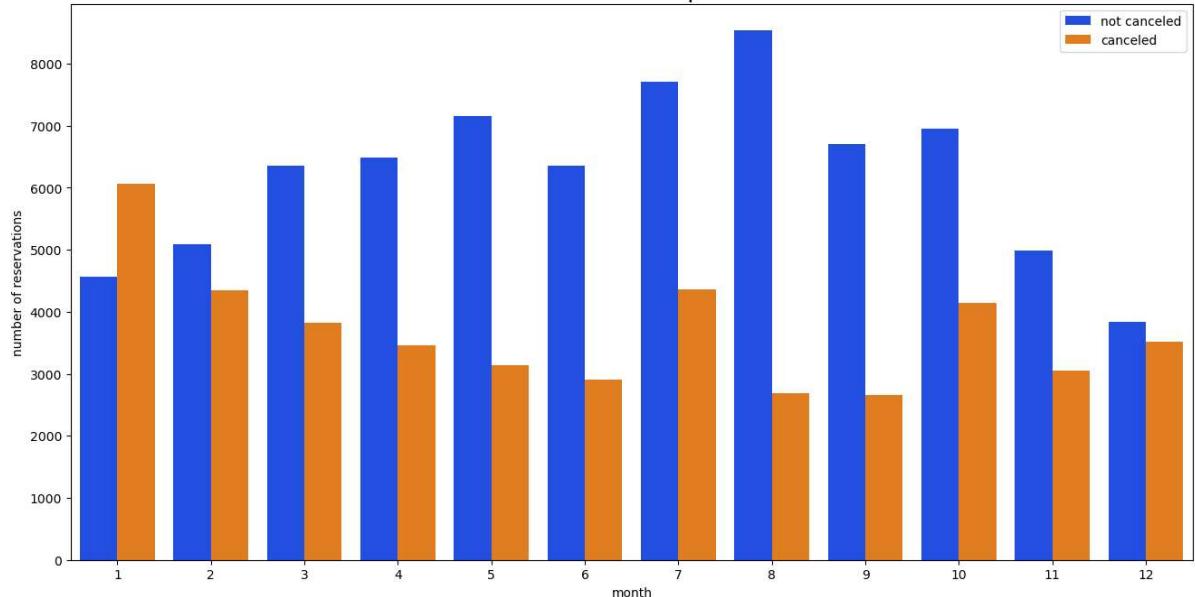
## Average Daily Rate in City and Resort Hotel



```
In [36]: df['month']=df['reservation_status_date'].dt.month
```

```
plt.figure(figsize=(16,8))
ax1=sns.countplot(x='month',hue='is_canceled',data=df,palette='bright')
legends_labels,_=ax1.get_legend_handles_labels()
ax1.legend(bbox_to_anchor=(1,1))
plt.title('Reservation status per month',size=20)
plt.xlabel('month')
plt.ylabel('number of reservations')
plt.legend(['not canceled','canceled'])
plt.show()
```

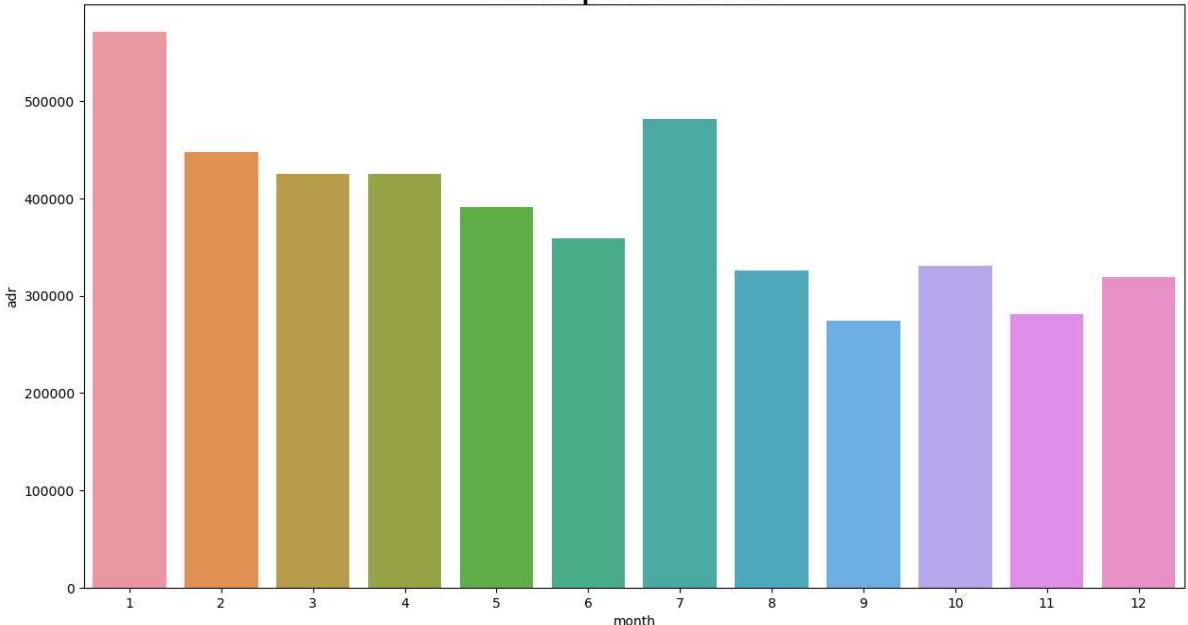
Reservation status per month



```
In [39]: plt.figure(figsize=(15, 8))
```

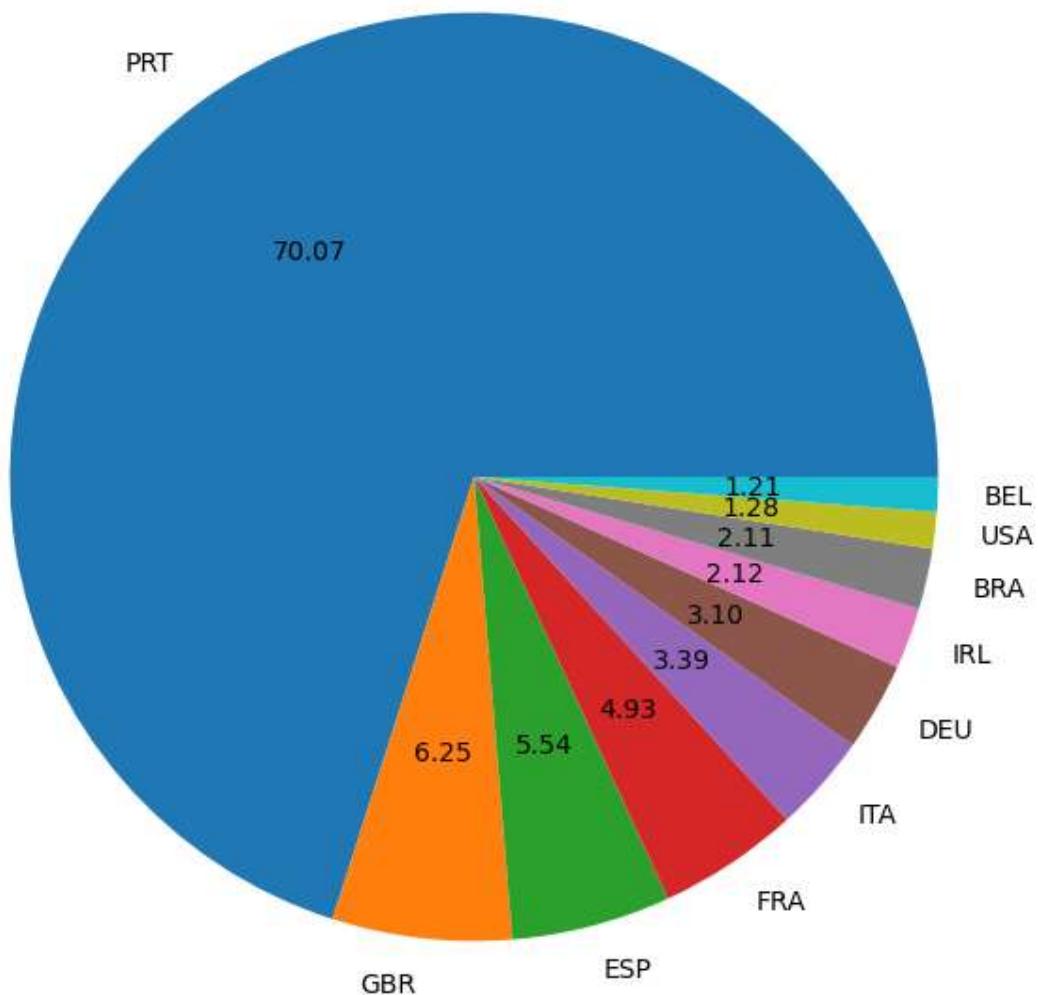
```
plt.title('ADR per month', fontsize=30)
sns.barplot(x='month', y='adr', data=df[df['is_canceled'] == 1].groupby('month')[[]]
plt.show()
```

## ADR per month



```
In [40]: cancelled_data=df[df['is_canceled']==1]
top_10_country=cancelled_data['country'].value_counts()[:10]
plt.figure(figsize=(8,8))
plt.title('Top 10 countries with reservation canceled')
plt.pie(top_10_country, autopct='%.2f', labels=top_10_country.index)
plt.show()
```

## Top 10 countries with reservation canceled



```
In [41]: df['market_segment'].value_counts()
```

```
Out[41]: market_segment
Online TA      56402
Offline TA/T0  24159
Groups         19806
Direct          12448
Corporate       5111
Complementary   734
Aviation        237
Name: count, dtype: int64
```

```
In [42]: df['market_segment'].value_counts(normalize=True)
```

```
Out[42]: market_segment
Online TA      0.474377
Offline TA/T0  0.203193
Groups         0.166581
Direct          0.104696
Corporate       0.042987
Complementary   0.006173
Aviation        0.001993
Name: proportion, dtype: float64
```

```
In [43]: cancelled_data['market_segment'].value_counts(normalize=True)
```

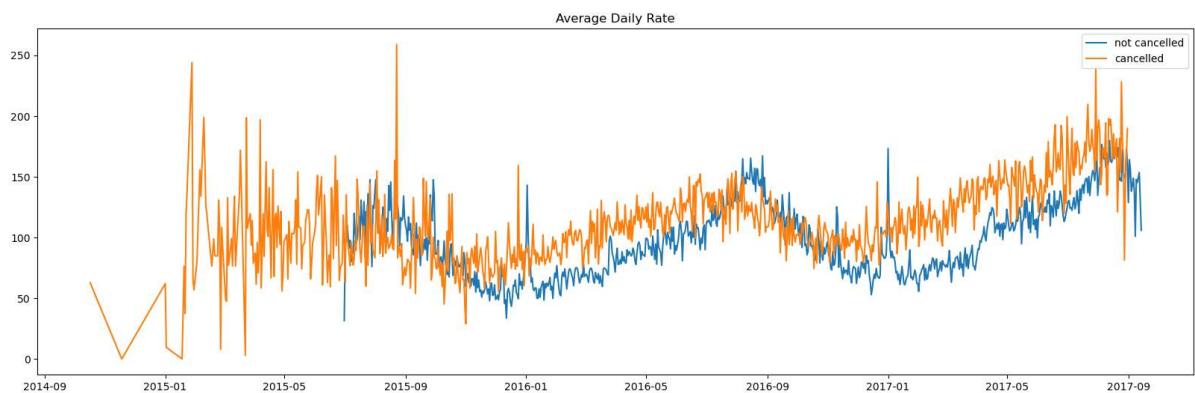
```
Out[43]: market_segment
Online TA      0.469696
Groups         0.273985
Offline TA/T0  0.187466
Direct          0.043486
Corporate       0.022151
Complementary   0.002038
Aviation        0.001178
Name: proportion, dtype: float64
```

```
In [49]: cancelled_df_adr=cancelled_data.groupby('reservation_status_date')[['adr']].mean()
cancelled_df_adr.reset_index(inplace=True)
cancelled_df_adr.sort_values('reservation_status_date', inplace=True)

not_cancelled_df=df[df['is_canceled']==0]
not_cancelled_df_adr=not_cancelled_df.groupby('reservation_status_date')[['adr']].mean()
not_cancelled_df_adr.reset_index(inplace=True)
not_cancelled_df_adr.sort_values('reservation_status_date', inplace=True)

plt.figure(figsize=(20,6))
plt.title('Average Daily Rate')
plt.plot(not_cancelled_df_adr['reservation_status_date'],not_cancelled_df_adr['adr'],
         color='blue',label='not cancelled')
plt.plot(cancelled_df_adr['reservation_status_date'],cancelled_df_adr['adr'],color='orange',
         label='cancelled')
plt.legend()
```

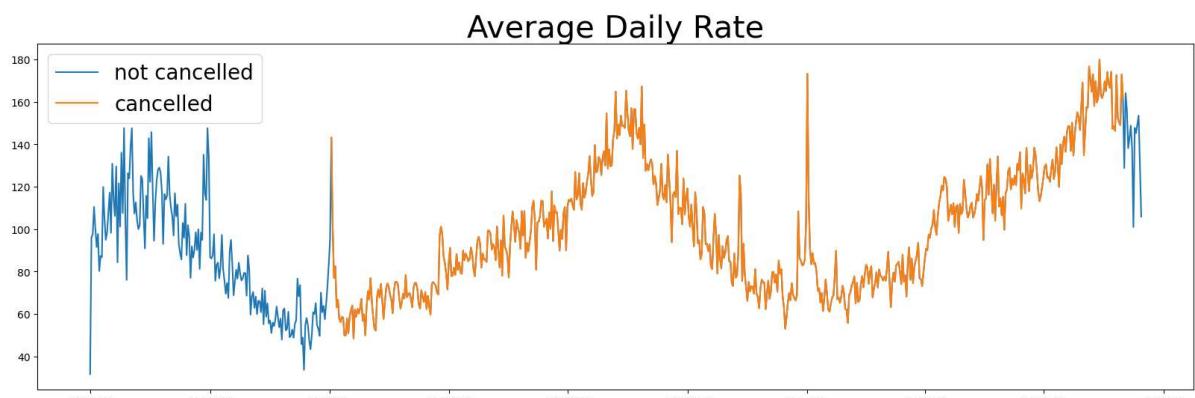
```
Out[49]: <matplotlib.legend.Legend at 0x1e939f61bd0>
```



```
In [50]: cancelled_df_adr=cancelled_df_adr[(cancelled_df_adr['reservation_status_date']>'2014-09-01') & (cancelled_df_adr['reservation_status_date']<'2015-01-01')]
not_cancelled_df_adr=not_cancelled_df_adr[(not_cancelled_df_adr['reservation_status_date']>'2014-09-01') & (not_cancelled_df_adr['reservation_status_date']<'2015-01-01')]
```

```
In [52]: plt.figure(figsize=(20,6))
plt.title('Average Daily Rate', fontsize=30)
plt.plot(not_cancelled_df_adr['reservation_status_date'],not_cancelled_df_adr['adr'],
         color='blue',label='not cancelled')
plt.plot(cancelled_df_adr['reservation_status_date'],cancelled_df_adr['adr'],color='orange',
         label='cancelled')
plt.legend(fontsize=20)
```

```
Out[52]: <matplotlib.legend.Legend at 0x1e94294d850>
```



In [ ]: