Objective

The goal of this Data Analysis Project using Sql would to identifify opportunities to increase occupancy rate on low-performing flight, which can ultimately lead to increase profitabilty for airline

Importing Liabraries

In [97]:

```
import sqlite3
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

Database Connection

In [11]:

```
connection=sqlite3.connect("travel.sqlite")
cursor=connection.cursor()
```

In [12]:

```
cursor.execute("""select name from sqlite_master where type='table';""")
print("list of tables present in the database")
table_list=[table[0] for table in cursor.fetchall()]
table_list
```

```
list of tables present in the database
```

Out[12]:

```
['aircrafts_data',
 'airports_data',
 'boarding_passes',
 'bookings',
 'flights',
 'seats',
 'ticket_flights',
 'tickets']
```

Data Exploration

In [ ]:

```

```

In [14]:

```
aircrafts_data=pd.read_sql_query("select * from aircrafts_data",connection)
aircrafts_data.head()
```

Out[14]:

	aircraft_code	model	range
0	773	{"en": "Boeing 777-300", "ru": "Боинг 777-300"}	11100
1	763	{"en": "Boeing 767-300", "ru": "Боинг 767-300"}	7900
2	SU9	{"en": "Sukhoi Superjet-100", "ru": "Сухой Суп...	3000
3	320	{"en": "Airbus A320-200", "ru": "Аэробус A320-...	5700
4	321	{"en": "Airbus A321-200", "ru": "Аэробус A321-...	5600

In [17]:

```
aircrafts_data.shape
```

Out[17]:

```
(9, 3)
```

In [23]:

```
airports_data=pd.read_sql_query("select * from airports_data",connection)
airports_data.head()
```

Out[23]:

	airport_code	airport_name	city	coordinates	timezone
0	YKS	{"en": "Yakutsk Airport", "ru": "Якутск"}	{"en": "Yakutsk", "ru": "Якутск"}	(129.77099609375,62.0932998657226562)	Asia/Yakutsk
1	MJZ	{"en": "Mirny Airport", "ru": "Мирный"}	{"en": "Mirnyj", "ru": "Мирный"}	(114.03900146484375,62.534698486328125)	Asia/Yakutsk
2	KHV	{"en": "Khabarovsk-Novy Airport", "ru": "Хабар...	{"en": "Khabarovsk", "ru": "Хабаровск"}	(135.18800354004,48.5279998779300001)	Asia/Vladivostok
3	PKC	{"en": "Yelizovo Airport", "ru": "Елизово"}	{"en": "Petropavlovsk", "ru": "Петропавловск-К...	(158.453994750976562,53.1679000854492188)	Asia/Kamchatka
4	UUS	{"en": "Yuzhno-Sakhalinsk Airport", "ru": "Хом...	{"en": "Yuzhno-Sakhalinsk", "ru": "Южно-Сахали...	(142.718002319335938,46.8886985778808594)	Asia/Sakhalin

In [29]:

```
boarding_passes=pd.read_sql_query("select * from boarding_passes",connection)
boarding_passes
```

Out[29]:

	ticket_no	flight_id	boarding_no	seat_no
0	0005435212351	30625	1	2D
1	0005435212386	30625	2	3G
2	0005435212381	30625	3	4H
3	0005432211370	30625	4	5D
4	0005435212357	30625	5	11A
...	...	...	...	...
579681	0005434302871	19945	85	20F
579682	0005432892791	19945	86	21C
579683	0005434302869	19945	87	20E
579684	0005432802476	19945	88	21F
579685	0005432802482	19945	89	21E

579686 rows × 4 columns

In [30]:

```
bookings=pd.read_sql_query("select * from bookings",connection)
bookings
```

Out[30]:

	book_ref	book_date	total_amount
0	00000F	2017-07-05 03:12:00+03	265700
1	000012	2017-07-14 09:02:00+03	37900
2	000068	2017-08-15 14:27:00+03	18100
3	000181	2017-08-10 13:28:00+03	131800
4	0002D8	2017-08-07 21:40:00+03	23600
...	...	...	...
262783	FFFEF3	2017-07-17 07:23:00+03	56000
262784	FFFF2C	2017-08-08 05:55:00+03	10800
262785	FFFF43	2017-07-20 20:42:00+03	78500
262786	FFFFA8	2017-08-08 04:45:00+03	28800
262787	FFFFF7	2017-07-01 22:12:00+03	73600

262788 rows × 3 columns

In [31]:

```
flights=pd.read_sql_query("select * from flights",connection)
flights
```

Out[31]:

	flight_id	flight_no	scheduled_departure	scheduled_arrival	departure_airport	arrival_airport	status	aircraft_code	actual_departu
0	1185	PG0134	2017-09-10 09:50:00+03	2017-09-10 14:55:00+03	DME	BTK	Scheduled	319	
1	3979	PG0052	2017-08-25 14:50:00+03	2017-08-25 17:35:00+03	VKO	HMA	Scheduled	CR2	
2	4739	PG0561	2017-09-05 12:30:00+03	2017-09-05 14:15:00+03	VKO	AER	Scheduled	763	
3	5502	PG0529	2017-09-12 09:50:00+03	2017-09-12 11:20:00+03	SVO	UFA	Scheduled	763	
4	6938	PG0461	2017-09-04 12:25:00+03	2017-09-04 13:20:00+03	SVO	ULV	Scheduled	SU9	
...	...	...	...	...	...	...	...	...	
33116	33117	PG0063	2017-08-02 19:25:00+03	2017-08-02 20:10:00+03	SKX	SVO	Arrived	CR2	2017-08-19:25:00+
33117	33118	PG0063	2017-07-28 19:25:00+03	2017-07-28 20:10:00+03	SKX	SVO	Arrived	CR2	2017-07-19:30:00+
33118	33119	PG0063	2017-09-08 19:25:00+03	2017-09-08 20:10:00+03	SKX	SVO	Scheduled	CR2	
33119	33120	PG0063	2017-08-01 19:25:00+03	2017-08-01 20:10:00+03	SKX	SVO	Arrived	CR2	2017-08-19:26:00+
33120	33121	PG0063	2017-08-26 19:25:00+03	2017-08-26 20:10:00+03	SKX	SVO	Scheduled	CR2	

33121 rows × 10 columns

In [32]:

```
seats=pd.read_sql_query("select * from seats",connection)
seats
```

Out[32]:

	aircraft_code	seat_no	fare_conditions
0	319	2A	Business
1	319	2C	Business
2	319	2D	Business
3	319	2F	Business
4	319	3A	Business
...	...	...	...
1334	773	48H	Economy
1335	773	48K	Economy
1336	773	49A	Economy
1337	773	49C	Economy
1338	773	49D	Economy

1339 rows × 3 columns

In [34]:

```
ticket_flights=pd.read_sql_query("select * from ticket_flights",connection)
ticket_flights
```

Out[34]:

	ticket_no	flight_id	fare_conditions	amount
0	0005432159776	30625	Business	42100
1	0005435212351	30625	Business	42100
2	0005435212386	30625	Business	42100
3	0005435212381	30625	Business	42100
4	0005432211370	30625	Business	42100
...	...	...	...	...
1045721	0005435097522	32094	Economy	5200
1045722	0005435097521	32094	Economy	5200
1045723	0005435104384	32094	Economy	5200
1045724	0005435104352	32094	Economy	5200
1045725	0005435104389	32094	Economy	5200

1045726 rows × 4 columns

In [35]:

```
tickets=pd.read_sql_query("select * from tickets",connection)
tickets
```

Out[35]:

	ticket_no	book_ref	passenger_id
0	0005432000987	06B046	8149 604011
1	0005432000988	06B046	8499 420203
2	0005432000989	E170C3	1011 752484
3	0005432000990	E170C3	4849 400049
4	0005432000991	F313DD	6615 976589
...	...	...	...
366728	0005435999869	D730BA	0474 690760
366729	0005435999870	D730BA	6535 751108
366730	0005435999871	A1AD46	1596 156448
366731	0005435999872	7B6A53	9374 822707
366732	0005435999873	7B6A53	7380 075822

366733 rows × 3 columns

In [42]:

```
for table in table_list:
    print('\ntable',table)
    column_info=connection.execute("PRAGMA table_info({})".format(table))
    for column in column_info.fetchall():
        print(column[1:3])
```

```
table aircrafts_data
('aircraft_code', 'character(3)')
('model', 'jsonb')
('range', 'INTEGER')

table airports_data
('airport_code', 'character(3)')
('airport_name', 'jsonb')
('city', 'jsonb')
('coordinates', 'point')
('timezone', 'TEXT')

table boarding_passes
('ticket_no', 'character(13)')
('flight_id', 'INTEGER')
('boarding_no', 'INTEGER')
('seat_no', 'character varying(4)')

table bookings
('book_ref', 'character(6)')
('book_date', 'timestamp with time zone')
('total_amount', 'numeric(10,2)')

table flights
('flight_id', 'INTEGER')
('flight_no', 'character(6)')
('scheduled_departure', 'timestamp with time zone')
('scheduled_arrival', 'timestamp with time zone')
('departure_airport', 'character(3)')
('arrival_airport', 'character(3)')
('status', 'character varying(20)')
('aircraft_code', 'character(3)')
('actual_departure', 'timestamp with time zone')
('actual_arrival', 'timestamp with time zone')

table seats
('aircraft_code', 'character(3)')
('seat_no', 'character varying(4)')
('fare_conditions', 'character varying(10)')

table ticket_flights
('ticket_no', 'character(13)')
('flight_id', 'INTEGER')
('fare_conditions', 'character varying(10)')
('amount', 'numeric(10,2)')

table tickets
('ticket_no', 'character(13)')
('book_ref', 'character(6)')
('passenger_id', 'character varying(20)')
```

In [ ]:

```
#Checking Missing Value
```

In [44]:

```
for table in table_list:
    print('\ntable:',table)
    df_table=pd.read_sql_query(f"select * from {table}",connection)
    print(df_table.isnull().sum())
```

```
table: aircrafts_data
aircraft_code    0
model            0
range            0
dtype: int64

table: airports_data
airport_code    0
airport_name    0
city            0
coordinates     0
timezone        0
dtype: int64

table: boarding_passes
ticket_no      0
flight_id      0
boarding_no    0
seat_no        0
dtype: int64

table: bookings
book_ref        0
book_date       0
total_amount    0
dtype: int64

table: flights
flight_id              0
flight_no              0
scheduled_departure    0
scheduled_arrival      0
departure_airport      0
arrival_airport        0
status                 0
aircraft_code          0
actual_departure       0
actual_arrival         0
dtype: int64

table: seats
aircraft_code      0
seat_no            0
fare_conditions    0
dtype: int64

table: ticket_flights
ticket_no          0
flight_id          0
fare_conditions    0
amount             0
dtype: int64

table: tickets
ticket_no       0
book_ref        0
passenger_id    0
dtype: int64
```

Basic Analysis

In [54]:

```
# How many planes have more than 100 seats?
```

In [55]:

```
pd.read_sql_query("""select aircraft_code, count(*) as num_seats from seats
                        group by aircraft_code having num_seats >100""",connection)
```

Out[55]:

	aircraft_code	num_seats
0	319	116
1	320	140
2	321	170
3	733	130
4	763	222
5	773	402

In [56]:

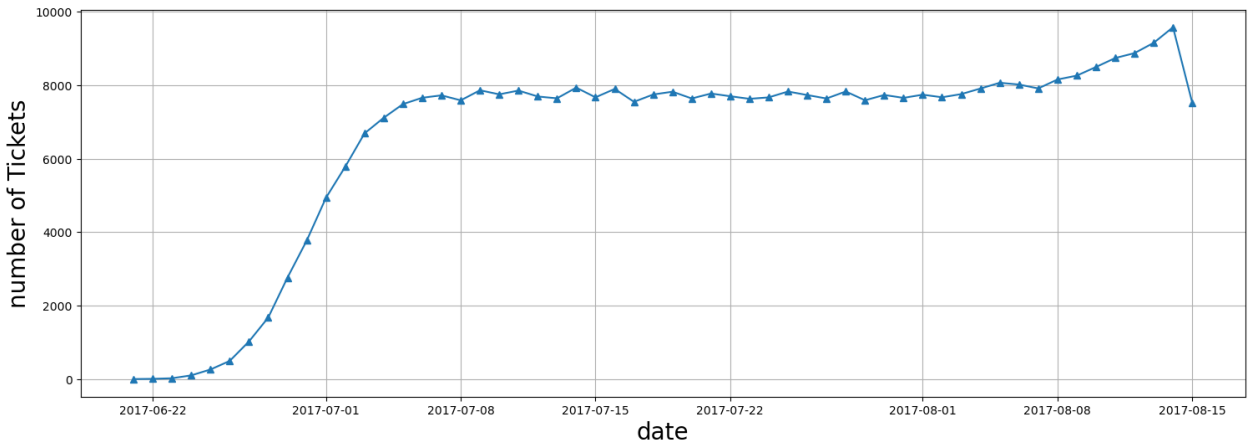
```
# How the number of tickets booked and total amount earned changed with the time
```

In [67]:

```
tickets=pd.read_sql_query("""select * from tickets inner join bookings on tickets.book_ref=bookings.book_ref""",connection)

tickets['book_date']=pd.to_datetime(tickets['book_date'])

tickets['date']=tickets["book_date"].dt.date
```

In [72]:

```
x=tickets.groupby('date')[['date']].count()

plt.figure(figsize=(18,6))
plt.plot(x.index,x['date'],marker= "^")
plt.xlabel('date',fontsize=20)
plt.ylabel('number of Tickets',fontsize=20)
plt.grid('b')
plt.show()
```



In [79]:

```
bookings=pd.read_sql_query("select * from bookings",connection)
bookings['book_date']=pd.to_datetime(bookings['book_date'])

bookings['date']=bookings["book_date"].dt.date
```

In [81]:

```
bookings.groupby('date')[['total_amount']].sum()
```

Out[81]:

date	total_amount
2017-06-21	441900
2017-06-22	775300
2017-06-23	1822000
2017-06-24	5977000
2017-06-25	15305400
2017-06-26	29049100
2017-06-27	54339900
2017-06-28	91256400
2017-06-29	152484000
2017-06-30	205910000
2017-07-01	281864700
2017-07-02	332231100
2017-07-03	384108400
2017-07-04	409175900
2017-07-05	424680000
2017-07-06	434393100
2017-07-07	443575300
2017-07-08	430814500
2017-07-09	444432000
2017-07-10	441434900
2017-07-11	437876000
2017-07-12	426721800
2017-07-13	432826700
2017-07-14	460449000
2017-07-15	441120100
2017-07-16	448014600
2017-07-17	430686400
2017-07-18	440378400
2017-07-19	448547900
2017-07-20	445062300
2017-07-21	437084500
2017-07-22	427789700
2017-07-23	433387400
2017-07-24	433862000
2017-07-25	455336100
2017-07-26	434484900
2017-07-27	427743700
2017-07-28	446519200
2017-07-29	423439400
2017-07-30	436956700
2017-07-31	439255100
2017-08-01	447861400
2017-08-02	442331900
2017-08-03	428452000
2017-08-04	451766500
2017-08-05	450449600
2017-08-06	456387300
2017-08-07	452158300
2017-08-08	467666600
2017-08-09	479377800
2017-08-10	485604400

date	total_amount
2017-08-11	490795600
2017-08-12	492638500
2017-08-13	509633600
2017-08-14	524600500
2017-08-15	395644100

In [73]:

```
# calculate the average charges for each aircraft with different fare conditions.
```

In [92]:

```
df=pd.read_sql_query("""select * from ticket_flights join flights on ticket_flights.flight_id=flights.flight_id""",connection
```

In [95]:

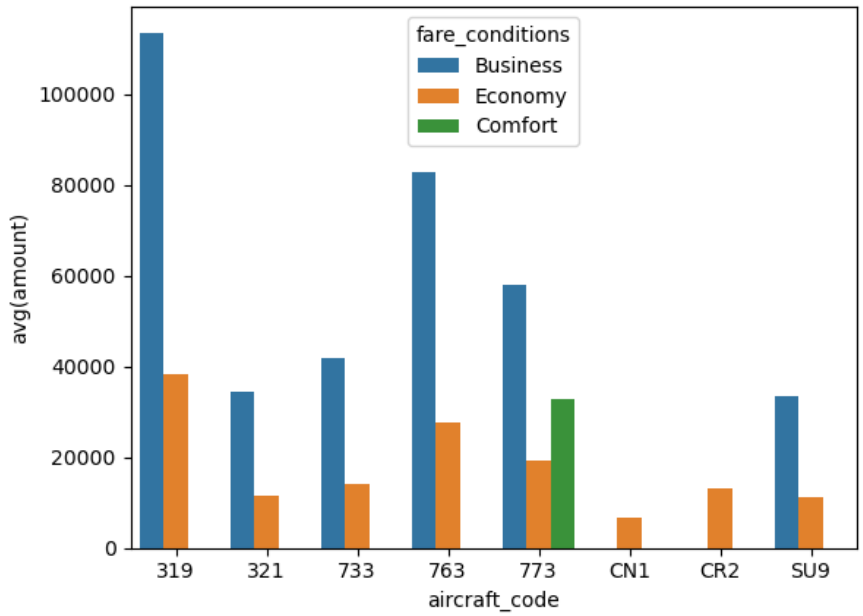
```
df=pd.read_sql_query("""select fare_conditions, aircraft_code, avg(amount)
                    from ticket_flights join flights on ticket_flights.flight_id=flights.flight_id
                    group by aircraft_code, fare_conditions""",connection)
```

In [100]:

```
sns.barplot(data=df, x="aircraft_code",y='avg(amount)',hue='fare_conditions')
```

Out[100]:

```
<Axes: xlabel='aircraft_code', ylabel='avg(amount)'>
```



In [89]:

```
```

Out[89]:

	ticket_no	flight_id	fare_conditions	amount	flight_id	flight_no	scheduled_departure	scheduled_arrival	departure_airport	a
0	0005432159776	30625	Business	42100	30625	PG0013	2017-07-16 18:15:00+03	2017-07-16 20:00:00+03	AER	
1	0005435212351	30625	Business	42100	30625	PG0013	2017-07-16 18:15:00+03	2017-07-16 20:00:00+03	AER	
2	0005435212386	30625	Business	42100	30625	PG0013	2017-07-16 18:15:00+03	2017-07-16 20:00:00+03	AER	
3	0005435212381	30625	Business	42100	30625	PG0013	2017-07-16 18:15:00+03	2017-07-16 20:00:00+03	AER	
4	0005432211370	30625	Business	42100	30625	PG0013	2017-07-16 18:15:00+03	2017-07-16 20:00:00+03	AER	
...	...	...	...	...	...	...	...	...	...	
1045721	0005435097522	32094	Economy	5200	32094	PG0708	2017-09-14 17:15:00+03	2017-09-14 18:00:00+03	SGC	
1045722	0005435097521	32094	Economy	5200	32094	PG0708	2017-09-14 17:15:00+03	2017-09-14 18:00:00+03	SGC	
1045723	0005435104384	32094	Economy	5200	32094	PG0708	2017-09-14 17:15:00+03	2017-09-14 18:00:00+03	SGC	
1045724	0005435104352	32094	Economy	5200	32094	PG0708	2017-09-14 17:15:00+03	2017-09-14 18:00:00+03	SGC	
1045725	0005435104389	32094	Economy	5200	32094	PG0708	2017-09-14 17:15:00+03	2017-09-14 18:00:00+03	SGC	

1045726 rows × 14 columns

Analyzing Occupancy rate

In [101]:

```
#for each aircraft, calculate the total revenue per year and the average revenue per ticket
```

In [104]:

```
pd.read_sql_query("""select aircraft_code, ticket_count, total_revenue/ticket_count as avg_revenue_per_ticket from
(select aircraft_code, count(*) as ticket_count, sum(amount) as total_revenue from ticket_flights
                  join flights on ticket_flights.flight_id=flights.flight_id group by aircraft_code)""",connection)
```

Out[104]:

	aircraft_code	ticket_count	avg_revenue_per_ticket
0	319	52853	51201
1	321	107129	15291
2	733	86102	16568
3	763	124774	35033
4	773	144376	23765
5	CN1	14672	6568
6	CR2	150122	13207
7	SU9	365698	13985

In [105]:

```
#calculate the average occupancy per aircraft.
```

In [123]:

```
occupancy_rate=pd.read_sql_query("""select a.aircraft_code, avg(a.seats_count) as booked_seats, b.num_seats, avg(a.seats_count
from
(select aircraft_code, flights.flight_id, count(*) as seats_count from boarding_passes
                    inner join flights
                    on boarding_passes.flight_id=flights.flight_id
                    group by aircraft_code, flights.flight_id) as a
                    inner join
                    (select aircraft_code, count(*) as num_seats from seats group by aircraft_code) as b
                    on a.aircraft_code=b.aircraft_code group by a.aircraft_code""",connection
                )
```

In [124]:

```
#Caculate by how much the total annual turnover could increase by giving 10%higher occupancy rate
```

In [126]:

```
occupancy_rate["inc occupancy rate"]=occupancy_rate['occupancy_rate']+occupancy_rate['occupancy_rate']*0.1
```

In [127]:

```
occupancy_rate
```

Out[127]:

	aircraft_code	booked_seats	num_seats	occupancy_rate	inc occupancy rate
0	319	53.583181	116	0.461924	0.508116
1	321	88.809231	170	0.522407	0.574648
2	733	80.255462	130	0.617350	0.679085
3	763	113.937294	222	0.513231	0.564554
4	773	264.925806	402	0.659019	0.724921
5	CN1	6.004431	12	0.500369	0.550406
6	CR2	21.482847	50	0.429657	0.472623
7	SU9	56.812113	97	0.585692	0.644261

In [128]:

```
#total revenue
```

In [137]:

```
total_revenue=pd.read_sql_query("""select aircraft_code, sum(amount) as total_revenue from ticket_flights
join flights on ticket_flights.flight_id = flights.flight_id group by aircraft_code""", connection)
occupancy_rate['inc Total annual Turnover']=(total_revenue['total_revenue']/occupancy_rate['occupancy_rate'])*occupancy_rate[
```

In [142]:

```
pd.set_option("display.float_format",str)
occupancy_rate
```

Out[142]:

	aircraft_code	booked_seats	num_seats	occupancy_rate	inc occupancy rate	inc Total annual Turnover
0	319	53.58318098720292	116	0.46192397402761143	0.5081163714303726	2976779410.0
1	321	88.80923076923077	170	0.5224072398190045	0.574647963800905	1801980510.0
2	733	80.25546218487395	130	0.617349709114415	0.6790846800258565	1569207310.0000002
3	763	113.93729372937294	222	0.5132310528350132	0.5645541581185146	4808404810.0
4	773	264.9258064516129	402	0.659019419033863	0.7249213609372492	3774326050.0
5	CN1	6.004431314623338	12	0.5003692762186115	0.5504062038404727	106011180.00000001
6	CR2	21.48284690220174	50	0.42965693804403476	0.4726226318484382	2181036550.0
7	SU9	56.81211267605634	97	0.5856918832583128	0.644261071584144	5625933169.999999

In [ ]: