Operation Analytics and Investigating Metric Spike

Project Description:

- Operation Analytics is the analysis done for the complete end to end operations of a company.
- With the help of this, the company then finds the areas on which it must improve upon. Investigating metric spike is also an important part of operation analytics.
- Data Analyst must be able to understand or make other teams understand the questions asked.

Tech Stack Used:

This project is executed using MySQL workbench.

Approach and Insights:

We have performed analysis using SQL to answer the questions to derive certain insights out of it and answer the questions asked by different departments.

Case Study 1 (Job Data)

Create database and table:

```
CREATE TABLE job_data
(
   ds     VARCHAR(512),
   job_id         VARCHAR(512),
   actor_id       VARCHAR(512),
   event VARCHAR(512),
   language       VARCHAR(512),
   time_spent     VARCHAR(512),
   org    VARCHAR(512)
);
INSERT INTO job_data (ds, job_id, actor_id, event, language, time_spent, org) VALUES
        ('2020-11-30', '21', '1001', 'skip', 'English', '15', 'A'),
        ('2020-11-30', '22', '1006', 'transfer', 'Arabic', '25', 'B'),
        ('2020-11-29', '23', '1003', 'decision', 'Persian', '20', 'C'),
        ('2020-11-28', '23', '1005', 'transfer', 'Persian', '22', 'D'),
        ('2020-11-28', '25', '1002', 'decision', 'Hindi', '11', 'B'),
        ('2020-11-27', '11', '1007', 'decision', 'French', '104', 'D'),
        ('2020-11-26', '23', '1004', 'skip', 'Persian', '56', 'A'),
        ('2020-11-25', '20', '1003', 'transfer', 'Italian', '45', 'C');
```

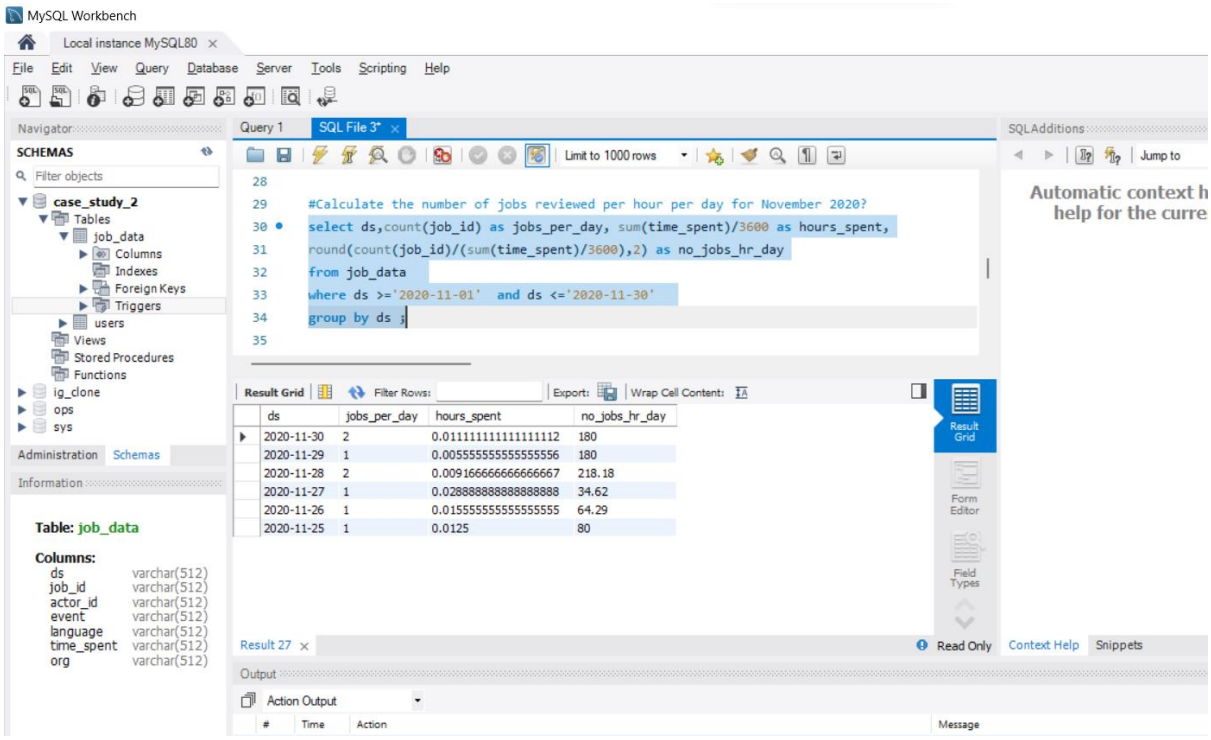
Number of jobs reviewed: Amount of jobs reviewed over time.
Your task: Calculate the number of jobs reviewed per hour per day for November 2020?

Query:

```
select ds,count(job_id) as jobs_per_day, sum(time_spent)/3600 as hours_spent,

round(count(job_id)/(sum(time_spent)/3600),2) as no_jobs_hr_day

from job_data

where ds >='2020-11-01'  and ds <='2020-11-30'

group by ds ;
```

Output:

ds	jobs_per_day	hours_spent	no_jobs_hr_day
2020-11-30	2	0.011111111111111112	180
2020-11-29	1	0.005555555555555556	180
2020-11-28	2	0.009166666666666667	218.18
2020-11-27	1	0.028888888888888888	34.62
2020-11-26	1	0.015555555555555555	64.29
2020-11-25	1	0.0125	80



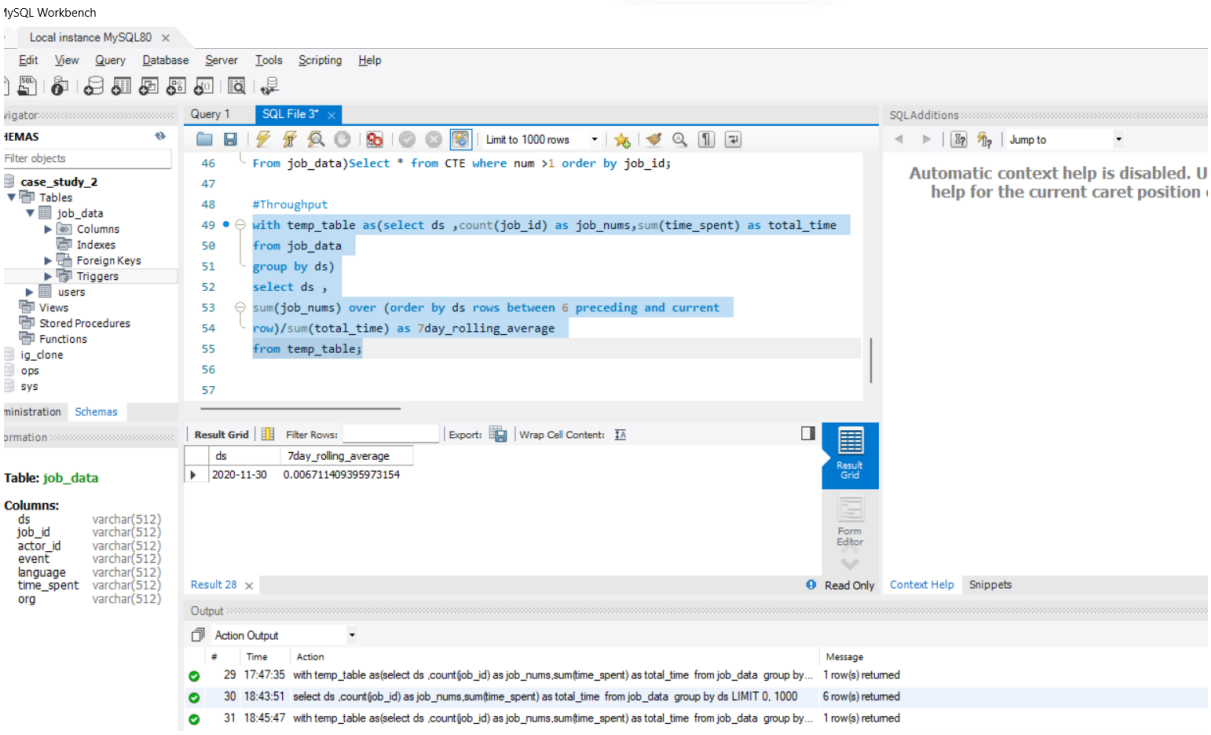
Throughput: It is the no. of events happening per second.
Your task: Let's say the above metric is called throughput. Calculate 7 day rolling average of throughput? For throughput, do you prefer daily metric or 7-day rolling and why?

Query:

```
with temp_table as(select ds ,count(job_id) as job_nums,sum(time_spent) as total_time
from job_data
group by ds)
select ds ,
sum(job_nums) over (order by ds rows between 6 preceding and current
row)/sum(total_time) as 7day_rolling_average
from temp_table;
```

Output:

ds	7day_rolling_average
2020-11-30	0.006711409395973154



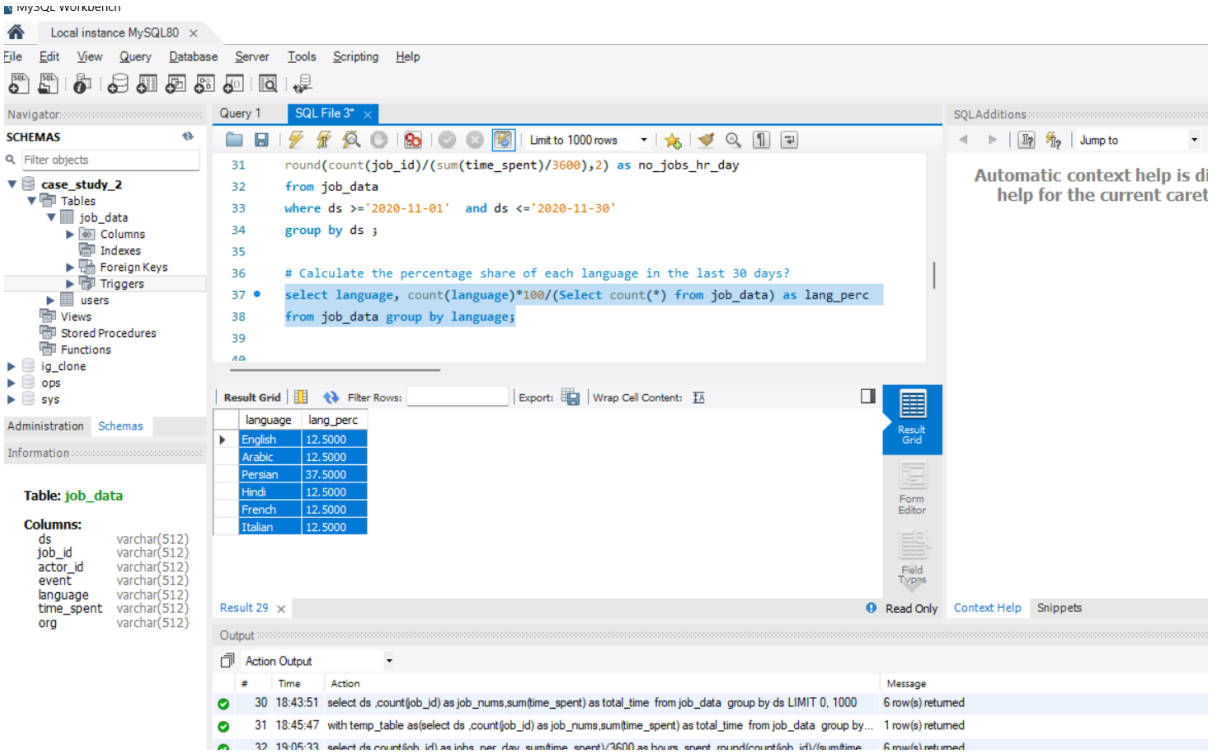
Percentage share of each language: Share of each language for different contents.
Your task: Calculate the percentage share of each language in the last 30 days?

Query:

```
select language, count(language)*100/(Select count(*) from job_data) as lang_perc
from job_data group by language;
```

Output:

language	lang_perc
English	12.5000
Arabic	12.5000
Persian	37.5000
Hindi	12.5000
French	12.5000
Italian	12.5000



Duplicate rows: Rows that have the same value present in them.
Your task: Let's say you see some duplicate rows in the data. How will you display duplicates from the table?

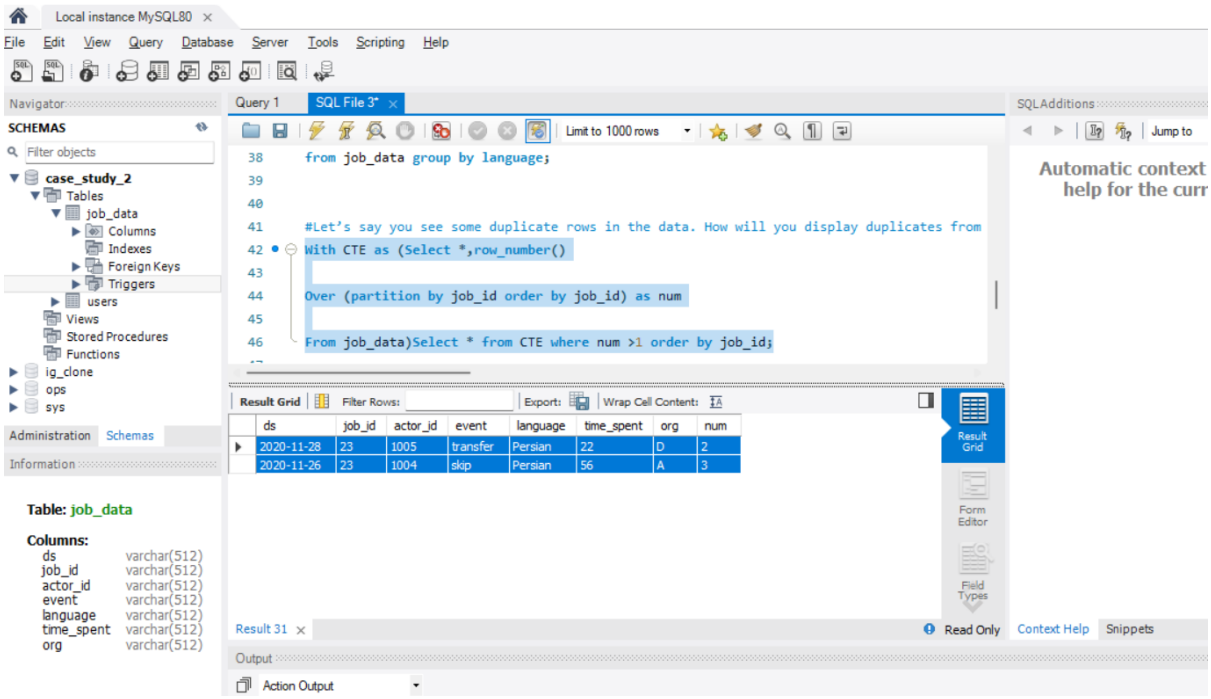
Query:

```
With CTE as (Select *,row_number()

Over (partition by job_id order by job_id) as num
```

From job_data)Select * from CTE where num >1 order by job_id;

Output:

ds	job_id	actor_id	event	language	time_spent	org	num
2020-11-28	23	1005	transfer	Persian	22	D	2
2020-11-26	23	1004	skip	Persian	56	A	3



Case Study 2 (Investigating metric spike)

User Engagement: To measure the activeness of a user. Measuring if the user finds quality in a product/service.
Your task: Calculate the weekly user engagement?

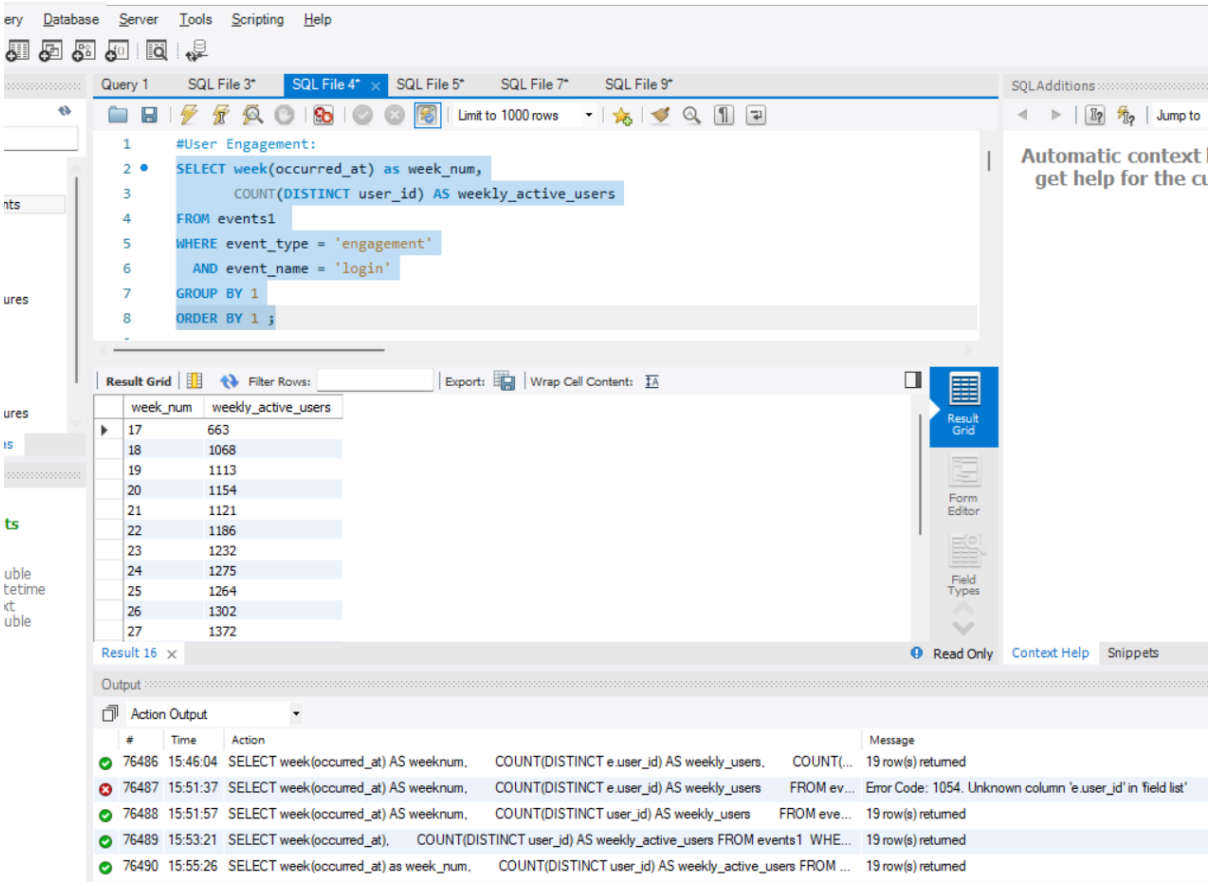
Query :

```
SELECT week(occurred_at) as week_num,
      COUNT(DISTINCT user_id) AS weekly_active_users
FROM events1
WHERE event_type = 'engagement'
 AND event_name = 'login'
```

```
GROUP BY 1

ORDER BY 1 ;
```

Output :

week_num	weekly_active users
17	663
18	1068
19	1113
20	1154
21	1121
22	1186
23	1232
24	1275
25	1264
26	1302
27	1372
28	1365
29	1376
30	1467
31	1299
32	1225
33	1225
34	1204
35	104



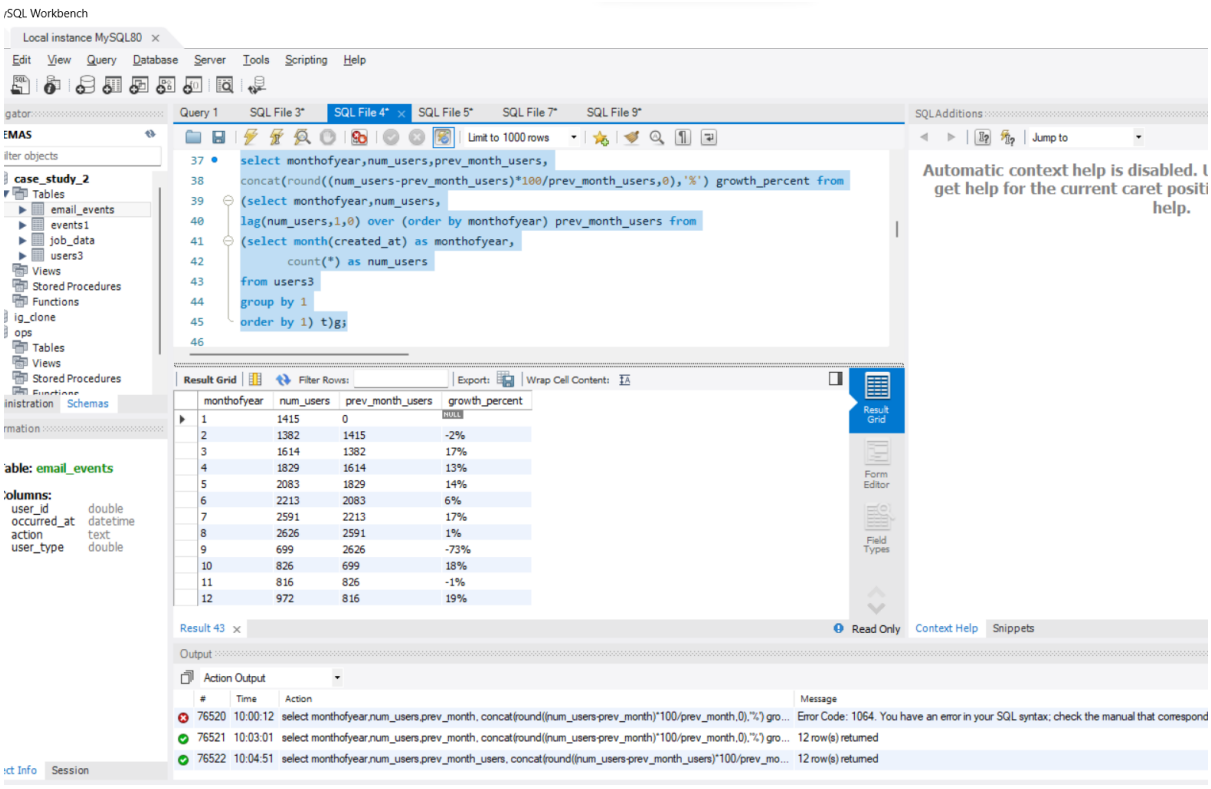
User Growth: Amount of users growing over time for a product.
Your task: Calculate the user growth for product?

Query:

```
select monthofyear,num_users,prev_month_users,

concat(round((num_users-prev_month_users)*100/prev_month_users,0),'%')
growth_percent from

(select monthofyear,num_users,

lag(num_users,1,0) over (order by monthofyear) prev_month_users from

(select month(created_at) as monthofyear,

      count(*) as num_users

from users3

group by 1

order by 1) t)g;
```

Output:

monthofyear	num_users	prev_month_users	growth_percent
1	1415	0	NULL
2	1382	1415	-2%
3	1614	1382	17%
4	1829	1614	13%
5	2083	1829	14%
6	2213	2083	6%
7	2591	2213	17%
8	2626	2591	1%
9	699	2626	-73%
10	826	699	18%
11	816	826	-1%
12	972	816	19%



Weekly Retention: Users getting retained weekly after signing-up for a product.
Your task: Calculate the weekly retention of users-sign up cohort?

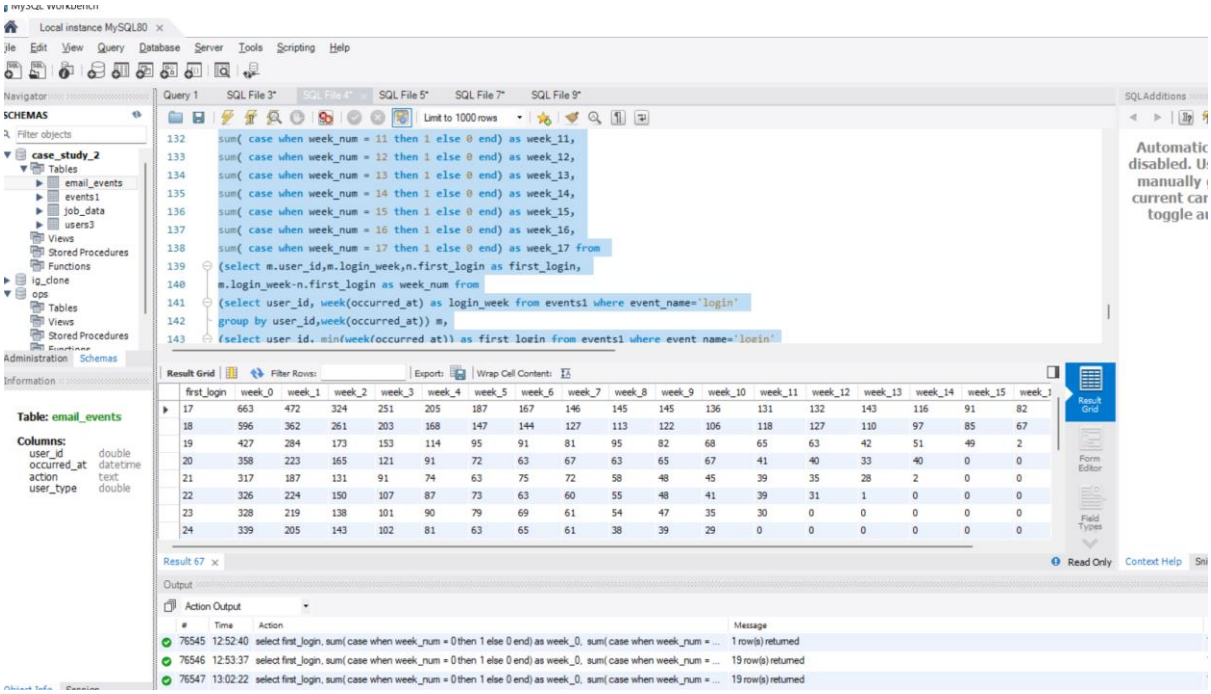
Query :

```
select first_login,

sum( case when week_num = 0 then 1 else 0 end) as week_0,
```

```
sum( case when week_num = 1 then 1 else 0 end) as week_1,

sum( case when week_num = 2 then 1 else 0 end) as week_2,

sum( case when week_num = 3 then 1 else 0 end) as week_3,

sum( case when week_num = 4 then 1 else 0 end) as week_4,

sum( case when week_num = 5 then 1 else 0 end) as week_5,

sum( case when week_num = 6 then 1 else 0 end) as week_6,

sum( case when week_num = 7 then 1 else 0 end) as week_7,

sum( case when week_num = 8 then 1 else 0 end) as week_8,

sum( case when week_num = 9 then 1 else 0 end) as week_9,

sum( case when week_num = 10 then 1 else 0 end) as week_10,

sum( case when week_num = 11 then 1 else 0 end) as week_11,

sum( case when week_num = 12 then 1 else 0 end) as week_12,

sum( case when week_num = 13 then 1 else 0 end) as week_13,

sum( case when week_num = 14 then 1 else 0 end) as week_14,

sum( case when week_num = 15 then 1 else 0 end) as week_15,

sum( case when week_num = 16 then 1 else 0 end) as week_16,

sum( case when week_num = 17 then 1 else 0 end) as week_17 from

(select m.user_id,m.login_week,n.first_login as first_login,

m.login_week-n.first_login as week_num from

(select user_id, week(occurred_at) as login_week from events1 where event_name='login'

group by user_id,week(occurred_at)) m,

(select user_id, min(week(occurred_at)) as first_login from events1 where
event_name='login'

group by user_id) n

where m.user_id=n.user_id) as with_week_num group by first_login order by first_login;
```

Output:

first_login	week_0	week_1	week_2	week_3	week_4	week_5	week_6	week_7	week_8	week_9	week_10	week_11	week_12	week_13	week_14	week_15	week_16	week_17
17	663	472	324	251	205	187	167	146	145	145	136	131	132	143	116	91	82	77
18	596	362	261	203	168	147	144	127	113	122	106	118	127	110	97	85	67	4
19	427	284	173	153	114	95	91	81	95	82	68	65	63	42	51	49	2	0
20	358	223	165	121	91	72	63	67	63	65	67	41	40	33	40	0	0	0
21	317	187	131	91	74	63	75	72	58	48	45	39	35	28	2	0	0	0
22	326	224	150	107	87	73	63	60	55	48	41	39	31	1	0	0	0	0
23	328	219	138	101	90	79	69	61	54	47	35	30	0	0	0	0	0	0
24	339	205	143	102	81	63	65	61	38	39	29	0	0	0	0	0	0	0
25	305	218	139	101	75	63	50	46	38	35	2	0	0	0	0	0	0	0
26	288	181	114	83	73	55	47	43	29	0	0	0	0	0	0	0	0	0
27	292	199	121	106	68	53	40	36	1	0	0	0	0	0	0	0	0	0
28	274	194	114	69	46	30	28	3	0	0	0	0	0	0	0	0	0	0
29	270	186	102	65	47	40	1	0	0	0	0	0	0	0	0	0	0	0
30	294	202	121	78	53	3	0	0	0	0	0	0	0	0	0	0	0	0
31	215	145	76	57	1	0	0	0	0	0	0	0	0	0	0	0	0	0
32	267	188	94	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	286	202	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	279	44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Weekly Engagement: To measure the activeness of a user. Measuring if the user finds quality in a product/service weekly.
Your task: Calculate the weekly engagement per device?

Query :

```
SELECT week(occurred_at) AS weeknum,
    COUNT(DISTINCT user_id) AS weekly_users,
    device
```

```
    FROM events1
WHERE event_type = 'engagement'
AND event_name = 'login'
GROUP BY weeknum, device
ORDER BY 1 ;
```

Output:

week_nam	weekly_users	device
17	9	acer aspire desktop
17	20	acer aspire notebook
17	4	amazon fire phone
17	21	asus chromebook
17	18	dell inspiron desktop
17	46	dell inspiron notebook
17	14	hp pavilion desktop
17	16	htc one
17	27	ipad air
17	19	ipad mini
17	21	iphone 4s
17	65	iphone 5
17	42	iphone 5s
17	6	kindle fire
17	86	lenovo thinkpad
17	6	mac mini
17	54	macbook air
17	143	macbook pro
17	16	nexus 10
17	40	nexus 5
17	18	nexus 7
17	17	nokia lumia 635
17	8	samsumg galaxy tablet
17	7	samsung galaxy note
17	52	samsung galaxy s4
17	10	windows surface
18	26	acer aspire desktop
18	33	acer aspire notebook
18	9	amazon fire phone
18	42	asus chromebook
18	58	dell inspiron desktop
18	77	dell inspiron notebook
18	37	hp pavilion desktop

18	19	htc one
18	52	ipad air
18	30	ipad mini
18	46	iphone 4s
18	113	iphone 5
18	73	iphone 5s
18	27	kindle fire
18	153	lenovo thinkpad
18	13	mac mini
18	121	macbook air
18	252	macbook pro
18	30	nexus 10
18	73	nexus 5
18	30	nexus 7
18	33	nokia lumia 635
18	11	samsumg galaxy tablet
18	15	samsung galaxy note
18	82	samsung galaxy s4
18	10	windows surface
19	23	acer aspire desktop
19	41	acer aspire notebook
19	12	amazon fire phone
19	27	asus chromebook
19	36	dell inspiron desktop
19	83	dell inspiron notebook
19	40	hp pavilion desktop
19	30	htc one
19	55	ipad air
19	36	ipad mini
19	44	iphone 4s
19	115	iphone 5
19	79	iphone 5s
19	21	kindle fire
19	178	lenovo thinkpad
19	18	mac mini
19	112	macbook air
19	266	macbook pro
19	25	nexus 10
19	87	nexus 5
19	41	nexus 7
19	23	nokia lumia 635
19	6	samsumg galaxy tablet
19	11	samsung galaxy note
19	91	samsung galaxy s4
19	16	windows surface
20	23	acer aspire desktop
20	40	acer aspire notebook
20	11	amazon fire phone

20	41	asus chromebook
20	52	dell inspiron desktop
20	84	dell inspiron notebook
20	30	hp pavilion desktop
20	29	htc one
20	59	ipad air
20	32	ipad mini
20	55	iphone 4s
20	125	iphone 5
20	79	iphone 5s
20	23	kindle fire
20	173	lenovo thinkpad
20	26	mac mini
20	119	macbook air
20	256	macbook pro
20	22	nexus 10
20	103	nexus 5
20	32	nexus 7
20	22	nokia lumia 635
20	9	samsumg galaxy tablet
20	18	samsung galaxy note
20	93	samsung galaxy s4
20	21	windows surface
21	29	acer aspire desktop
21	47	acer aspire notebook
21	5	amazon fire phone
21	38	asus chromebook
21	41	dell inspiron desktop
21	80	dell inspiron notebook
21	44	hp pavilion desktop
21	21	htc one
21	51	ipad air
21	23	ipad mini
21	45	iphone 4s
21	137	iphone 5
21	74	iphone 5s
21	30	kindle fire
21	167	lenovo thinkpad
21	18	mac mini
21	110	macbook air
21	247	macbook pro
21	25	nexus 10
21	91	nexus 5
21	29	nexus 7
21	25	nokia lumia 635
21	6	samsumg galaxy tablet
21	20	samsung galaxy note
21	84	samsung galaxy s4

21	17	windows surface
22	25	acer aspire desktop
22	41	acer aspire notebook
22	5	amazon fire phone
22	52	asus chromebook
22	52	dell inspiron desktop
22	92	dell inspiron notebook
22	38	hp pavilion desktop
22	24	htc one
22	58	ipad air
22	34	ipad mini
22	45	iphone 4s
22	125	iphone 5
22	71	iphone 5s
22	21	kindle fire
22	176	lenovo thinkpad
22	25	mac mini
22	145	macbook air
22	251	macbook pro
22	27	nexus 10
22	96	nexus 5
22	45	nexus 7
22	25	nokia lumia 635
22	10	samsumg galaxy tablet
22	19	samsung galaxy note
22	105	samsung galaxy s4
22	15	windows surface
23	22	acer aspire desktop
23	43	acer aspire notebook
23	16	amazon fire phone
23	49	asus chromebook
23	53	dell inspiron desktop
23	103	dell inspiron notebook
23	54	hp pavilion desktop
23	20	htc one
23	41	ipad air
23	33	ipad mini
23	53	iphone 4s
23	152	iphone 5
23	79	iphone 5s
23	25	kindle fire
23	176	lenovo thinkpad
23	18	mac mini
23	124	macbook air
23	266	macbook pro
23	45	nexus 10
23	88	nexus 5
23	36	nexus 7

23	31	nokia lumia 635
23	14	samsumg galaxy tablet
23	14	samsung galaxy note
23	99	samsung galaxy s4
23	14	windows surface
24	24	acer aspire desktop
24	40	acer aspire notebook
24	11	amazon fire phone
24	43	asus chromebook
24	59	dell inspiron desktop
24	99	dell inspiron notebook
24	56	hp pavilion desktop
24	20	htc one
24	57	ipad air
24	39	ipad mini
24	53	iphone 4s
24	142	iphone 5
24	79	iphone 5s
24	25	kindle fire
24	165	lenovo thinkpad
24	29	mac mini
24	152	macbook air
24	255	macbook pro
24	38	nexus 10
24	87	nexus 5
24	49	nexus 7
24	35	nokia lumia 635
24	11	samsumg galaxy tablet
24	20	samsung galaxy note
24	101	samsung galaxy s4
24	22	windows surface
25	28	acer aspire desktop
25	47	acer aspire notebook
25	13	amazon fire phone
25	38	asus chromebook
25	52	dell inspiron desktop
25	105	dell inspiron notebook
25	52	hp pavilion desktop
25	21	htc one
25	57	ipad air
25	30	ipad mini
25	40	iphone 4s
25	137	iphone 5
25	78	iphone 5s
25	24	kindle fire
25	197	lenovo thinkpad
25	21	mac mini
25	121	macbook air

25	275	macbook pro
25	29	nexus 10
25	89	nexus 5
25	51	nexus 7
25	37	nokia lumia 635
25	12	samsumg galaxy tablet
25	14	samsung galaxy note
25	99	samsung galaxy s4
25	22	windows surface
26	29	acer aspire desktop
26	35	acer aspire notebook
26	13	amazon fire phone
26	49	asus chromebook
26	60	dell inspiron desktop
26	89	dell inspiron notebook
26	46	hp pavilion desktop
26	23	htc one
26	56	ipad air
26	43	ipad mini
26	50	iphone 4s
26	152	iphone 5
26	94	iphone 5s
26	26	kindle fire
26	192	lenovo thinkpad
26	11	mac mini
26	134	macbook air
26	269	macbook pro
26	29	nexus 10
26	87	nexus 5
26	46	nexus 7
26	42	nokia lumia 635
26	12	samsumg galaxy tablet
26	9	samsung galaxy note
26	112	samsung galaxy s4
26	21	windows surface
27	29	acer aspire desktop
27	49	acer aspire notebook
27	10	amazon fire phone
27	52	asus chromebook
27	53	dell inspiron desktop
27	89	dell inspiron notebook
27	56	hp pavilion desktop
27	27	htc one
27	55	ipad air
27	35	ipad mini
27	67	iphone 4s
27	163	iphone 5
27	83	iphone 5s

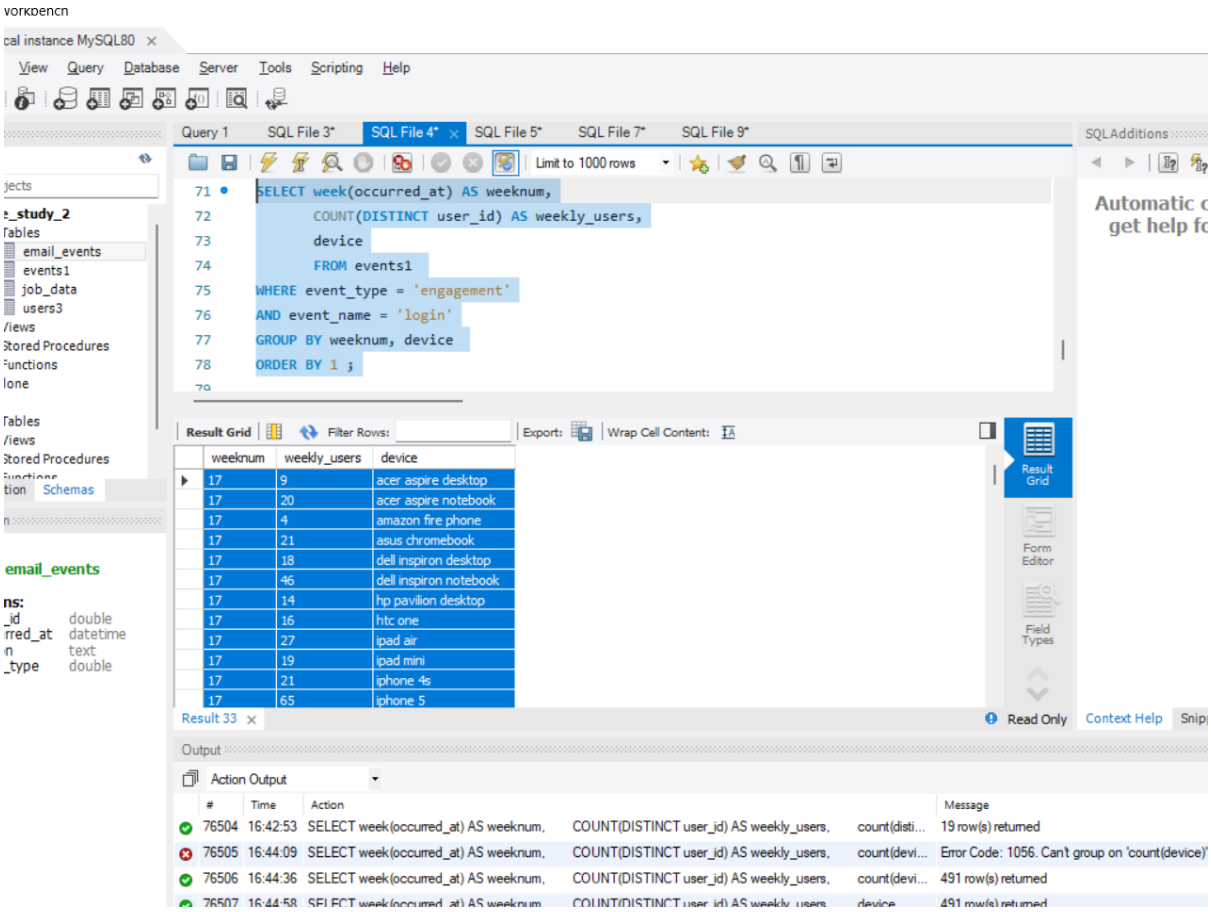
27	25	kindle fire
27	202	lenovo thinkpad
27	15	mac mini
27	142	macbook air
27	302	macbook pro
27	37	nexus 10
27	84	nexus 5
27	40	nexus 7
27	31	nokia lumia 635
27	15	samsumg galaxy tablet
27	15	samsung galaxy note
27	116	samsung galaxy s4
27	33	windows surface
28	30	acer aspire desktop
28	49	acer aspire notebook
28	6	amazon fire phone
28	50	asus chromebook
28	56	dell inspiron desktop
28	103	dell inspiron notebook
28	56	hp pavilion desktop
28	26	htc one
28	54	ipad air
28	35	ipad mini
28	61	iphone 4s
28	151	iphone 5
28	93	iphone 5s
28	31	kindle fire
28	220	lenovo thinkpad
28	28	mac mini
28	148	macbook air
28	295	macbook pro
28	26	nexus 10
28	85	nexus 5
28	39	nexus 7
28	35	nokia lumia 635
28	9	samsumg galaxy tablet
28	10	samsung galaxy note
28	122	samsung galaxy s4
28	33	windows surface
29	28	acer aspire desktop
29	53	acer aspire notebook
29	12	amazon fire phone
29	49	asus chromebook
29	54	dell inspiron desktop
29	113	dell inspiron notebook
29	58	hp pavilion desktop
29	31	htc one
29	52	ipad air

29	34	ipad mini
29	60	iphone 4s
29	144	iphone 5
29	90	iphone 5s
29	37	kindle fire
29	209	lenovo thinkpad
29	30	mac mini
29	148	macbook air
29	295	macbook pro
29	25	nexus 10
29	77	nexus 5
29	45	nexus 7
29	43	nokia lumia 635
29	13	samsumg galaxy tablet
29	16	samsung galaxy note
29	123	samsung galaxy s4
29	28	windows surface
30	33	acer aspire desktop
30	60	acer aspire notebook
30	12	amazon fire phone
30	56	asus chromebook
30	54	dell inspiron desktop
30	127	dell inspiron notebook
30	42	hp pavilion desktop
30	31	htc one
30	70	ipad air
30	35	ipad mini
30	65	iphone 4s
30	152	iphone 5
30	103	iphone 5s
30	25	kindle fire
30	206	lenovo thinkpad
30	23	mac mini
30	159	macbook air
30	322	macbook pro
30	36	nexus 10
30	84	nexus 5
30	62	nexus 7
30	34	nokia lumia 635
30	9	samsumg galaxy tablet
30	15	samsung galaxy note
30	103	samsung galaxy s4
30	19	windows surface
31	31	acer aspire desktop
31	55	acer aspire notebook
31	14	amazon fire phone
31	56	asus chromebook
31	44	dell inspiron desktop

31	113	dell inspiron notebook
31	51	hp pavilion desktop
31	13	htc one
31	55	ipad air
31	27	ipad mini
31	56	iphone 4s
31	135	iphone 5
31	71	iphone 5s
31	14	kindle fire
31	207	lenovo thinkpad
31	24	mac mini
31	147	macbook air
31	321	macbook pro
31	24	nexus 10
31	69	nexus 5
31	38	nexus 7
31	28	nokia lumia 635
31	8	samsumg galaxy tablet
31	14	samsung galaxy note
31	100	samsung galaxy s4
31	19	windows surface
32	35	acer aspire desktop
32	55	acer aspire notebook
32	12	amazon fire phone
32	62	asus chromebook
32	57	dell inspiron desktop
32	104	dell inspiron notebook
32	51	hp pavilion desktop
32	18	htc one
32	48	ipad air
32	30	ipad mini
32	34	iphone 4s
32	119	iphone 5
32	67	iphone 5s
32	12	kindle fire
32	179	lenovo thinkpad
32	20	mac mini
32	125	macbook air
32	307	macbook pro
32	30	nexus 10
32	67	nexus 5
32	25	nexus 7
32	28	nokia lumia 635
32	6	samsumg galaxy tablet
32	12	samsung galaxy note
32	82	samsung galaxy s4
32	10	windows surface
33	39	acer aspire desktop

33	46	acer aspire notebook
33	14	amazon fire phone
33	49	asus chromebook
33	37	dell inspiron desktop
33	110	dell inspiron notebook
33	38	hp pavilion desktop
33	19	htc one
33	40	ipad air
33	28	ipad mini
33	35	iphone 4s
33	110	iphone 5
33	65	iphone 5s
33	14	kindle fire
33	191	lenovo thinkpad
33	32	mac mini
33	133	macbook air
33	312	macbook pro
33	23	nexus 10
33	70	nexus 5
33	30	nexus 7
33	27	nokia lumia 635
33	12	samsumg galaxy tablet
33	13	samsung galaxy note
33	80	samsung galaxy s4
33	15	windows surface
34	30	acer aspire desktop
34	63	acer aspire notebook
34	11	amazon fire phone
34	47	asus chromebook
34	49	dell inspiron desktop
34	105	dell inspiron notebook
34	36	hp pavilion desktop
34	25	htc one
34	39	ipad air
34	25	ipad mini
34	50	iphone 4s
34	101	iphone 5
34	70	iphone 5s
34	13	kindle fire
34	193	lenovo thinkpad
34	30	mac mini
34	136	macbook air
34	292	macbook pro
34	25	nexus 10
34	70	nexus 5
34	33	nexus 7
34	17	nokia lumia 635
34	14	samsumg galaxy tablet

34	13	samsung galaxy note
34	90	samsung galaxy s4
34	18	windows surface
35	1	acer aspire desktop
35	3	acer aspire notebook
35	6	asus chromebook
35	1	dell inspiron desktop
35	9	dell inspiron notebook
35	1	hp pavilion desktop
35	2	htc one
35	2	ipad mini
35	6	iphone 4s
35	2	iphone 5
35	3	iphone 5s
35	3	kindle fire
35	16	lenovo thinkpad
35	2	mac mini
35	10	macbook air
35	17	macbook pro
35	2	nexus 10
35	4	nexus 5
35	2	nexus 7
35	2	nokia lumia 635
35	1	samsung galaxy note
35	6	samsung galaxy s4
35	3	windows surface



Email Engagement: Users engaging with the email service.
Your task: Calculate the email engagement metrics

Query :

```
SELECT week(occurred_at) AS week_num,

      COUNT(CASE WHEN action = 'sent_weekly_digest' THEN user_id ELSE NULL END) AS weekly_digest,

      COUNT(CASE WHEN action = 'sent_reengagement_email' THEN user_id ELSE NULL END) AS reengagement_emails,

      COUNT(CASE WHEN action = 'email_open' THEN user_id ELSE NULL END) AS email_opens,

      COUNT(CASE WHEN action = 'email_clickthrough' THEN user_id ELSE NULL END) AS email_clickthroughs

FROM email_events

GROUP BY 1
```

ORDER BY 1;

Output:

week_num	weekly_digest	reengagement_emails	email_opens	email_clickthroughs
17	908	73	310	166
18	2602	157	912	430
19	2665	173	972	477
20	2733	191	1004	507
21	2822	164	1014	443
22	2911	192	987	488
23	3003	197	1075	538
24	3105	226	1155	554
25	3207	196	1096	530
26	3302	219	1165	556
27	3399	213	1228	621
28	3499	213	1250	599
29	3592	213	1219	590
30	3706	231	1383	630
31	3793	222	1351	445
32	3897	200	1337	418
33	4012	264	1432	490
34	4111	261	1528	490
35	0	48	41	38