

A:

Table describe screenshot

```
mysql> describe champ;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| champion_name | varchar(15) | NO | NULL |
| champion_id | int | NO | PRI | NULL |
+-----+-----+-----+-----+
2 rows in set (0.01 sec)
```

```
mysql> describe match_info;
+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+
| match_id | int | NO | PRI | NULL |
| duration | int | YES | NULL |
| version | varchar(15) | YES | NULL |
+-----+-----+-----+-----+
3 rows in set (0.00 sec)
```

```
mysql> describe participant;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| player_id | int | NO | PRI | NULL |
| match_id | int | YES | MUL | NULL |
| player | tinyint | YES | NULL |
| champion_id | int | YES | NULL |
| ss1 | varchar(15) | YES | NULL |
| ss2 | varchar(15) | YES | NULL |
| position | varchar(13) | YES | NULL |
+-----+-----+-----+-----+
7 rows in set (0.00 sec)
```

```
mysql> describe teamban;
+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| match_id | int | NO | PRI | NULL |
| team | char(1) | NO | NULL |
| champion_id | int | NO | NULL |
| banturn | tinyint | NO | PRI | NULL |
+-----+-----+-----+-----+
4 rows in set (0.00 sec)
```

```

mysql> describe stat;
+-----+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| player_id | int | NO | PRI | NULL |       |
| win | tinyint(1) | YES |       | NULL |       |
| item1 | smallint | YES |       | NULL |       |
| item2 | smallint | YES |       | NULL |       |
| item3 | smallint | YES |       | NULL |       |
| item4 | smallint | YES |       | NULL |       |
| item5 | smallint | YES |       | NULL |       |
| item6 | smallint | YES |       | NULL |       |
| kills | tinyint | YES |       | NULL |       |
| deaths | tinyint | YES |       | NULL |       |
| assists | tinyint | YES |       | NULL |       |
| longesttimespentliving | smallint | YES |       | NULL |       |
| doublekills | tinyint | YES |       | NULL |       |
| triplekills | tinyint | YES |       | NULL |       |
| quadrakills | tinyint | YES |       | NULL |       |
| pentakills | tinyint | YES |       | NULL |       |
| legendarykills | tinyint | YES |       | NULL |       |
| goldearned | mediumint | YES |       | NULL |       |
| firstblood | tinyint(1) | YES |       | NULL |       |
+-----+-----+-----+-----+-----+-----+
19 rows in set (0.00 sec)

```

1. char 是固定長度的, varchar 是指定最大的長度(capacity)占用的長度是  $\min(\text{capacity}, \text{實際長度}) + 1$
2. Boolean type 實際上是用 tinyint(1) 儲存的
- 3.

	Bytes	Value range
tinyint	1 bytes	-128 ~ 127
smallint	2 bytes	-32768 ~ 32767
mediumint	3 bytes	-8388608 ~ 8388607
int	4 bytes	-2147483648 ~ 2147483647

4. 我覺得這些對於每次的 match 只能另外去用 stat 的 win 來判斷是否同隊太麻煩，因此會把 stat 的 win join 到 match\_info 裡面(用 player\_id)

## C.

1.

Sql command:

```
1  select count(distinct champion_id) as cnt
2  from champ;
```

Result:

```
mysql> source ./problemC_solution/q1.sql
+----+
| cnt |
+----+
| 138 |
+----+
1 row in set (0.00 sec)
```

2.

Sql command:

```
1  select count(distinct ver) as cnt
2  from
3  (  select substring_index(match_info.version, '.', 2) as ver
4    |   from match_info
5  ) as tmp;
```

Result:

```
mysql> source ./problemC_solution/q2.sql
+----+
| cnt |
+----+
| 74 |
+----+
1 row in set (0.17 sec)
```

3.

Sql command:

```
1  select c.champion_name, r.cnt
2  from(
3  champ as c,
4  (
5  select champion_id, count(*) as cnt
6  from participant as p
7  where p.position='JUNGLE'
8  group by champion_id
9  order by cnt desc
10 limit 3
11 ) as r
12 )
13 where c.champion_id=r.champion_id;
```

Result:

```
mysql> source ./problemC_solution/q3.sql
+-----+-----+
| champion_name | cnt   |
+-----+-----+
| Lee Sin      | 56598 |
| Master Yi    | 23385 |
| Graves       | 19767 |
+-----+-----+
3 rows in set (1.68 sec)
```

4.

Sql command:

```
1  select match_id, sec_to_time(duration) as time
2  from match_info
3  order by duration desc
4  limit 5;
```

Result:

```
mysql> source ./problemC_solution/q4.sql
+-----+-----+
| match_id | time      |
+-----+-----+
| 146486  | 01:23:11 |
| 69303   | 01:20:14 |
| 581     | 01:16:59 |
| 70361   | 01:15:06 |
| 176628  | 01:13:34 |
+-----+-----+
5 rows in set (0.05 sec)
```

5.

sql command:

```
1  select
2      case win
3          when 1 then 'win'
4          when 0 then 'lose'
5      end as win_loss,
6      count(*) as cnt
7  from
8      (select match_id,win
9       from participant
10      inner join match_info using(match_id)
11      inner join stat using(player_id)
12      group by match_id, win
13      having avg(longesttimespentliving) >= 1200
14      ) as q
15  group by win
16  order by win asc;
```

Result:

```
mysql> source ./problemC_solution/q5.sql
+-----+----+
| win_loss | cnt |
+-----+----+
| lose    | 338 |
| win     | 807 |
+-----+----+
2 rows in set (12.28 sec)
```

6.

sql command:

```
1 ↵ with data as(
2 ↵   select position, champion_name,
3 ↵     rank() over(partition by position order by count(*) desc) as rnk
4 ↵   from(
5 ↵     select position, champion_name
6 ↵       from(
7 ↵         participant as p
8 ↵       join (
9 ↵         select match_id
10 ↵           from match_info
11 ↵           where match_info.duration between 2400 and 3000
12 ↵       ) as m using(match_id)
13 ↵       join champ using(champion_id)
14 ↵     )
15 ↵     where position in ("DUO_CARRY", "DUO_SUPPORT", "JUNGLE", "MID", "TOP")
16 ↵   )as pc
17 ↵   group by position, champion_name
18 ↵ )
19
20   select position, champion_name
21   from data
22   where rnk=1;
```

Result:

```
mysql> source ./problemC_solution/q6.sql
+-----+-----+
| position | champion_name |
+-----+-----+
| DUO_CARRY | Caitlyn      |
| DUO_SUPPORT | Thresh      |
| JUNGLE | Lee Sin      |
| MID | Ahri        |
| TOP | Riven        |
+-----+-----+
5 rows in set (6.86 sec)
```

7.

sql command:

```
1  with data as(
2    select
3      position,
4      champion_id,
5      (totalkills+assists)/deaths as kda,
6      rank() over(partition by position order by (totalkills+assists)/deaths desc) as rnk
7    from(
8      select
9        position,
10       champion_id,
11       sum(kills)+sum(doublekills)+sum(triplekills)+
12         sum(quadrakills)+sum(pentakills)+sum(legendarykills) as totalkills
13       ,sum(deaths) as deaths
14       ,sum(assists) as assists
15     from(
16       from(
17         (
18           select player_id,champion_id,position
19             from participant
20             where position in ("TOP","MID","JUNGLE","DUO_CARRY","DUO_SUPPORT")
21           )as t1 join (
22             select player_id,kills,deaths,assists,doublekills,triplekills,
23               quadrakills,pentakills,legendarykills
24             from stat
25           )as t2 using(player_id)
26         )
27         where deaths>0
28         group by position,champion_id
29       )as bigtable
30       group by position,champion_id
31     )
32   select position,champion_name,kda
33   from
34     data join champ using(champion_id)
35   where rnk=1
36   order by position;
```

Result:

```
mysql> source ./problemC_solution/q7.sql
+-----+-----+-----+
| position | champion_name | kda |
+-----+-----+-----+
| DUO_CARRY | Evelynn | 13.0000 |
| DUO_SUPPORT | Janna | 3.6043 |
| JUNGLE | Ivern | 3.6815 |
| MID | Ivern | 3.3809 |
| TOP | Sona | 3.2036 |
+-----+-----+-----+
5 rows in set (24.55 sec)
```

8.

sql command:

```
1  select champion_name
2   from champ
3  where champion_id not in(
4    select distinct champion_id
5     from teamban
6    where teamban.match_id in(
7      select match_id
8        from match_info
9       where match_info.version like '7.7.%'
10     )
11   )
12  order by champion_name;
```

Result:

```
mysql> source ./problemC_solution/q8.sql
+-----+
| champion_name |
+-----+
| Kayn          |
| Ornn          |
| Rakan         |
| RekSai         |
| Sion          |
| Xayah         |
+-----+
6 rows in set (0.14 sec)
```

9.

Sql command:

```
1  -- Lee Sin: 64, Teemo: 17
2  with t1 as (
3      select ver,win
4      from(
5          select win,match_id,substring_index(version,".",2) as ver
6          from(
7              participant
8              join stat using(player_id)
9              join match_info using(match_id)
10         )
11        where champion_id in (64,17)
12     ) as t
13     group by ver,match_id,win
14     having count(*)>1
15   )
16
17   )
18   select
19       ver as version,
20       count(case when win=1 then 1 end) as win_cnt,
21       count(case when win=0 then 1 end) as lose_cnt,
22       count(case when win=1 then 1 end)/count(*) as win_ratio
23   from t1
24   group by ver
25   order by ver;
```

Result:

```
mysql> source ./problemC_solution/q9.sql
+-----+-----+-----+-----+
| version | win_cnt | lose_cnt | win_ratio |
+-----+-----+-----+-----+
| 4.10   |      2 |      1 | 0.6667  |
| 4.12   |      0 |      1 | 0.0000  |
| 4.15   |      1 |      1 | 0.5000  |
| 4.17   |      0 |      1 | 0.0000  |
| 4.18   |      0 |      1 | 0.0000  |
| 4.19   |      0 |      1 | 0.0000  |
| 4.21   |      1 |      1 | 0.5000  |
| 4.9    |      1 |      0 | 1.0000  |
| 5.1    |      1 |      2 | 0.3333  |
| 5.12   |      1 |      0 | 1.0000  |
```

5.12	1	0	1.0000
5.13	0	1	0.0000
5.15	0	1	0.0000
5.19	1	0	1.0000
5.20	2	0	1.0000
5.21	0	2	0.0000
5.24	1	1	0.5000
5.5	1	0	1.0000
5.6	0	1	0.0000
5.7	1	0	1.0000
6.1	0	1	0.0000
6.13	1	0	1.0000
6.14	1	0	1.0000
6.18	1	1	0.5000
6.19	1	0	1.0000
6.2	1	1	0.5000
6.2	1	1	0.5000
6.20	3	2	0.6000
6.21	0	2	0.0000
6.22	2	1	0.6667
6.23	3	2	0.6000
6.24	4	3	0.5714
6.5	1	0	1.0000
6.6	0	1	0.0000
6.8	1	0	1.0000
6.9	1	1	0.5000
7.10	282	304	0.4812
7.2	2	1	0.6667
7.3	0	1	0.0000
7.4	1	1	0.5000
7.5	2	2	0.5000
7.6	2	5	0.2857
7.7	32	29	0.5246
7.8	210	237	0.4698
7.9	527	464	0.5318

+-----+-----+-----+-----+

43 rows in set (2.41 sec)

10.

```
1  -- Gragas : 79
2  with
3      enemytable as(
4          select match_id,player_id as enemy_id
5          from participant
6          where champion_id=79 and position="TOP"
7      ),
8      selftable1 as (
9          select match_id,champion_id,player_id as self_id
10         from participant
11        where participant.match_id in (select match_id from enemytable)
12        and participant.position="TOP" and participant.champion_id!=79
13     ),
14     selftable as(
15         select *
16         from selftable1
17         where selftable1.champion_id in (
18             select champion_id
19             from selftable1
20             group by champion_id
21
22             having count(*)>=100
23         )
24     ),
25     bigtable as([
26         select
27             champion_id,champion_name,self_win,
28             self_deaths,self_assists,
29             self_kills+ self_doublekills+ self_triplekills+
30                 self_quadrakills+ self_pentakills+ self_legendarykills as self_kill,
31             self_goldearned,enemy_win, enemy_deaths,enemy_assists,
32             enemy_kills+ enemy_doublekills+ enemy_triplekills+ enemy_quadrakills+
33                 enemy_pentakills+ enemy_legendarykills as enemy_kill,
34             enemy_goldearned |
35         from selftable
36         join champ using(champion_id)
37
38         select
39             player_id as self_id,
40             win as self_win,
41             deaths as self_deaths,
42             assists as self_assists,
43             kills as self_kills,
44             doublekills as self_doublekills,
45             triplekills as self_triplekills,
46             quadrakills as self_quadrakills,
47             pentakills as self_pentakills,
48             legendarykills as self_legendarykills,
49             goldearned as self_goldearned
50         from stat
51         where stat.player_id in (select player_id from selftable)
52     )as s using (self_id)
53     join enemytable using (match_id)
```

```

53    |     join (
54    |       select
55    |         player_id as enemy_id,
56    |         win as enemy_win,
57    |         deaths as enemy_deaths,
58    |         assists as enemy_assists,
59    |         kills as enemy_kills,
60    |         doublekills as enemy_doublekills,
61    |         triplekills as enemy_triplekills,
62    |         quadrakills as enemy_quadrakills,
63    |         pentakills as enemy_pentakills,
64    |         legendarykills as enemy_legendarykills,
65    |         goldearned as enemy_goldearned
66    |       from stat
67    |       where stat.player_id in (select player_id from enemytable)
68    |     )as enemy using (enemy_id)
69  ),
70    result as(
71    |       select
72    |         champion_name as self_champ_name,
73    |         count(case when self_win=1 then 1 end)/count(*) as win_ratio,
74    |         (sum(self_kill)+sum(self_assists))/sum(self_deaths) as self_kda,
75    |         avg(self_goldearned) as self_avg_gold,
76    |         (sum(enemy_kill)+sum(enemy_assists))/sum(enemy_deaths) as enemy_kda,
77    |         avg(enemy_goldearned) as enemy_avg_gold,
78    |         count(*) as battle_record
79    |       from bigtable
80    |       group by champion_name
81  )
82  | )
82 √ select
83  |   self_champ_name, win_ratio, self_kda,
84  |   self_avg_gold, "Garas" as enemy_champ_name,
85  |   enemy_kda, enemy_avg_gold, battle_record
86 √ from
87  |   result
88  | order by win_ratio desc
89  | limit 5;

```

Result:

```

mysql> source ./problemC_solution/q10.sql
+-----+-----+-----+-----+-----+-----+-----+-----+
| self_champ_name | win_ratio | self_kda | self_avg_gold | enemy_champ_name | enemy_kda | enemy_avg_gold | battle_record |
+-----+-----+-----+-----+-----+-----+-----+-----+
| Yasuo          | 0.6042  | 1.8668  | 12501.5833 | Garas          | 2.5288  | 10755.1042 | 288        |
| Darius         | 0.5881  | 2.3390  | 12017.6165 | Garas          | 2.2642  | 10681.5057 | 352        |
| Jax            | 0.5825  | 1.8364  | 12132.2330 | Garas          | 2.4583  | 10994.5340 | 206        |
| Teemo          | 0.5820  | 1.8971  | 12376.0899 | Garas          | 2.4963  | 11256.6878 | 189        |
| Nasus          | 0.5528  | 2.1494  | 11905.5366 | Garas          | 2.4443  | 10985.0000 | 123        |
+-----+-----+-----+-----+-----+-----+-----+-----+
5 rows in set (46.47 sec)

```

11.

Sql 說明:

我篩選出所有走上路的玩家的 ss1,ss2,champion\_id，join 進 stat 的 player\_id, win column，然後計算 win\_ratio(for each champion\_id,for each ss1,ss2)，對每個 champion\_id，只取戰鬥數量前 5 的(避免場數太少而導致結果沒有代表性)，取出後再對每個 champion\_id 取出 win\_ratio 最高者，最後，若 champion\_id 有相同 win\_ratio 的 ss1\_ss2 組合，則取其場數最多者(較具代表性)。

從結果得知，若玩家角色為 Aatrox 時，技能選擇 Flash,teleport 可以有最大的勝率

```
1  with t as (
2    select *
3    from(
4      select champion_name,ss1,ss2,win_ratio,turns,
5        rank() over(partition by champion_name order by win_ratio desc) as rnk
6      from(
7        select champion_id,
8          ss1,
9          ss2,
10         count(case when win=1 then 1 end)/count(*) as win_ratio,
11         rank() over(partition by champion_id order by count(*) desc) as turns
12       from(
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
      ) as t3 join champ using(champion_id)
      ) as t4
      where rnk=1
    )
    select champion_name,ss1,ss2,win_ratio
  ) as t5
  where rnk1=1
```

champion_name	ss1	ss2	win_ratio
Aatrox	Flash	Teleport	0.5455
Ahri	Ignite	Flash	0.5507
Akali	Teleport	Flash	0.5289
Alistar	Flash	Ignite	0.5714
Amumu	Flash	Ignite	0.7500
Anivia	Flash	Ignite	0.7222
Annie	Flash	Exhaust	0.8333
Ashe	Flash	Exhaust	0.5000
Aurelion Sol	Teleport	Flash	0.7222
Azir	Flash	Barrier	0.7500
Bard	Haste	Flash	1.0000
Blitzcrank	Flash	Teleport	0.4884
Brand	Ignite	Flash	0.7143
Braum	Flash	Teleport	0.5294
Caitlyn	Flash	Teleport	0.4815
Camille	Flash	Exhaust	0.5714
Cassiopeia	Flash	Exhaust	0.6172
ChoGath	Flash	Ignite	0.5233
Corki	Teleport	Flash	1.0000
Darius	Flash	Haste	0.5388
Diana	Teleport	Haste	1.0000
Draven	Flash	Barrier	0.6667
DrMundo	Haste	Teleport	0.5245
Ekko	Flash	Exhaust	0.8000
Elise	Flash	Smite	0.5294
Evelynn	Smite	Flash	0.6000
Ezreal	Flash	Ignite	0.7000
Fiddlesticks	Ignite	Flash	0.7500
Fiora	Ignite	Flash	0.5106
Fizz	Ignite	Teleport	0.5171
Galio	Ignite	Flash	0.5556
Gangplank	Flash	Ignite	0.5615
Garen	Ignite	Teleport	0.6543
Gnar	Ignite	Flash	0.5526
Gragas	Flash	Ignite	0.5357
Graves	Ignite	Flash	0.5476
Hecarim	Teleport	Flash	0.6207
Heimerdinger	Ignite	Flash	0.5422
Illaoi	Flash	Exhaust	0.5588
Irelia	Flash	Ignite	0.5825

12.

Sql 指令說明: 我選出了獲得過 legendarykills 的 player\_id 然後去 join participant、match\_info、champ 的部分欄位，並擷取出奇對手的部分欄位資訊。

**Legendarykills** 真的是傳說級別的，在整份 stat 中只有 2 人獲得過，他們都有的共通點是技能選 Heal 和 Flash，都走 DUO\_CARRY，都是 version 7.10.187.9675(或許也有可能 **legendarykills** 是這個版本更新才有的)，但，其對手技能也是 Heal 和 Flash，只是擊殺總數較少，所以技術還是主要原因呀。

Sql command:

```

1 with data as(
2     select match_id,champion_name,player_id,win,ss1,ss2,player,
3           position,duration,version,killn,deaths,assists
4     from (
5         select player_id,win,kills+doublekills+triplekills+
6               quadrakills+pentakills+legendarykills as killn,
7               deaths,assists
8         from stat where legendarykills=1)as t1
9     join participant using(player_id)
10    join champ using(champion_id) join match_info using(match_id)
11 )
12 select data.match_id as matchId,champion_name as selfName,win as w,ss1,ss2,killn,deaths,assists,
13       enemy_name as enName,enemy_ss1 as ens1,enemy_ss2 as ens2,ekilln as ekill,edeaths as edeath,
14       eassists as eassist,position,version
15 from data join
16   (
17     select match_id,champion_name as enemy_name,position as eposition,player,
18           ss1 as enemy_ss1,ss2 as enemy_ss2,kills+doublekills+triplekills+
19           quadrakills+pentakills+legendarykills as ekilln,
20           deaths as edeaths,assists as eassists
21     from participant join champ using(champion_id) join stat using(player_id)
22   ) as p on p.match_id = data.match_id and
23          p.eposition = data.position and
24          p.player <> data.player

```

mysql> source ./problemC\_solution/q12.sql

matchId	selfName	w	ss1	ss2	killn	deaths	assists	enName	ens1	ens2	ekill	edeath	eassist	position	version	
46660	Draven	1	1	Heal	Flash	28	2	7	Vayne	Heal	Flash	6	6	3	DUO_CARRY	7.10.187.9675
120238	Ezreal	1	1	Flash	Heal	22	8	10	Jinx	Heal	Flash	3	7	7	DUO_CARRY	7.10.187.9675

2 rows in set (0.91 sec)