In [87]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

In [88]:

```
df=pd.read_csv("D:\\2nd_Year Projects\\Hotel Booking(Python)\\DATA\\hotel_bookings 2.csv
```

In [89]:

```
df.head()
```

Out[89]:

	hotel	is_canceled	lead_time	arrival_date_year	arrival_date_month	arrival_date_week_number	arrival_date_
0	Resort Hotel	0	342	2015	July	27	
1	Resort Hotel	0	737	2015	July	27	
2	Resort Hotel	0	7	2015	July	27	
3	Resort Hotel	0	13	2015	July	27	
4	Resort Hotel	0	14	2015	July	27	

5 rows × 32 columns

In [90]:

```
df.tail()
```

Out[90]:

	hotel	is_canceled	lead_time	arrival_date_year	arrival_date_month	arrival_date_week_number	arrival_
119385	City Hotel	0	23	2017	August	35	
119386	City Hotel	0	102	2017	August	35	
119387	City Hotel	0	34	2017	August	35	
119388	City Hotel	0	109	2017	August	35	
119389	City Hotel	0	205	2017	August	35	

5 rows × 32 columns

In [91]:

```
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 [92]:

```
df.shape
```

Out[92]:

```
(119390, 32)
```

In [93]:

```
df.columns
```

Out[93]:

```
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 [96]:

```
df['reservation_status_date']=pd.to_datetime(df['reservation_status_date'])
```

In [97]:

```
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 [98]:

```
df.describe(include='object')
```

Out[98]:

	hotel	arrival_date_month	meal	country	market_segment	distribution_channel	reserved_room_typ
count	119390	119390	119390	118902	119390	119390	11939
unique	2	12	5	177	8	5	1
top	City Hotel	August	BB	PRT	Online TA	TA/TO	
freq	79330	13877	92310	48590	56477	97870	8599

In [99]:

```
for col in df.describe(include='object').columns:
    print(col)
    print(df[col].unique())
    print('-'*100)
```

```
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 [100…

```
df.isnull().sum()
```

Out[100]:

```
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 [101…

```python
df.drop(['company','agent'], axis = 1, inplace = True)
df.dropna(inplace = True)
```

In [102…

```python
df.isnull().sum()
```

Out[102]:

```
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 [103…

```python
df.describe()
```

Out[103]:

	is_canceled	lead_time	arrival_date_year	arrival_date_week_number	arrival_date_day_of_month
count	118898.000000	118898.000000	118898.000000	118898.000000	118898.000000
mean	0.371352	104.311435	2016.157656	27.166555	15.800880
std	0.483168	106.903309	0.707459	13.589971	8.780324
min	0.000000	0.000000	2015.000000	1.000000	1.000000
25%	0.000000	18.000000	2016.000000	16.000000	8.000000
50%	0.000000	69.000000	2016.000000	28.000000	16.000000
75%	1.000000	161.000000	2017.000000	38.000000	23.000000
max	1.000000	737.000000	2017.000000	53.000000	31.000000

In [104…

```python
df=df[df['adr']<5000]
```

In [105…

```python
df.describe
```

Out[105]:

```
<bound method NDFrame.describe of                hotel  is_canceled  lead_time  arrival
_date_year  \
0       Resort Hotel            0        342               2015
1       Resort Hotel            0        737               2015
2       Resort Hotel            0          7               2015
3       Resort Hotel            0         13               2015
4       Resort Hotel            0         14               2015
...              ...          ...        ...                ...
119385    City Hotel            0         23               2017
119386    City Hotel            0        102               2017
119387    City Hotel            0         34               2017
119388    City Hotel            0        109               2017
119389    City Hotel            0        205               2017

       arrival_date_month  arrival_date_week_number  \
0                    July                        27
1                    July                        27
2                    July                        27
3                    July                        27
4                    July                        27
...                   ...                       ...
119385             August                        35
119386             August                        35
119387             August                        35
119388             August                        35
119389             August                        35

        arrival_date_day_of_month  stays_in_weekend_nights  \
0                               1                        0
1                               1                        0
2                               1                        0
3                               1                        0
4                               1                        0
...                           ...                      ...
119385                         30                        2
119386                         31                        2
119387                         31                        2
119388                         31                        2
119389                         29                        2

        stays_in_week_nights  adults  ...  assigned_room_type  \
0                          0       2  ...                   C
1                          0       2  ...                   C
2                          1       1  ...                   C
3                          1       1  ...                   A
4                          2       2  ...                   A
...                      ...     ...  ...                 ...
119385                     5       2  ...                   A
119386                     5       3  ...                   E
119387                     5       2  ...                   D
119388                     5       2  ...                   A
119389                     7       2  ...                   A

        booking_changes deposit_type days_in_waiting_list customer_type  \
0                     3   No Deposit                    0     Transient
1                     4   No Deposit                    0     Transient
2                     0   No Deposit                    0     Transient
3                     0   No Deposit                    0     Transient
4                     0   No Deposit                    0     Transient
...                 ...          ...                  ...           ...
119385                0   No Deposit                    0     Transient
119386                0   No Deposit                    0     Transient
119387                0   No Deposit                    0     Transient
119388                0   No Deposit                    0     Transient
119389                0   No Deposit                    0     Transient
```

```
           adr  required_car_parking_spaces  total_of_special_requests  \
0         0.00                            0                          0
1         0.00                            0                          0
2        75.00                            0                          0
3        75.00                            0                          0
4        98.00                            0                          1
...        ...                          ...                        ...
119385   96.14                            0                          0
119386  225.43                            0                          2
119387  157.71                            0                          4
119388  104.40                            0                          0
119389  151.20                            0                          2

        reservation_status reservation_status_date
0                Check-Out              2015-01-07
1                Check-Out              2015-01-07
2                Check-Out              2015-02-07
3                Check-Out              2015-02-07
4                Check-Out              2015-03-07
...                    ...                     ...
119385           Check-Out              2017-06-09
119386           Check-Out              2017-07-09
119387           Check-Out              2017-07-09
119388           Check-Out              2017-07-09
119389           Check-Out              2017-07-09

[118897 rows x 30 columns]>
```

In [106…

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

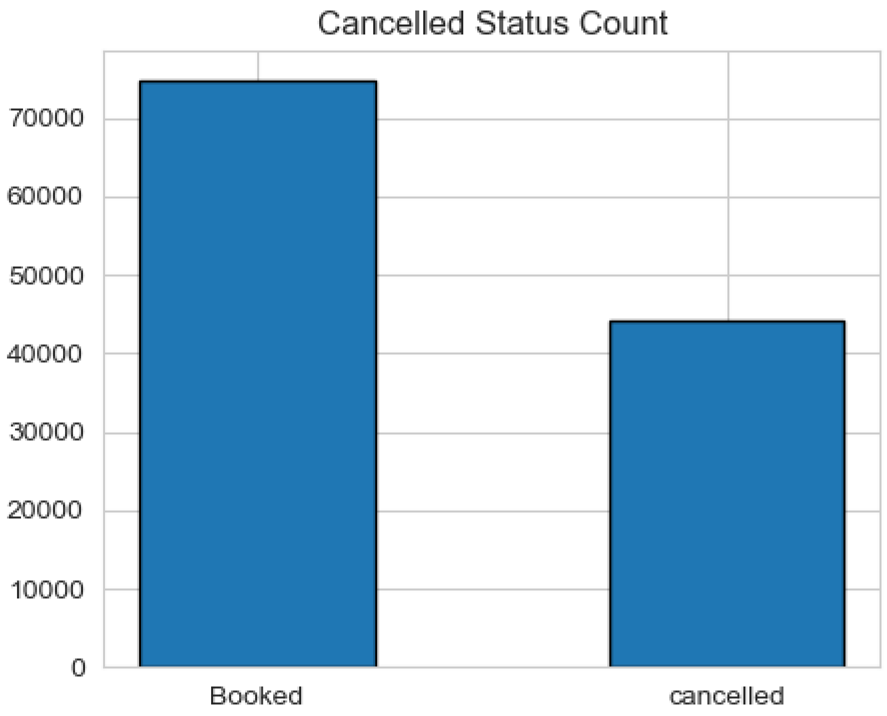
Out[106]:

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

In [107…

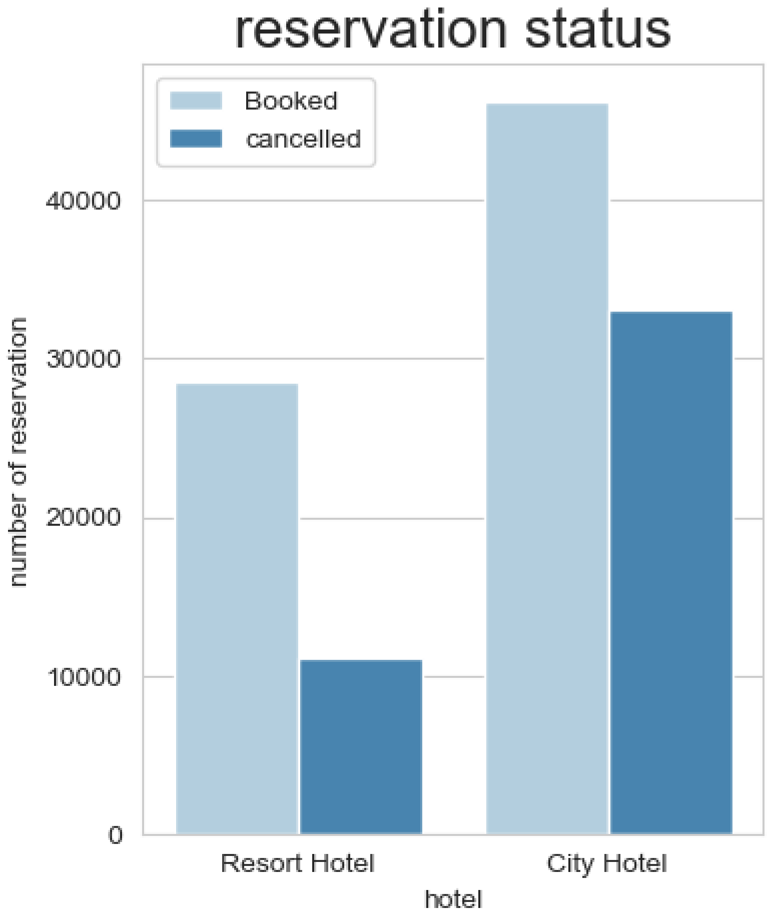
```
cancelled_perc=df['is_canceled'].value_counts(normalize=True)
print(cancelled_perc)

plt.figure(figsize=(5,4))
plt.title('Cancelled Status Count')
plt.bar(['Booked','cancelled'],df['is_canceled'].value_counts(),edgecolor='k',width=0.5,
plt.show()
```

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



In [108…

```
plt.figure(figsize=(4,5))
ax1=sns.countplot(x='hotel',hue='is_canceled',data=df,palette='Blues')
legend_labels=ax1.get_legend_handles_labels()
ax1.legend(bbox_to_anchor=(1,1))
plt.title('reservation status',size=20)
plt.xlabel('hotel')
plt.ylabel('number of reservation')
plt.legend(['Booked','cancelled'])
plt.show()
```



In [109…

```
resort_hotel=df[df['hotel']=='Resort Hotel']
```

```
resort_hotel['is_canceled'].value_counts(normalize = True)
```

Out[109]:

```
0    0.72025
1    0.27975
Name: is_canceled, dtype: float64
```

In [110…

```
city_hotel=df[df['hotel']=='city hotel']
city_hotel['is_canceled'].value_counts(normalize=True)
```

Out[110]:

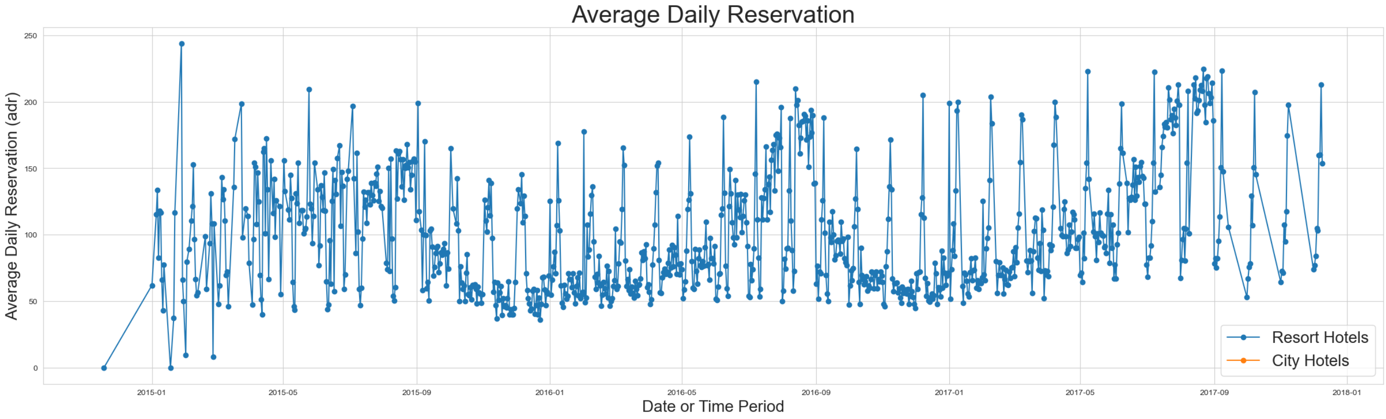
```
Series([], Name: is_canceled, dtype: float64)
```

In [111…

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

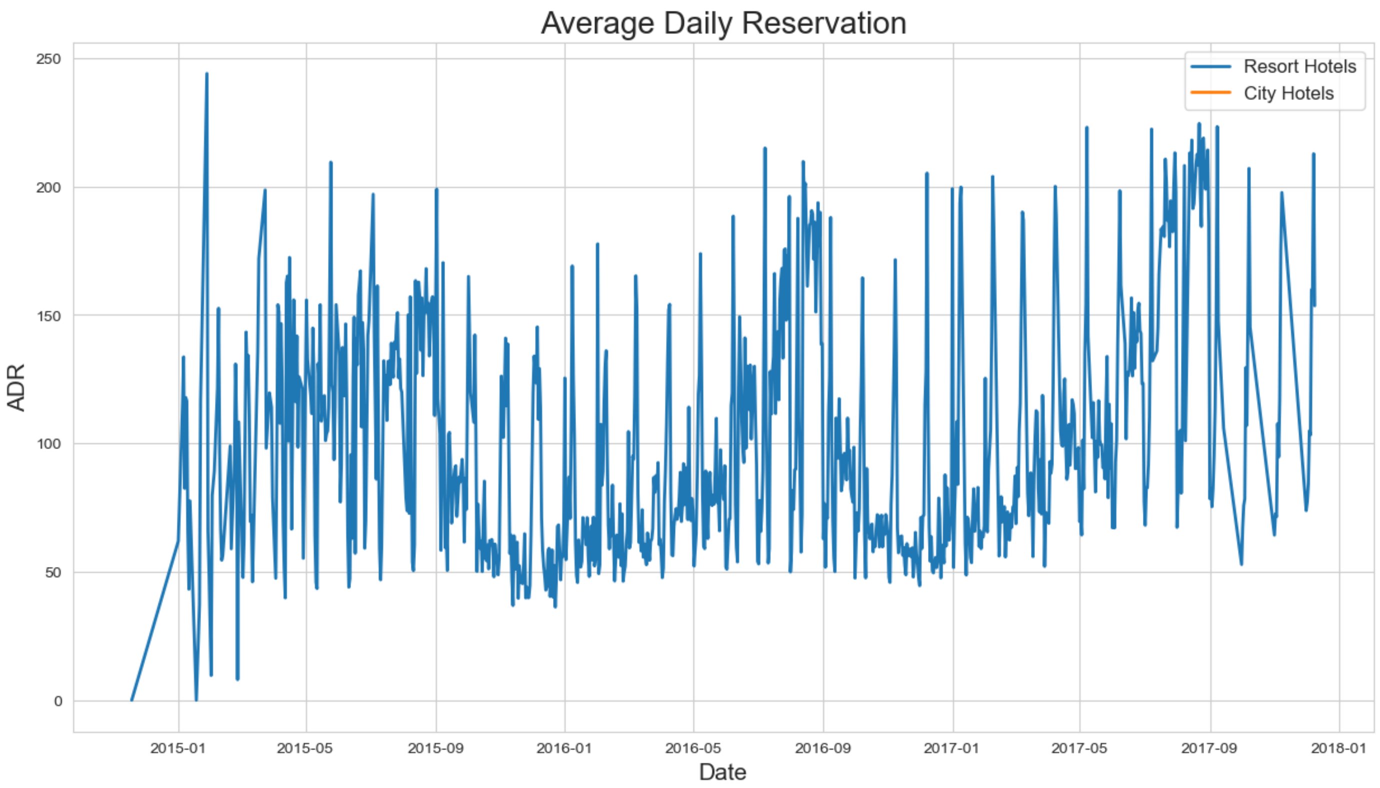
In [112…

```
plt.figure(figsize=(30, 8))
plt.title('Average Daily Reservation', fontsize=30)
plt.plot(resort_hotel.index, resort_hotel['adr'], label='Resort Hotels', marker='o')
plt.plot(city_hotel.index, city_hotel['adr'], label='City Hotels', marker='o')
plt.xlabel('Date or Time Period', fontsize=20)
plt.ylabel('Average Daily Reservation (adr)', fontsize=20)
plt.legend(fontsize=20)
plt.grid(True)
plt.show()
```



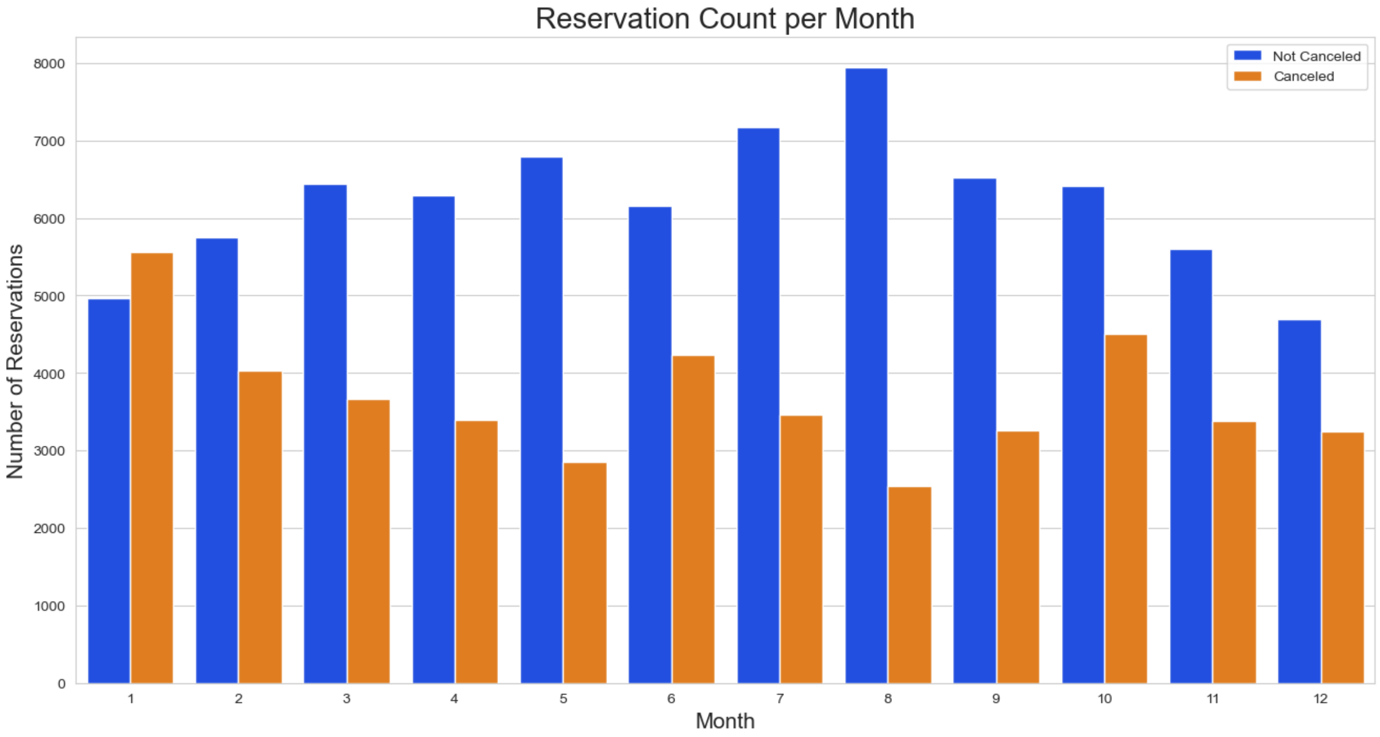
In [113…

```
plt.figure(figsize=(15, 8))
plt.title('Average Daily Reservation', fontsize=20)
plt.xlabel('Date', fontsize=15)
plt.ylabel('ADR', fontsize=15)
plt.plot(resort_hotel.index, resort_hotel['adr'], label='Resort Hotels', linewidth=2)
plt.plot(city_hotel.index, city_hotel['adr'], label='City Hotels', linewidth=2)
plt.legend(fontsize=12)
plt.grid(True)
plt.show()
```



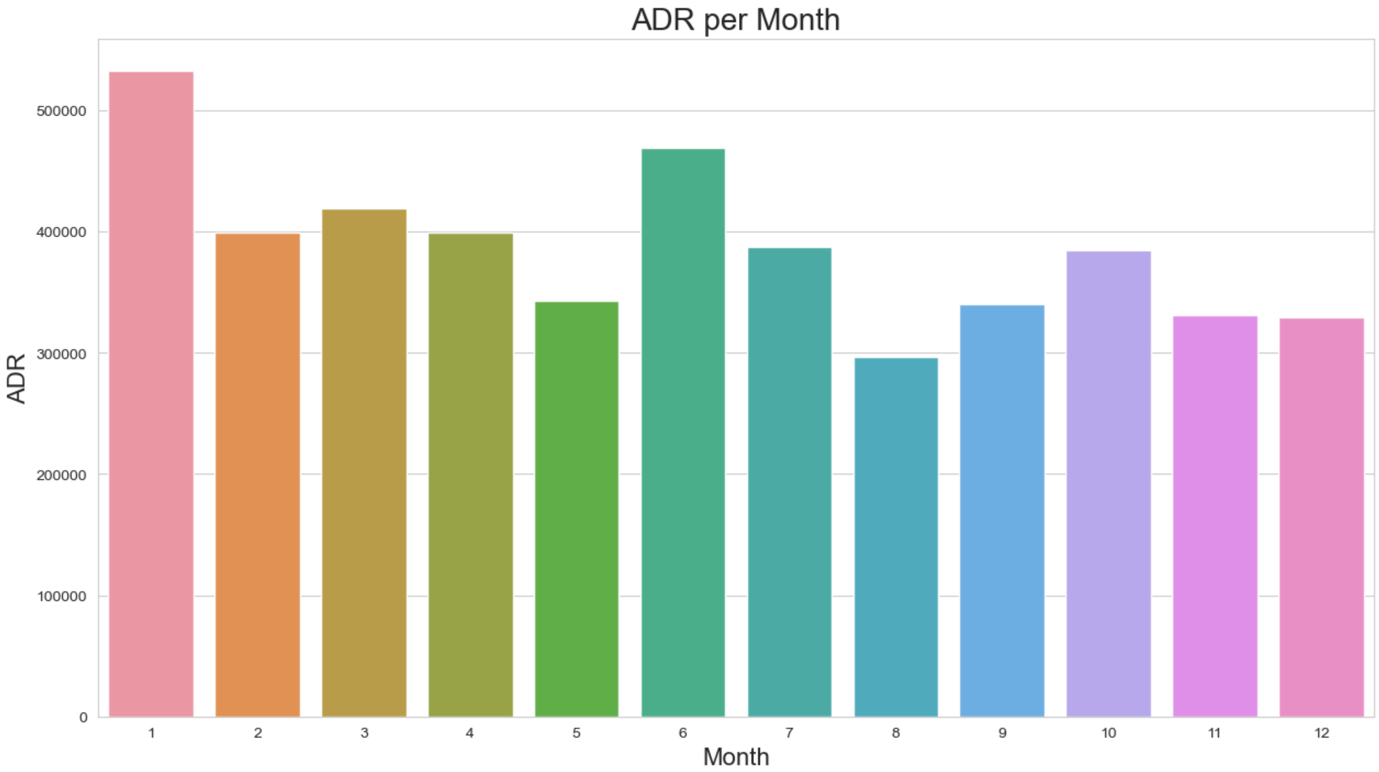
In [114…

```
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')
legend_labels, _ = ax1.get_legend_handles_labels()
ax1.legend(legend_labels, ['Not Canceled', 'Canceled'], bbox_to_anchor=(1, 1))
plt.title('Reservation Count per Month', fontsize=20)
plt.xlabel('Month', fontsize=15)
plt.ylabel('Number of Reservations', fontsize=15)
plt.show()
```



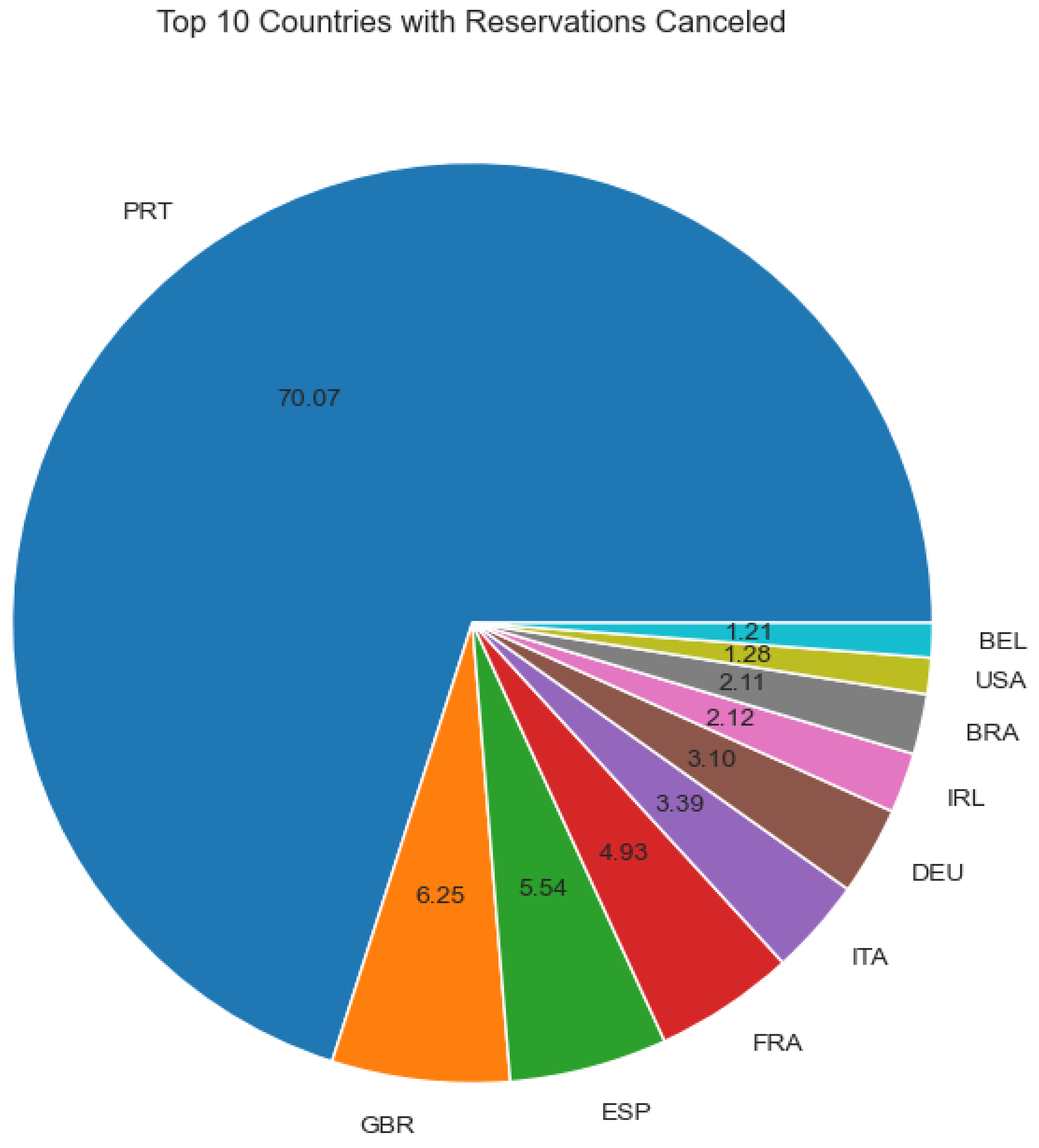
In [115…

```
plt.figure(figsize=(15, 8))
sns.barplot(x='month', y='adr', data=df[df['is_canceled'] == 1].groupby('month')[['adr']
plt.title('ADR per Month', fontsize=20)
plt.xlabel('Month', fontsize=16)
plt.ylabel('ADR', fontsize=16)
plt.show()
```



In [116…

```
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 Reservations Canceled')
plt.pie(top_10_country, autopct='%.2f', labels=top_10_country.index)
plt.show()
```



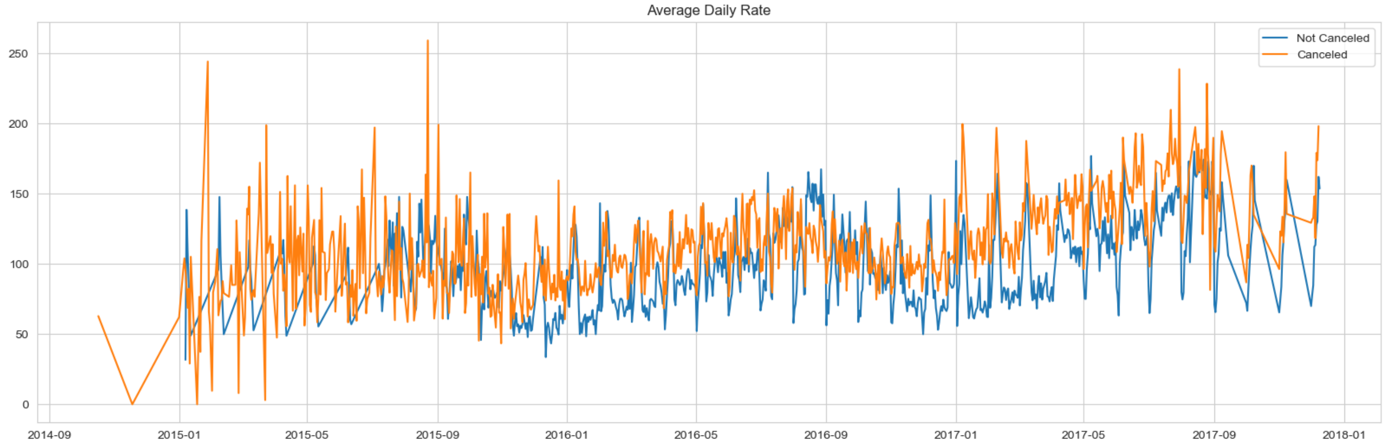
```
In [117…  df['market_segment'].value_counts()

Out[117]: Online TA        56402
          Offline TA/TO    24159
          Groups           19806
          Direct           12448
          Corporate         5111
          Complementary      734
          Aviation           237
          Name: market_segment, dtype: int64
```

```
In [118…  df['market_segment'].value_counts(normalize=True)

Out[118]: Online TA        0.474377
          Offline TA/TO    0.203193
          Groups           0.166581
          Direct           0.104696
          Corporate        0.042987
          Complementary    0.006173
          Aviation         0.001993
          Name: market_segment, dtype: float64
```

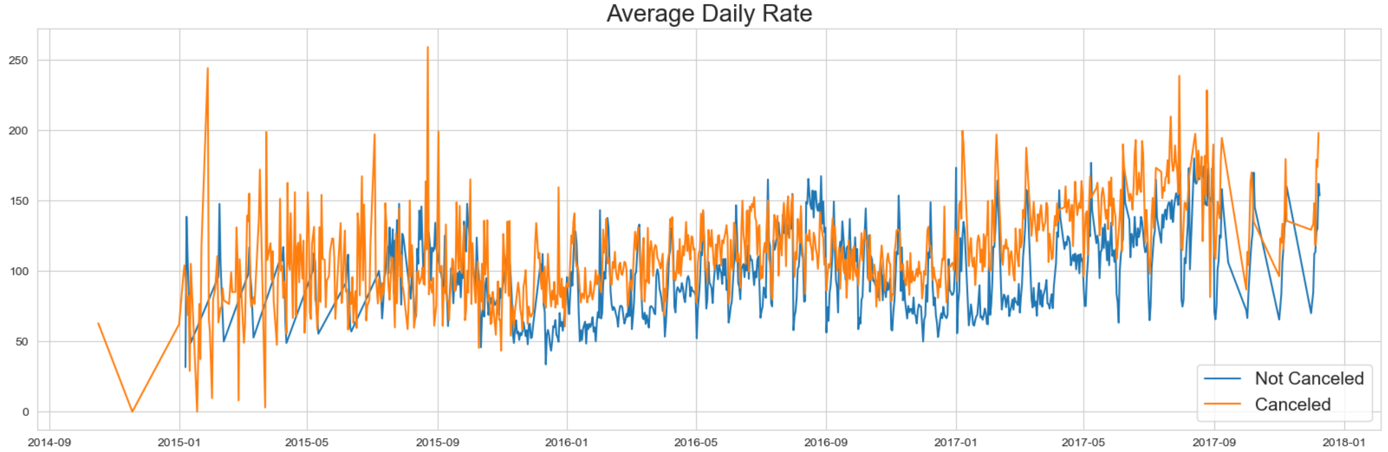
```
In [119…  cancelled_data['market_segment'].value_counts(normalize=True)
```

```
Out[119]: Online TA         0.469696
          Groups            0.273985
          Offline TA/TO     0.187466
          Direct            0.043486
          Corporate         0.022151
          Complementary     0.002038
          Aviation          0.001178
          Name: market_segment, dtype: float64
```

```
In [120…  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_data = df[df['is_canceled'] == 0]
          not_cancelled_df_adr = not_cancelled_data.groupby('reservation_status_date')[['adr']].me
          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'], l
          plt.plot(cancelled_df_adr['reservation_status_date'], cancelled_df_adr['adr'], label='Ca
          plt.legend()
          plt.show()
```



```
In [121…  plt.figure(figsize=(20, 6))
          plt.title('Average Daily Rate', fontsize=20)
          plt.plot(not_cancelled_df_adr['reservation_status_date'], not_cancelled_df_adr['adr'], l
          plt.plot(cancelled_df_adr['reservation_status_date'], cancelled_df_adr['adr'], label='Ca
          plt.legend(fontsize=15)
          plt.show()
```



```
In [83]:
```