Overall Report:

PART A: (Airline A)

Given Data:

- Operations sheet for Airline A
- AC Characteristics

Observations:

Based on the AC Characteristics:

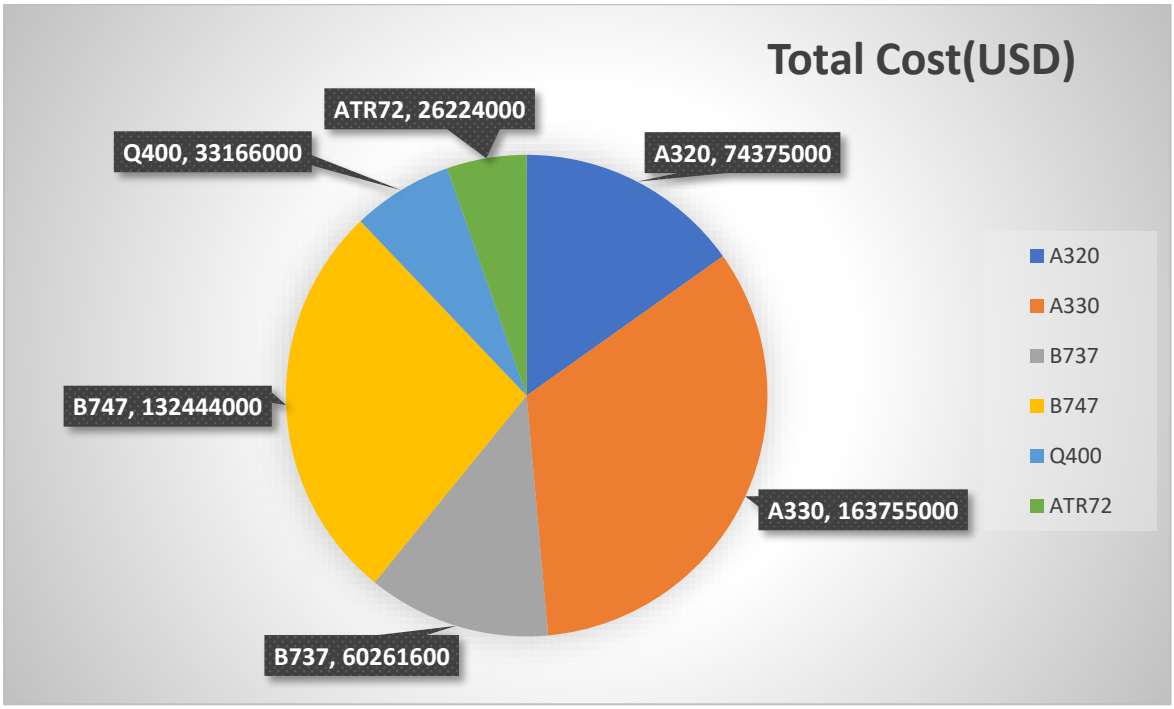
Aircraft Type	Range (Km)	Ave. Speed (km/h)	Number of Seats	Costs per flight hour
A320	5000	800	150	5000
A330	8000	900	250	7500
B737	5000	800	150	5100
B747	10000	900	350	12000
Q400	1500	750	90	3500
ATR72	1000	650	75	2750

I calculated the Total cost per Aircraft Type using data from Operations:
(Using Python scripts in Ipython Notebook)

Total hours	**Total Cost(USD)**	Dist Flown(Km)	Cost per Dist(USD/Km)	**Cost per Dist per Seat**
14875	**74375000**	11900000	6.25	0.041666667
21834	**163755000**	19650600	8.333333333	**0.033333333**
11816	**60261600**	9452800	6.375	0.0425
11037	**132444000**	9933300	13.33333333	0.038095238
9476	**33166000**	7107000	4.666666667	0.051851852
9536	**26224000**	6198400	4.230769231	0.056410256

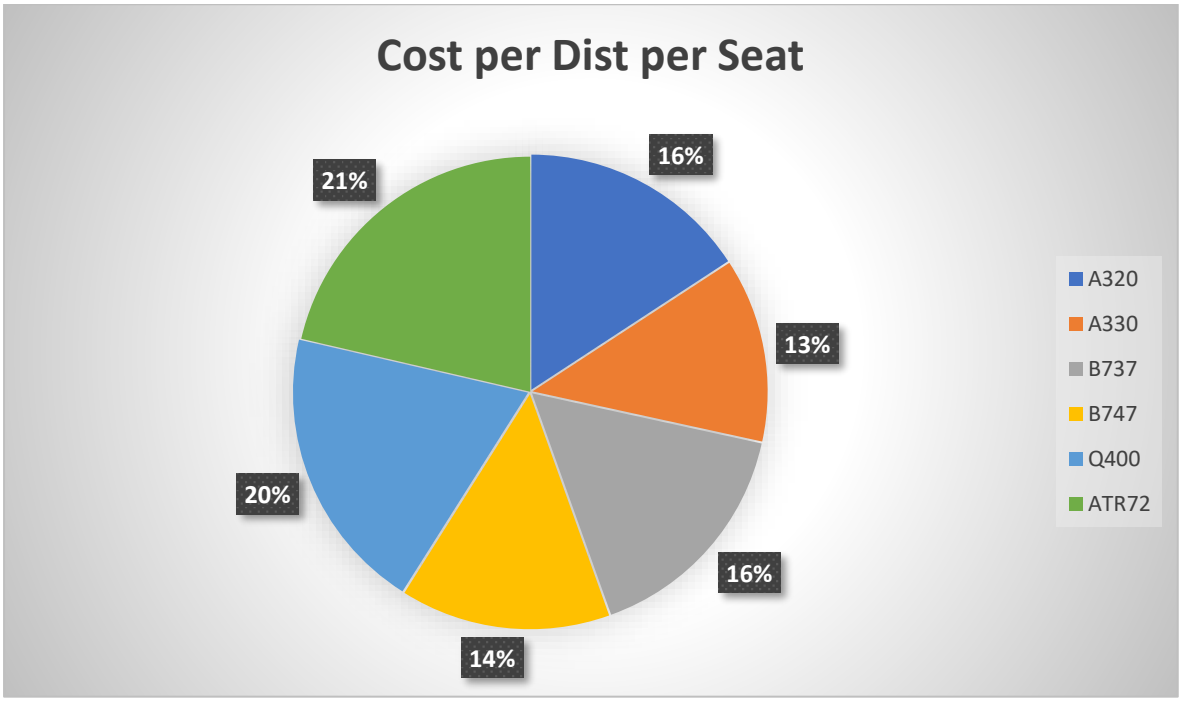
1:

Thus, Total Cost(USD) by Aircraft Type for the year 2014 by Airlines A is calculated. A330 aircraft has the highest Total Cost.



2:

A330 Aircraft has the lowest Cost Per Seat per Km Flown too.



Methodology:

- Using Pandas Library of Python and scripts written in IPython Notebook.
- Total Hours of Aircraft Type was calculated initially from Operations sheet
- Total Distance flown was calculated by multiplying Total hours and Ave Speed.
- Thus, Cost Per Distance per Seat was known

Conclusion and Recommendations:

- Few assumptions were made:

In airline A, for the operations data all seats were filled. Also, Total distance calculation by multiplying Total hours flown and Average speed.

- Flight A330 had the most hours flown and hence contributed the most to Total cost and most Distance covered too. Due to this distance covered, it also had the lowest Cost per seat per Km.

Part B: (Airline B)

Given Data:

- AC Characteristics
- City Pairs

Aircraft Type	Range (Km)	Ave. Speed (km/h)	Number of Seats	Costs per flight hour
A320	5,000	800	150	5,000
A330	8,000	900	250	7,500
B737	5,000	800	150	5,100
B747	10,000	900	350	12,000
Q400	1,500	750	90	3,500
ATR72	1,000	650	75	2,750

Answer:

Origin City	Desitnation City	Pass. Demand (per day)	Distance (km)	Aircraft Selected
AA	BB	420	3,000	**A330**
BB	CC	450	6,500	**A330**
CC	AA	300	400	**A320**
AA	DD	300	1,000	**A320**

Methodology:

For each City Pair,

- **Distance** between the cities and **Passenger Demand** is firstly taken care of.
- Based on the Distance (of the cities), those aircrafts are selected which can actually cover this distance.
- Next, using average speed of the aircrafts, **Time** is calculated for these chosen aircrafts (Distance/Speed)
- Using Cost per Flight hour, **Cost per Trip** for each Aircraft is found out
- Since seats are limited, we need to carry out more trips to fulfil passenger demand and hence **No of Trips** are found.
- **Total Cost** is calculated by multiplying Cost per trip with No of Trips.

Thus, Total Cost, here, is thus optimized along with Distance and Passenger demand and minimum costing Aircraft has been selected for each city pair.

Results:

For Example,

City Pair AA-BB having Passenger demand of 420 and Distance between the cities as 3000 Km:

Aircraft Selected	Speed	Time	Cost per Flight hour	Cost per trip	Seats	No of trips	Total Cost
A320	800	3.75	5,000	18,750.00	150	3	56,250.00
A330	900	3.33	7,500	25,000.00	250	2	**50,000.00**
B737	800	3.75	5,100	19,125.00	150	3	57,375.00
B747	900	3.33333	12,000	40,000.00	350	2	80,000.00

Thus accordingly, for each city pair, the following was found using pandas Python library and scripts were written in IPython Notebook.

Conclusions and recommendations:

- Though Optimization model must have been a linear combination eg. $Ax_1+Bx_2+Cx_2$, where, x_1,x_2 and x_3 could have been Total Cost, Distance between Cities and Passenger Demand with A,B and C being weights given to these variables. But since every city trip will have atleast one optimal Aircraft, and to simplify things, I took Total Cost as the important criterion

- For each City Pair, there definitely won't be only one Aircraft operating. There will be a fleet of aircrafts. So, Airline B should consider multiple aircrafts according to the Total Costs. For eg. we could also have had **Cost per Seat** as a criterion for optimization for Aircrafts.
- In addition, using Cost per Seat for the desired aircrafts for each city pairs, we can set Profit margins for the Airlines.