（一）

```
mysql> select count(*) from (select distinct P.Origin,P.Dest from performance P) p;
+----------+
| count(*) |
+----------+
|     6266 |
+----------+
1 row in set (3 min 16.59 sec)
```

（二）

```
mysql> select count(*) as count from performance P where P.Dest='TPA' and P.AirTime between 60
and 300;
+--------+
| count  |
+--------+
| 201142 |
+--------+
1 row in set (1 min 18.49 sec)
```

（三）

```
mysql> select plane.model, count(*) from plane where plane.model like '767%' group by
plane.model;
+-----------+----------+
| model     | count(*) |
+-----------+----------+
| 767-201   |        5 |
| 767-223   |       15 |
| 767-224   |       10 |
| 767-2B7   |        5 |
| 767-322   |       35 |
| 767-323   |       27 |
| 767-324   |        1 |
| 767-332   |       77 |
| 767-33A   |        8 |
| 767-3CB   |        3 |
| 767-3G5   |        3 |
| 767-3P6   |        6 |
| 767-424ER |       16 |
| 767-432ER |       21 |
+-----------+----------+
14 rows in set (0.43 sec)
```

（四）

```
create index idx_TailNum on performance(TailNum);
create index idx_tailnum on plane(tailnum);

select model, avg(Distance/ActualElapsedTime) as velocity
from(
```

```
        select model,ActualElapsedTime,Distance
        from performance P,plane where P.TailNum=plane.tailnum
)A
where  ActualElapsedTime!=0 and model is not NULL
group by model;

drop index idx_TailNum on performance;
drop index idx_tailnum on plane;
```

time: 10 min 26.00 sec+1.24 sec+43 min 38.72 sec+1.98 sec+0.52 sec

model	velocity
1121	7.44571381
150	5.97580100
172E	7.35897285
172M	6.00987796
182A	6.17938211
182P	5.71675565
206B	5.71288761
210-5(205)	5.66403834
421C	5.82854266
550	5.70006496
60	5.71821133
65-A90	6.22358489
690A	7.43519330
717-200	4.91611986
737-230	3.56633213
737-236	3.53836791
737-282	3.54783782
737-282C	3.50006890
737-2P6	3.56940270
737-2X6C	3.29341766
737-2Y5	3.59042513
737-301	4.87374504
737-317	5.34705102
737-322	5.34241900
737-33A	5.31381939
737-3A4	5.35091024
737-3B7	4.62929634
737-3G7	5.34179158
737-3H4	5.36354609
737-3K2	5.34987084
737-3L9	5.37119783
737-3Q8	5.35022496
737-3S3	5.36656722
737-3T5	5.35620578
737-3TO	5.48356172
737-3Y0	5.36383970
737-401	5.04877130
737-490	5.41946072

737-4B7	5.02488223
737-4Q8	5.38625973
737-4S3	5.37945852
737-522	5.35037927
737-524	5.01269315
737-5H4	5.11821909
737-705	5.74360238
737-724	6.11834918
737-73A	6.84045691
737-76N	5.90069793
737-76Q	5.69456961
737-790	5.92217967
737-7AD	5.65069971
737-7BD	5.83303556
737-7H4	5.68739574
737-7Q8	6.01779993
737-824	6.28920404
737-832	5.99259023
737-890	6.58418070
737-8FH	6.61628343
737-924	6.02254626
737-924ER	6.08330925
737-990	6.17536042
747-2B5F	5.73768394
747-422	7.26304046
747-451	7.22213784
757-212	5.57391397
757-222	6.47666690
757-223	6.59122588
757-224	6.09831370
757-225	5.88652385
757-231	6.01631238
757-232	5.96030128
757-23N	5.61862914
757-251	6.12451804
757-26D	5.75267987
757-2B7	5.92887728
757-2G7	7.20750700
757-2Q8	6.08611150
757-2S7	6.90141401
757-324	6.36977000
757-33N	6.38870394
757-351	6.62805741
767-201	5.58747775
767-223	7.20244479
767-224	6.27342255
767-2B7	5.50566748
767-322	7.08281658
767-323	7.44535795
767-324	5.79167692
767-332	6.26225127
767-33A	8.58709635

767-3CB	8.59748045
767-3G5	8.57209160
767-3P6	5.67481297
767-424ER	7.94991366
767-432ER	6.86489709
777-222	7.10629717
777-224	6.58434773
777-232	6.16518037
777-232LR	5.54514737
A-1B	7.44561140
A109E	7.41463015
A318-111	6.05097840
A319-111	6.08399815
A319-112	4.82002359
A319-114	5.42579377
A319-131	6.07147347
A319-132	5.67747984
A320-211	5.54359451
A320-212	5.66651814
A320-214	5.82915425
A320-231	5.82538058
A320-232	6.11068469
A321-211	6.24841943
A330-223	7.25086296
A330-323	7.45819045
AS 355F1	7.47623068
ATR 72-212	2.66971826
ATR-72-212	2.66781202
C90	5.70297670
CL-600-2B19	4.54892491
CL-600-2C10	5.13617909
CL600-2D24	4.69881964
DA 20-A1	6.33445977
DC-7BF	7.46754885
DC-9-31	4.23564543
DC-9-32	4.44513524
DC-9-41	4.09587864
DC-9-51	4.16634188
DC-9-82(MD-82)	5.69583189
DC-9-83(MD-83)	5.99215655
DHC-8-102	2.21289783
DHC-8-202	2.70823933
E-90	7.45500796
EMB-120	2.90353465
EMB-120ER	2.80263915
EMB-135ER	3.90290556
EMB-135KL	4.63608887
EMB-135LR	4.40801556
EMB-145	4.39315571
EMB-145EP	3.87077326
EMB-145LR	4.52266589
EMB-145XR	5.48174353

ERJ 190-100 IGW	4.56071389
EXEC 162F	5.61732857
F85P-1	6.60067147
FALCON XP	5.87375020
FALCON-XP	5.96475968
G-IV	7.45884975
HST-550	5.69701237
KITFOX IV	5.67786178
MD 83	5.98141401
MD-88	4.75522981
MD-90-30	5.50411904
OTTER DHC-3	6.01715812
PA-28-180	4.93236802
PA-31-350	5.92568773
PA-32R-300	5.71012420
PA-32RT-300	7.34155092
S-50A	5.69101550
S-76A	7.46644474
S55A	5.68331932
SAAB 340B	2.43309256
T210N	5.68835788
T337G	5.61930305
VANS AIRCRAFT RV6	5.74387340
+-------------------+------------+

（五）

```
create index idx_iata on airports(iata);

select origin,dest,zone
from(
        select distinct p.Origin as origin,p.Dest as dest,floor(abs(A1.lat-A2.lat)/15) as zone
        from performance p,airports A1,airports A2
        where p.Origin=A1.iata and p.Dest=A2.iata
) P
order by zone desc,origin,dest limit 50;

drop index idx_iatav on airports;
```

time: 0.98 sec+27 min 10.99 sec+3.74 sec

origin	dest	zone
ANC	HNL	2
ANC	IAH	2
ANC	KOA	2
ANC	OGG	2
HNL	ANC	2
IAH	ANC	2
OGG	ANC	2
ALB	FLL	1
ANC	ATL	1

ANC	CVG	1
ANC	DEN	1
ANC	DFW	1
ANC	DTW	1
ANC	LAS	1
ANC	LAX	1
ANC	MSP	1
ANC	ORD	1
ANC	PDX	1
ANC	PHX	1
ANC	SFO	1
ANC	SLC	1
ATL	ANC	1
ATL	BQN	1
ATL	PSE	1
ATL	SJU	1
ATL	STT	1
ATL	STX	1
AUS	SEA	1
BDL	FLL	1
BDL	MIA	1
BDL	PBI	1
BDL	RSW	1
BDL	SJU	1
BOS	FLL	1
BOS	MIA	1
BOS	PBI	1
BOS	RSW	1
BOS	SJU	1
BOS	STT	1
BQN	EWR	1
BQN	JFK	1
BTV	MCO	1
BUF	FLL	1
BUF	PBI	1
BUF	RSW	1
BWI	SJU	1
CLE	FLL	1
CLE	MIA	1
CLE	SJU	1
CLT	SJU	1
+--------+------+------+

（六）

```
mysql> select distinct model from plane
    -> where tailnum not in (select distinct TailNum from performance where Year=2008);

Empty set (42 min 16.96 sec)
```

（七）

```
create index idx_TailNum on performance(TailNum);
```

```
create index idx_tailnum on plane(tailnum);

select manu from
(
        select plane.manufacturer as manu,avg(P.ArrDelay) as average
        from plane,performance P
        where P.TailNum=plane.tailnum
        group by plane.manufacturer
) data
where average>30;

drop index idx_Tailnum on performance;
drop index idx_tailnum on plane;
```

time: 8 min 6.88 sec+1.18 sec+1 hour 12 min 48.33 sec+4.65 sec+0.62 sec

result: Empty set

（八）

先查詢以一天為單位的 delay 時間：

```
mysql> select P.DayOfWeek,avg(P.ArrDelay) as delay
    -> from performance P group by P.DayOfWeek order by P.DayOfWeek;
+-----------+---------+
| DayOfWeek | delay   |
+-----------+---------+
|         1 |  9.0241 |
|         2 |  7.1566 |
|         3 |  7.9923 |
|         4 | 10.6783 |
|         5 | 11.8416 |
|         6 |  5.5041 |
|         7 |  9.1364 |
+-----------+---------+
7 rows in set (2 min 58.00 sec)
```

可以發現統計下來，禮拜六的平均 delay 時間最少

再來查 24 小時為單位的 delay 時間：

```
mysql> select floor(P.CRSDepTime/100),avg(P.ArrDelay) as delay
    -> from performance P group by floor(P.CRSDepTime/100) order by floor(P.CRSDepTime/100);
+------------------------+---------+
| floor(P.CRSDepTime/100) | delay   |
+------------------------+---------+
|                      0 |  2.8345 |
|                      1 |  2.1318 |
|                      2 |  1.6644 |
|                      3 |  8.9932 |
|                      4 |  3.5882 |
|                      5 |  0.7689 |
|                      6 |  0.6046 |
|                      7 |  1.6227 |
|                      8 |  3.0429 |
|                      9 |  4.0603 |
```

```
|                   10 |  5.2579 |
|                   11 |  6.2243 |
|                   12 |  7.6011 |
|                   13 |  9.6781 |
|                   14 | 11.0541 |
|                   15 | 12.2673 |
|                   16 | 13.5018 |
|                   17 | 15.0906 |
|                   18 | 15.4076 |
|                   19 | 15.5707 |
|                   20 | 15.8314 |
|                   21 | 13.4131 |
|                   22 |  9.0028 |
|                   23 |  7.0387 |
+------------------------+---------+
24 rows in set (3 min 24.78 sec)
```

6~7 點的平均 delay 時間最少

（九）

```
create index idx_tailnum on plane(tailnum);
create index idx_TailNum on performance(TailNum);

select a.tailnum,a.delay,pla.year
from
(
        select plane.tailnum as tailnum,avg(P.ArrDelay) as delay
        from performance P,plane
        where P.TailNum=plane.tailnum
        group by plane.tailnum
        order by avg(P.ArrDelay) desc limit 30
) a,plane pla
where pla.tailnum=a.tailnum order by a.delay desc;

drop index idx_tailnum on plane;
drop index idx_TailNum on performance;
```

time: 0.85 sec+7 min 58.13 sec+40 min 26.46 sec+1.70 sec+0.46 sec

```
+---------+----------+------+
| tailnum | delay    | year |
+---------+----------+------+
| N852NW  | 167.8333 | 2004 |
| N853NW  | 127.0000 | 2004 |
| N78004  | 124.4000 | 1998 |
| N810NW  |  59.4458 | 2005 |
| N104UA  |  57.4615 | 1998 |
| N817NW  |  50.0000 | 2007 |
| N859NW  |  49.5000 | 2006 |
| N271AY  |  46.3061 |    0 |
| N855NW  |  46.0000 | 2004 |
| N179UA  |  45.9487 | 1991 |
```

N187UA	45.7143	1992
N270AY	43.5672	2000
N278AY	40.7798	2001
N181UA	40.6744	1991
N808NW	39.7340	2004
N276AY	39.3630	2001
N275AY	38.6378	2000
N804NW	38.3875	2003
N857NW	37.0000	2004
N7ACAA	36.9852	NULL
N277AY	36.1812	2001
N7BWAA	36.1081	NULL
N854NW	36.0000	2004
N174UA	35.1667	1990
N7BKAA	34.3894	NULL
N273AY	34.2877	2000
N117UA	33.1333	1999
N7AHAA	32.5714	NULL
N77006	31.3333	1998
N120UA	31.1923	1999
+---------+----------+------+

delay 時間最久的前幾名有新也有舊的飛機，看起來是沒有什麼關聯。

（十）

首先先查詢每個月的平均 delay 時間：

```
mysql> select Month,avg(ArrDelay) from performance group by Month;
+-------+---------------+
| Month | avg(ArrDelay) |
+-------+---------------+
|     1 |        8.1447 |
|     2 |       10.9568 |
|     3 |        9.5075 |
|     4 |        7.1377 |
|     5 |        6.5539 |
|     6 |       13.5223 |
|     7 |       11.5676 |
|     8 |        9.2630 |
|     9 |        4.2925 |
|    10 |        5.9391 |
|    11 |        4.7173 |
|    12 |       14.1058 |
+-------+---------------+
12 rows in set (3 min 5.79 sec)
```

可以發現，若將 3,4,5 月當作春天，可以發現夏天的 delay 時間最多，冬天次之，春第三，最後是秋天，推測可能美國夏天的颶風與冬天的冰雹影響了 delay 時間，而春秋則相對的安寧。

```
mysql> select avg(WeatherDelay) as average from performance P where P.WeatherDelay!=0;
+---------+
| average |
+---------+
```

```
| 44.5791 |
+---------+
1 row in set (2 min 34.78 sec)
```
再查了這三年來，若有受到天氣影響而 delay 的航班，發現平均 delay 時間竟然有 44.58 之高，可見天氣影響的時間是很大的。

```
mysql> select avg(WeatherDelay) as average from performance;
+---------+
| average |
+---------+
|  0.7048 |
+---------+
1 row in set (3 min 39.97 sec)
```
然而若從總平均來看，可以發現因天氣而 delay 的比例是很低的。

（BONUS）

查詢了 2006~2008 年近距離(Distance<1000 miles)與遠距離（Distance>3500 miles)航機的次數

```
mysql> select P.Year,count(*) from performance P where convert(Distance/100,signed)<=10 group
by P.Year order by P.Year;
+------+----------+
| Year | count(*) |
+------+----------+
| 2006 |  5702478 |
| 2007 |  5993487 |
| 2008 |  5614605 |
+------+----------+
3 rows in set (3 min 7.77 sec)
```

```
mysql> select P.Year,count(*) from performance P where convert(Distance/100,signed)>35 group
by P.Year order by P.Year;
+------+----------+
| Year | count(*) |
+------+----------+
| 2006 |    10082 |
| 2007 |     8508 |
| 2008 |     8054 |
+------+----------+
3 rows in set (2 min 52.76 sec)
```

發現 2006~2007 年，近距離航班的比例大幅提升，而遠距離則大幅下降，有可能是受到當時社會狀況的影響，例如經濟狀況或天災病毒等等，這就要在查詢其他資訊才能得知了。而 2007~2008 近距離航班大幅下降，但遠距離也略為下降，代表中距離航班比例提高，有可能是 2006~2007 年的狀況改善，但因為其他原因，遠距離航班依然下降，也許資料在往後更多年的話可以分析出更多東西，