# Business Problem

In recent years, City Hotel and Resort Hotel have seen high cancellation rates. Each hotel is now dealing with a number of issues as a result, including fewer revenues and less than ideal hotel room use. Consequently, lowering cancellation rates is both hotels' primary goal in order to increase their efficiency in generating revenue, and for us to offer thorough business advice to address this problem.

The analysis of hotel booking cancellations as well as other factors that have no bearing on their business and yearly revenue generation are the main topics of this report.


# Assumptions

1. No unusual occurrences between 2015 and 2017 will have a substantial impact on the data used.
2. The information is still current and can be used to analyze a hotel's possible plans in an efficient manner.
3. There are no unanticipated negatives to the hotel employing any advised technique.
4. The hotels are not currently using any of the suggested solutions.

5. The biggest factor affecting the effectiveness of earning income is booking cancellations.
6. Cancellations result in vacant rooms for the booked length of time.
7. Clients make hotel reservations the same year they make cancellations.

# Research Question

1. What are the variables that affect hotel reservation cancellations?
2. How can we make hotel reservations cancellations better?
3. How will hotels be assisted in making pricing and promotional decisions?

## Loading The DataSet

```
df = pd.read_csv("./hotel_bookings 2.csv")
```

## Exploratory Data Analysis and Cleaning

```
df.head()
```

```
          hotel is_canceled lead_time arrival_date_year
arrival_date_month  \
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

   arrival_date_week_number  arrival_date_day_of_month  \
0                        27                          1
1                        27                          1
2                        27                          1
3                        27                          1
4                        27                          1
```

```
   stays_in_weekend_nights stays_in_week_nights adults ...
deposit_type  \
0                        0                     0       2  ...    No
Deposit
1                        0                     0       2  ...    No
Deposit
2                        0                     1       1  ...    No
Deposit
3                        0                     1       1  ...    No
Deposit
4                        0                     2       2  ...    No
Deposit
```

```
   agent  company days_in_waiting_list customer_type   adr  \
0    NaN      NaN                    0     Transient   0.0
1    NaN      NaN                    0     Transient   0.0
2    NaN      NaN                    0     Transient  75.0
```

```
3  304.0     NaN                     0     Transient  75.0
4  240.0     NaN                     0     Transient  98.0

   required_car_parking_spaces total_of_special_requests
reservation_status  \
0                            0                          0
Check-Out
1                            0                          0
Check-Out
2                            0                          0
Check-Out
3                            0                          0
Check-Out
4                            0                          1
Check-Out

  reservation_status_date
0                1/7/2015
1                1/7/2015
2                2/7/2015
3                2/7/2015
4                3/7/2015

[5 rows x 32 columns]

df.shape

(118897, 30)
```

# Data Tranformation

```
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
```

```
df['reservation_status_date'] =
pd.to_datetime(df['reservation_status_date'], format='%d/%m/%Y')
```

```
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' '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'
 'Aviation']
----------------------------------------------------
distribution_channel
['Direct' 'Corporate' 'TA/TO' 'Undefined' 'GDS']
----------------------------------------------------
reserved_room_type
['C' 'A' 'D' 'E' 'G' 'F' 'H' 'L' 'B' 'P']
----------------------------------------------------
assigned_room_type
['C' 'A' 'D' 'E' 'G' 'F' 'I' 'B' 'H' 'L' 'K' 'P']
----------------------------------------------------
deposit_type
['No Deposit' 'Refundable' 'Non Refund']
----------------------------------------------------
customer_type
['Transient' 'Contract' 'Transient-Party' 'Group']

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

# Data Cleaning (Removing nulls)

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

```
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
```

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

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

```
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
```

# Removing Outlier

```
df.describe()
```

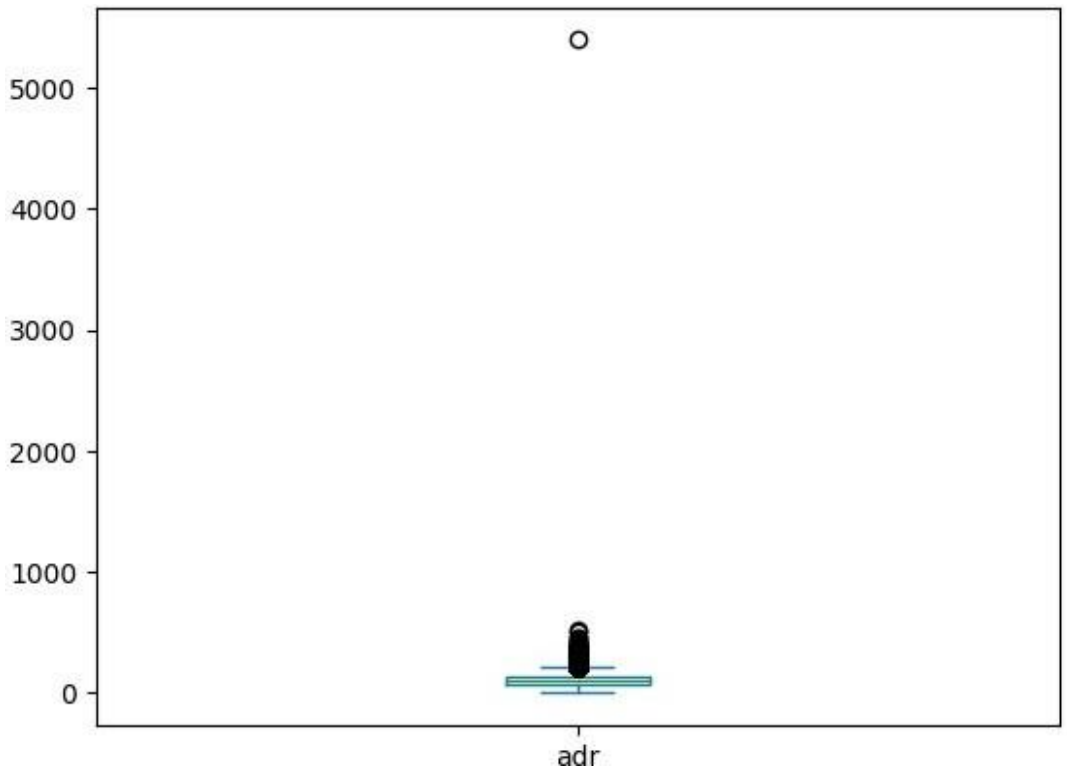
```
         is_canceled      lead_time  arrival_date_year  \
count  118898.000000  118898.000000      118898.000000
mean        0.371352     104.311435        2016.157656
min         0.000000       0.000000        2015.000000
25%         0.000000      18.000000        2016.000000
50%         0.000000      69.000000        2016.000000
75%         1.000000     161.000000        2017.000000
max         1.000000     737.000000        2017.000000
std         0.483168     106.903309           0.707459

       arrival_date_week_number  arrival_date_day_of_month  \
count             118898.000000              118898.000000
mean                  27.166555                  15.800880
min                    1.000000                   1.000000
25%                   16.000000                   8.000000
50%                   28.000000                  16.000000
75%                   38.000000                  23.000000
max                   53.000000                  31.000000
std                   13.589971                   8.780324

       stays_in_weekend_nights  stays_in_week_nights         adults  \
count            118898.000000         118898.000000  118898.000000
mean                  0.928897              2.502145       1.858391
min                   0.000000              0.000000       0.000000
```

```
25%                   0.000000              1.000000       2.000000
50%                   1.000000              2.000000       2.000000
75%                   2.000000              3.000000       2.000000
max                  16.000000             41.000000      55.000000
std                   0.996216              1.900168       0.578576

            children         babies  is_repeated_guest  \
count  118898.000000  118898.000000      118898.000000
mean        0.104207       0.007948           0.032011
min         0.000000       0.000000           0.000000
25%         0.000000       0.000000           0.000000
50%         0.000000       0.000000           0.000000
75%         0.000000       0.000000           0.000000
max        10.000000      10.000000           1.000000
std         0.399172       0.097380           0.176029

       previous_cancellations  previous_bookings_not_canceled  \
count           118898.000000                   118898.000000
mean                 0.087142                        0.131634
min                  0.000000                        0.000000
25%                  0.000000                        0.000000
50%                  0.000000                        0.000000
75%                  0.000000                        0.000000
max                 26.000000                       72.000000
std                  0.845869                        1.484672

       booking_changes  days_in_waiting_list            adr  \
count    118898.000000         118898.000000  118898.000000
mean          0.221181              2.330754     102.003243
min           0.000000              0.000000      -6.380000
25%           0.000000              0.000000      70.000000
50%           0.000000              0.000000      95.000000
75%           0.000000              0.000000     126.000000
max          21.000000            391.000000    5400.000000
std           0.652785             17.630452      50.485862

       required_car_parking_spaces  total_of_special_requests  \
count                118898.000000              118898.000000
mean                      0.061885                   0.571683
min                       0.000000                   0.000000
25%                       0.000000                   0.000000
50%                       0.000000                   0.000000
75%                       0.000000                   1.000000
max                       8.000000                   5.000000
std                       0.244172                   0.792678

             reservation_status_date
count                         118898
mean   2016-07-30 07:37:53.336809984
min              2014-10-17 00:00:00
```

```
25%                  2016-02-02 00:00:00
50%                  2016-08-08 00:00:00
75%                  2017-02-09 00:00:00
max                  2017-09-14 00:00:00
std                                  NaN
```

```
df['adr'].plot(kind='box')
```

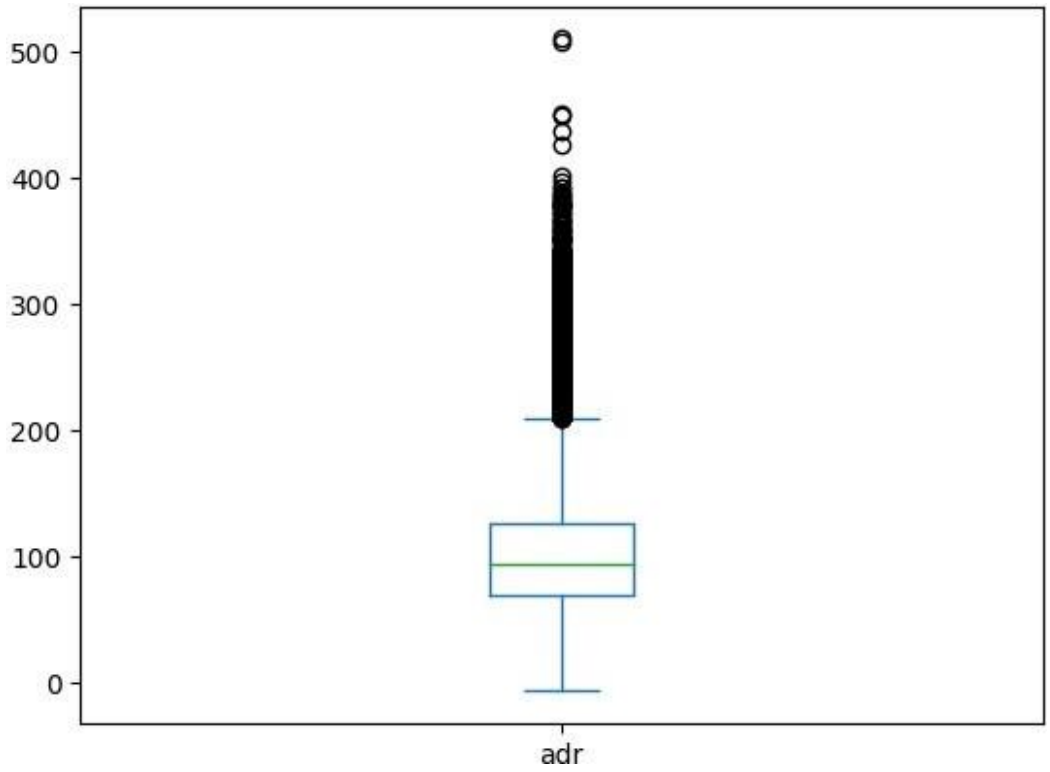
```
<Axes: >
```




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

```
df['adr'].plot(kind='box')
```

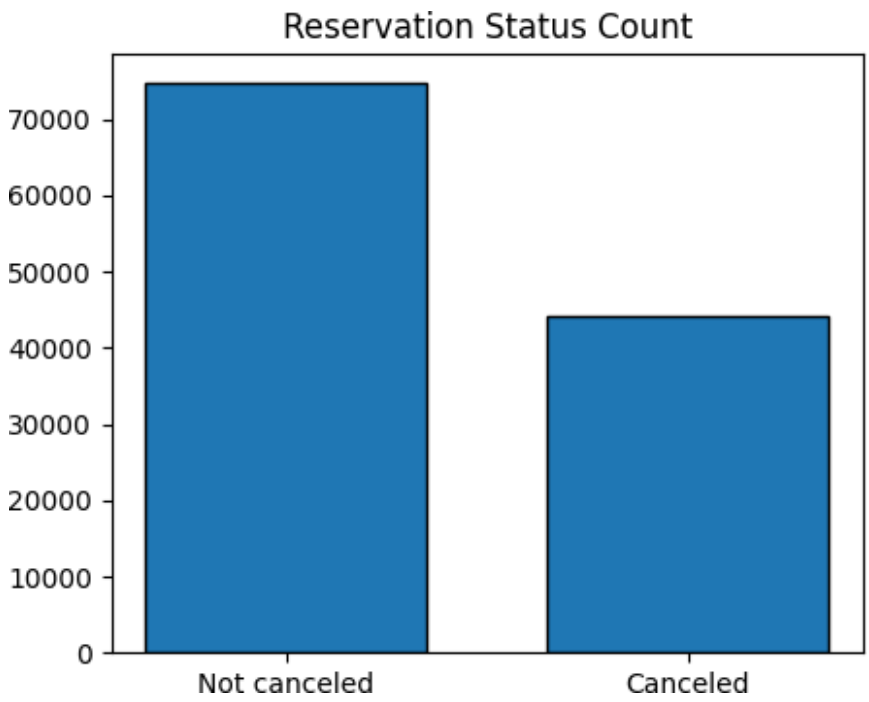
```
<Axes: >
```




## Data Analysis and Visualization

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

plt.figure(figsize=(5,4))
plt.title('Reservation Status Count')
plt.bar(['Not canceled', 'Canceled'],df['is_canceled'].value_counts(),
edgecolor = 'k' , width = 0.7)
```

```
<BarContainer object of 2 artists>
```




```
plt.figure(figsize=(7,4))
axl= sns.countplot(x = 'hotel', hue = 'is_canceled', data = df,
palette='Blues')
legend_labels,_ = axl. get_legend_handles_labels()
plt.title('Reservation status in different hotels', size = 20)
plt.xlabel = ('Hotel')
plt.ylabel = ('Number of reservations')
```


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

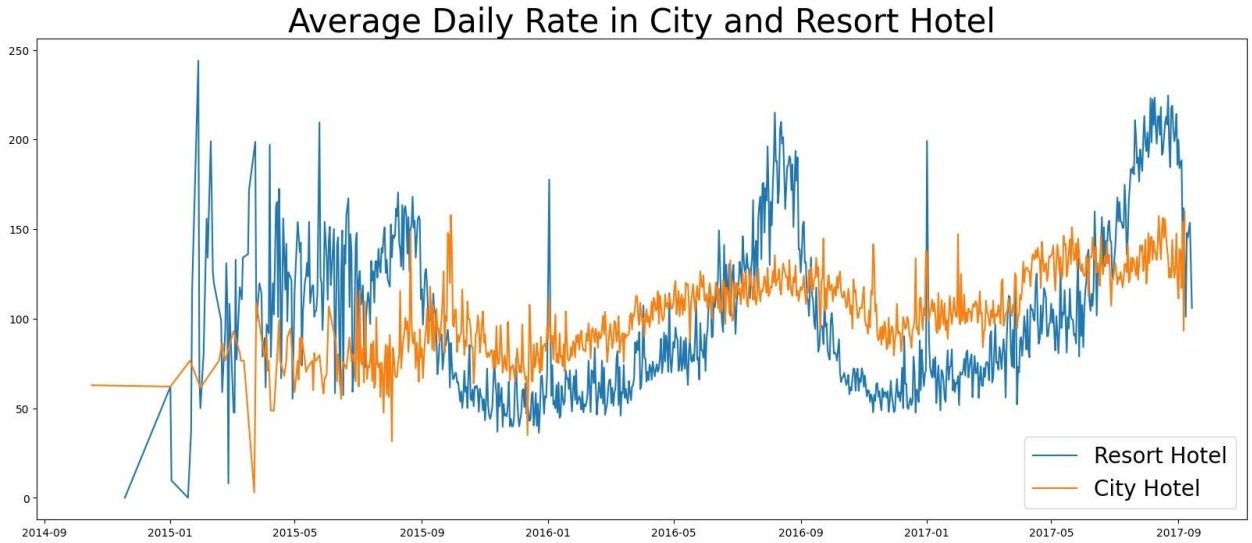
```
is_canceled
0    0.72025
1    0.27975
Name: proportion, dtype: float64
```

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

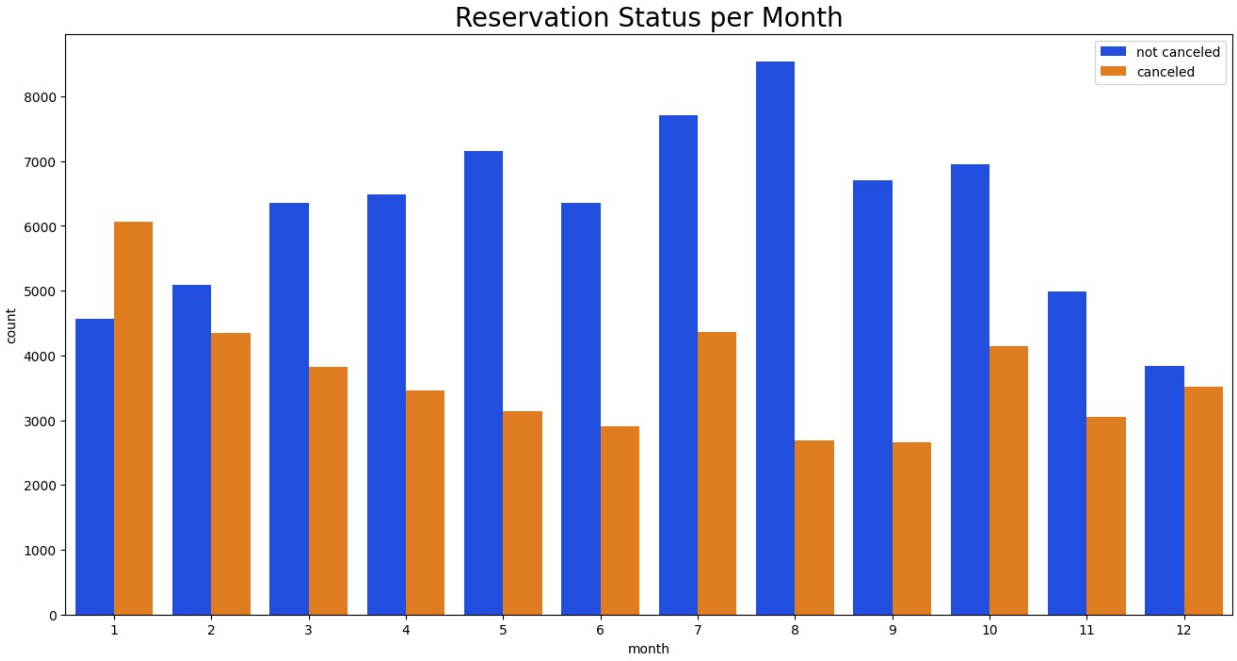
```
is_canceled
0    0.582918
1    0.417082
Name: proportion, dtype: float64
```

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

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')
```

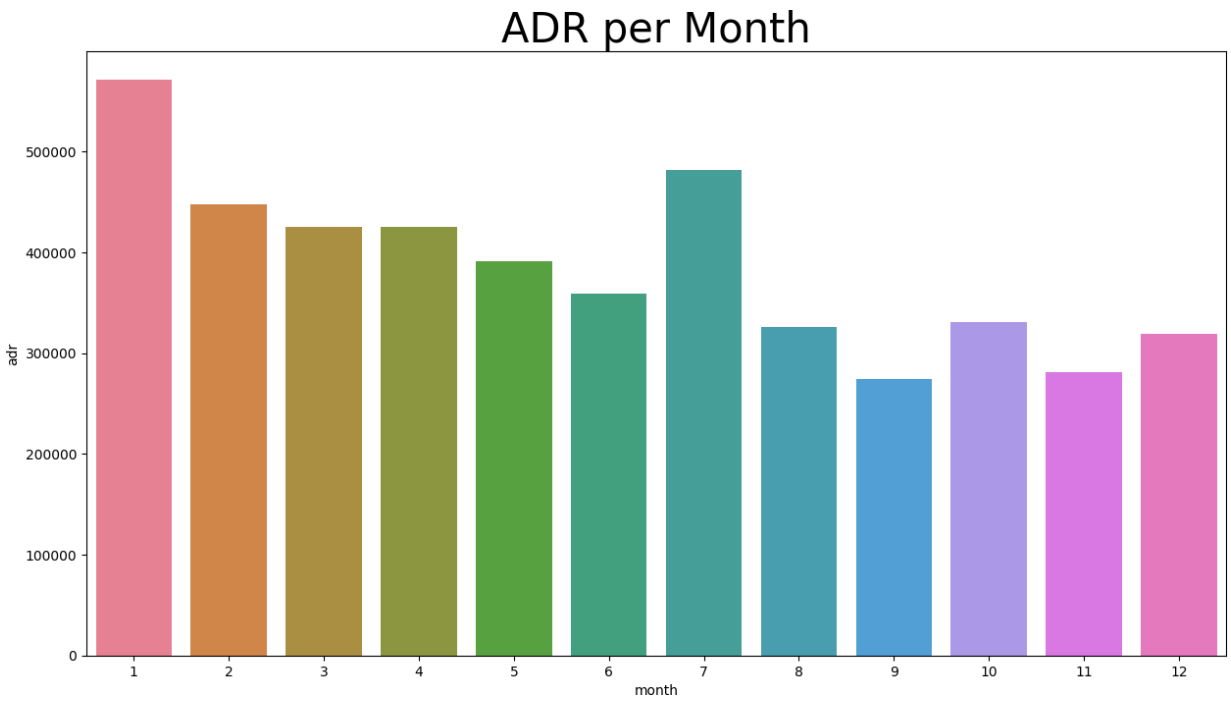
```
plt.legend(fontsize = 20)
plt.show()
```



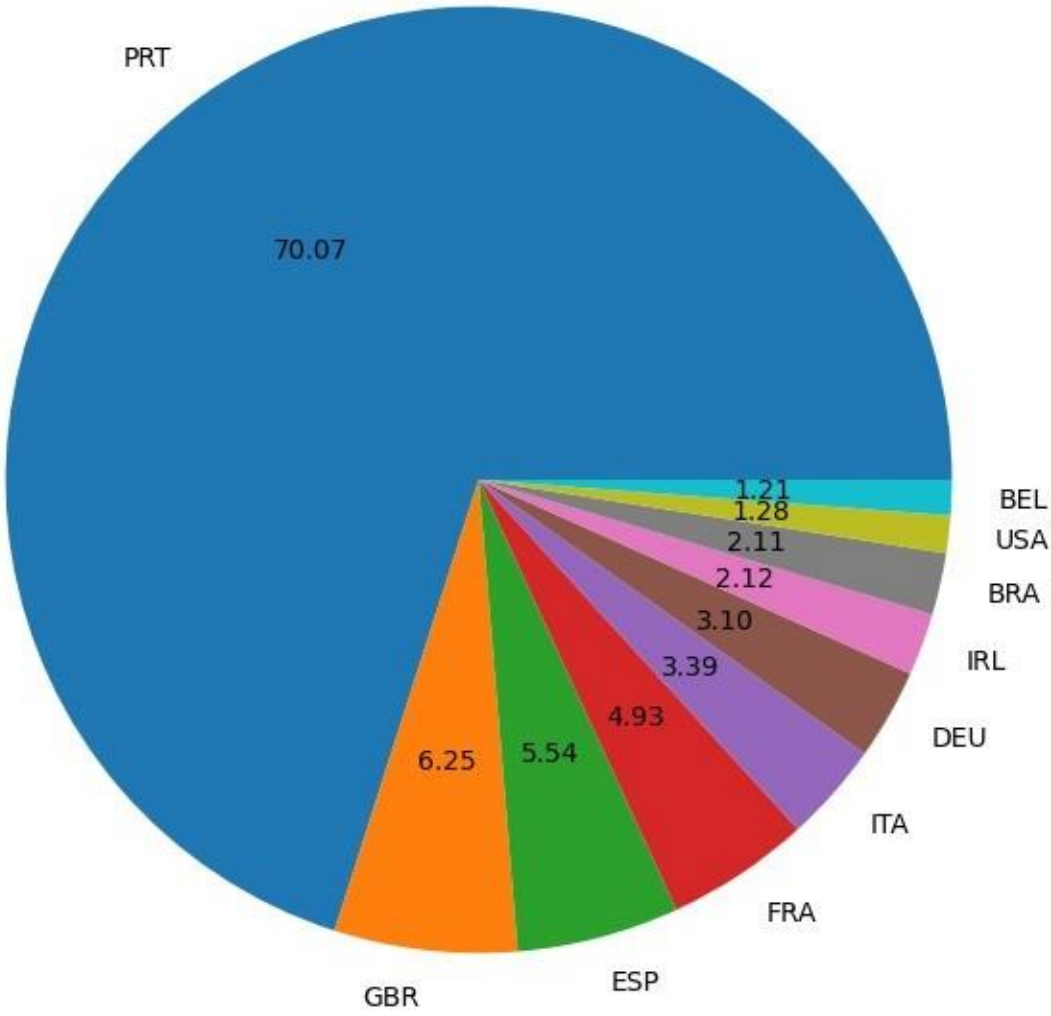

```
df['month'] = df['reservation_status_date'].dt.month
plt.figure(figsize=(16,8))
axl = sns.countplot(x = 'month', hue='is_canceled' , data=df,
palette='bright')
legend_labels,_ = axl. get_legend_handles_labels()
plt.title('Reservation Status per Month' , size = 20)
plt.legend(['not canceled', 'canceled'])
plt.show()
```



```
plt.figure(figsize=(15,8))
plt.title('ADR per Month' , size = 30)
palette = sns.color_palette("husl", len(df[df['is_canceled']==1]
['month'].unique()))
sns.barplot(x='month', y='adr',hue='month',
data=df[df['is_canceled']==1].groupby('month')
[['adr']].sum().reset_index(), palette=palette, legend=False)
plt.show()
```




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


Top 10 countries with reservation cancelled
PRT
70.07
GBR
6.25
ESP
5.54
FRA
4.93
ITA
3.39
DEU
3.10
IRL
2.12
BRA
2.11
USA
1.28
BEL
1.21