CLICK - STREAM BUSINESS CASE STUDY

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- 1. Our CEO wants to know how our website is doing in terms of customer acquisition?
 - 1. How many users are added each month?

Query:

```
WITH new_users_added_per_month AS
(SELECT

EXTRACT(YEAR FROM created_at) AS year,

EXTRACT(MONTH FROM created_at) AS month,

COUNT(DISTINCT user_id) AS new_users_added
FROM

click_stream.users

GROUP BY year, month

ORDER BY year, month)

SELECT

*
FROM

new_users_added_per_month;
```

Result:

Row	year //	month //	new_users_added
1	2013	2	9
2	2013	3	153
3	2013	4	288
4	2013	5	376
5	2013	6	481
6	2013	7	588
7	2013	8	648

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2. How many users are deleted or merged (with parent user) each month?

```
WITH deleted_or_merged_users_per_month AS
   (SELECT
         del_merged_users_temp.year,
         del_merged_users_temp.month,
         SUM(del_merged_users_temp.users_del_or_merged) AS users_del_or_merged
   FROM
       (SELECT
                    EXTRACT(YEAR FROM deleted_at) AS year,
                    EXTRACT(MONTH FROM deleted_at) AS month,
                    COUNT(DISTINCT user_id) AS users_del_or_merged
        FROM
                 click_stream.users
        WHERE
                 deleted_at IS NOT NULL
        GROUP BY year,
                         month
        UNION ALL
        SELECT
                 EXTRACT(YEAR FROM merged_at) AS year,
                 EXTRACT(MONTH FROM merged_at) AS month,
                 COUNT(DISTINCT user_id) AS users_del_or_merged
        FROM
                 click_stream.users
        WHERE
                 merged_at IS NOT NULL
          AND user_id != parent_user_id
        GROUP BY year,
                 month) AS del_merged_users_temp
   GROUP BY del merged users temp.year.
             del_merged_users_temp.month
   ORDER BY del_merged_users_temp.year,
            del_merged_users_temp.month)
SELECT
 FROM
        deleted_or_merged_users_per_month;
```

Row	year //	month //	users_del_or_merged
1	2013	5	1
2	2013	7	2
3	2013	8	6
4	2013	9	5
5	2013	10	10
6	2013	11	11
7	2013	12	10

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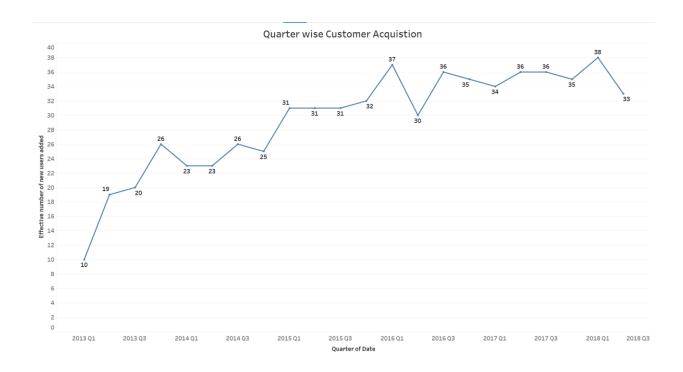
3. How many users are added effectively each month.

(Base tables <u>new_users_added_per_month_______</u> & <u>deleted_or_merged_users_per_month______</u> on Pages 3 & 4)

```
month_wise_user_data AS
 (SELECT
      a.year,
      a.month,
      a.new_users_added,
      COALESCE(d.users_del_or_merged, 0) AS users_deleted_or_merged,
      a.new_users_added - COALESCE(d.users_del_or_merged, 0) AS eff_users_added
 FROM
    new_users_added_per_month AS a
          LEFT JOIN
    deleted_or_merged_users_per_month AS d ON a.year = d.year
                                                   AND a.month = d.month
 ORDER BY a.year,
             a.month)
SELECT
FROM
   month_wise_user_data;
```

Row	year //	month //	new_users_added //	users_deleted_or_merged	eff_users_added
1	2013	2	9	0	9
2	2013	3	153	0	153
3	2013	4	288	0	288
4	2013	5	376	1	375
5	2013	6	481	0	481
6	2013	7	588	2	586
7	2013	8	648	6	642

Results per page: $50 \checkmark 1 - 50 \text{ of } 65$



2. Investigate how each product category is doing and their popularities with respect to their revenues and how many times, any item from that category has been ordered.

```
WITH most_popular_categories AS

(SELECT

i.category,

ROUND(SUM(COALESCE(o.price, 0))) AS total_revenue,

COUNT(o.line_item_id) AS items_ordered

FROM

click_stream.items AS i

LEFT JOIN

click_stream.orders AS o ON i.item_id = o.item_id

GROUP BY i.category

ORDER BY SUM(o.price) DESC,

COUNT(DISTINCT o.line_item_id) DESC)

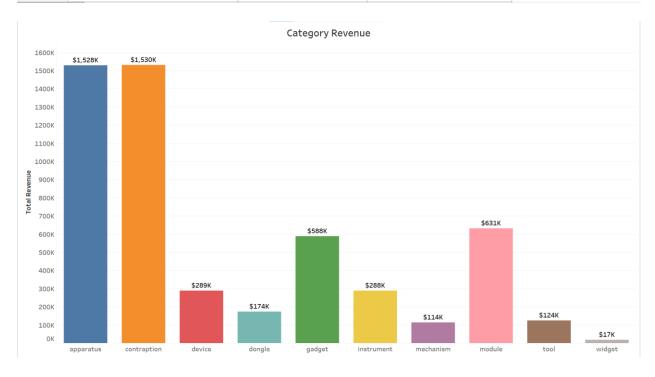
SELECT

*

FROM

most_popular_categories;
```

Row	category	total_revenue	items_ordered
1	contraption	1529855.0	4700
2	apparatus	1527894.0	4892
3	module	631364.0	4800
4	gadget	588179.0	4695
5	device	288543.0	4735
6	instrument	288342.0	4767
7	dongle	174168.0	4665
8	tool	124022.0	4633



- 3. Our CEO wants to know the trend of how our company is doing in terms of revenue and number of orders.
 - 1. Revenue and number of orders on a daily basis.

Query:

```
WITH daily_revenue_data AS

(SELECT

EXTRACT(DATE FROM created_at) AS day,

COUNT(DISTINCT invoice_id) AS orders,

ROUND(SUM(price), 1) AS revenue

FROM

click_stream.orders

GROUP BY day

ORDER BY day)

SELECT

*

FROM

daily_revenue_data;
```

Result:

Row	day	orders	revenue
1	2013-03-12	1	387.5
2	2013-03-26	1	48.4
3	2013-03-30	1	64.5
4	2013-04-05	1	41.1
5	2013-04-12	1	13.5
6	2013-04-15	1	118.8
7	2013-04-22	1	15.0

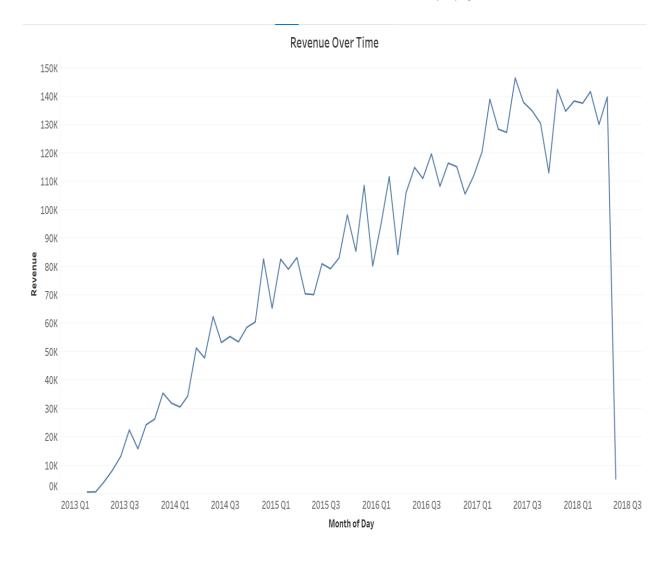
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2. Weekly running average of revenue and number of orders.

```
WITH daily_revenue_data AS
   (SELECT
          EXTRACT(DATE FROM created_at) AS day,
          COUNT(DISTINCT invoice_id) AS orders,
          ROUND(SUM(price), 1) AS revenue
   FROM
          click_stream.orders
   GROUP BY day
   ORDER BY day),
seven_day_rolling_avg AS
   (SELECT
         d1.day,
         ROUND(AVG(d2.orders), 2) AS sev_day_roll_avg_orders,
         ROUND(AVG(d2.revenue), 1) AS sev_day_roll_avg_revenue
   FROM
         daily_revenue_data AS d1
          JOIN
daily_revenue_data AS d2 ON DATETIME_DIFF(d1.day, d2.day, DAY) BETWEEN 0 AND 6
   GROUP BY d1.day
   ORDER BY d1.day)
SELECT
FROM
   seven_day_rolling_avg;
```

Row	day	sev_day_roll_avg_orders	sev_day_roll_avg_revenue
1	2013-03-12	1.0	387.5
2	2013-03-26	1.0	48.4
3	2013-03-30	1.0	56.5
4	2013-04-05	1.0	52.8
5	2013-04-12	1.0	13.5
6	2013-04-15	1.0	66.2
7	2013-04-22	1.0	15.0

Results per page: 50 ▼ 1 − 50 of 1820



4. The data science team at our organization wants to analyze the customer engagement of our website. Please analyze the data to find out the average time (in days) which a user takes to revisit our website and order an item.

```
WITH users_distinct_orders AS
   (SELECT invoice id,
                    user id.
                    ROUND(SUM(price), 1) AS price,
                    created at,
             paid_at
    FROM
             click stream.orders
   GROUP BY invoice id,
             user id,
             created at,
             paid at
   ORDER BY user id, created at),
users consecutive orders AS
   (SELECT
          user id,
          invoice id AS cur invoice id,
          created at AS cur order date,
          price AS cur order price,
          LAG(invoice_id) OVER(PARTITION BY user_id ORDER BY created_at) AS last_invoice_
id.
          LAG(created_at) OVER(PARTITION BY user_id ORDER BY created_at) AS last_order_d
ate,
          LAG(price) OVER(PARTITION BY user id ORDER BY created at) AS last order price,
          DATETIME_DIFF(created_at, LAG(created_at) OVER(PARTITION BY user_id ORDER B
Y created at),
       DAY) AS day_diff
   FROM
                users_distinct_orders),
user_level_avg_reorder_time AS
   (SELECT
          user_id,
          ROUND(AVG(day_diff), 2) AS avg_reorder_time_in_days
   FROM
          users_consecutive_orders
   GROUP BY user_id
   HAVING AVG(day_diff) IS NOT NULL
   ORDER BY user_id),
```

```
avg_reorder_time_in_days AS

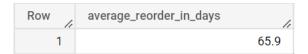
(SELECT
    ROUND(AVG(avg_reorder_time_in_days), 1) AS average_reorder_in_days
FROM
    user_level_avg_reorder_time)

SELECT

*
FROM
    user_level_avg_reorder_time;
```

Row	user_id //	avg_reorder_time_in_days
1	694	130.0
2	849	27.0
3	1004	62.0
4	1009	126.0
5	1053	41.0
6	1078	117.0
7	1317	67.0

```
FROM avg_reorder_time_in_days;
```



5. The data science team at our company wants to design a recommender system which recommends a subscription of products from a specific category to the customer if he has ordered items from that category in the past for two or more times. Please help analyze the data to give relevant insights.

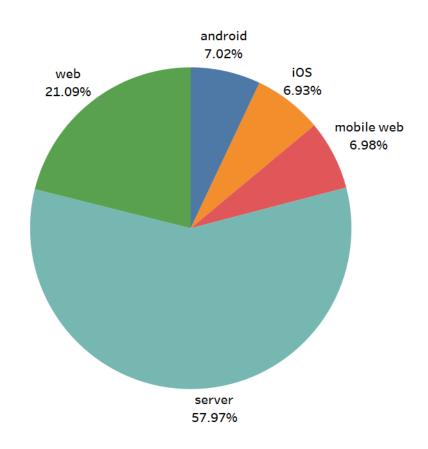
```
WITH categories_ordered AS
   (SELECT
          COALESCE(u.parent_user_id, u.user_id) AS user_id,
         item_category,
          1 AS order_count
   FROM
         click_stream.orders AS o
          JOIN
         click_stream.users AS u ON o.user_id = COALESCE(u.parent_user_id, u.user_id)
   WHERE
         u.deleted_at IS NULL
   GROUP BY invoice_id, COALESCE(u.parent_user_id, u.user_id), item_category),
categories reordered AS
   (SELECT
          user_id,
          item_category,
          SUM(order_count) AS orders
   FROM
          categories ordered
   GROUP BY user_id, item_category
   HAVING SUM(order_count) >= 2),
recommended_categories AS
   (SELECT
          user_id,
          STRING_AGG(item_category, ',' ORDER BY orders DESC) AS category_recommendatio
ns
   FROM
         categories_reordered
   GROUP BY user id
   ORDER BY LENGTH(category_recommendations) DESC)
SELECT
FROM
   recommended_categories;
```

Row	user_id	category_recommendations
1	38278	mechanism,contraption,gadget
2	104899	mechanism,instrument,gadget
3	20865	instrument,device
4	60455	instrument,gadget
5	88724	apparatus,widget
6	92223	dongle,mechanism
7	219570	device,dongle

6. Our company want to run an advertisement campaign but for that, their data science team want you to analyze the customer engagement on various platforms like web browser, iOS etc. For that, they have provided you the user click stream. Please help them do the analysis so that they can plan in a better manner.

```
WITH user platforms AS
   (SELECT DISTINCT
          COALESCE(parent_user_id, u.user_id) AS user_id,
          platform
   FROM
          click stream.events AS e
          JOIN
          click_stream.users AS u ON e.user_id = u.user_id
   WHERE
          u.deleted_at IS NULL
   ORDER BY user_id),
platform users AS
   (SELECT
          platform,
          COUNT(user_id) AS users
   FROM
        user_platforms
   GROUP BY platform),
platform_pct AS
   (SELECT
          platform,
          users,
          ROUND(users * 100
                  /(SELECT SUM(users) FROM platform_users), 1) AS users_pct
   FROM
        platform users
   ORDER BY users_pct DESC)
SELECT
FROM
   platform_pct;
```

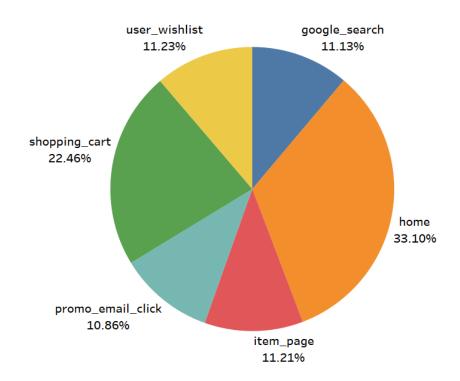
Row	platform	11	users	users_pct //
1	server		92906	58.0
2	web		33801	21.1
3	android		11255	7.0
4	mobile web		11192	7.0
5	iOS		11102	6.9



- 7. Customers Visiting Item Webpage.
 - 1. The data science team at our organization want to understand the relative contribution of various referrers such as google search, promo e-mail etc. which made customer visit the webpage and view a particular item.

```
WITH referrer_count AS
   (SELECT
         parameter value AS referrer,
         COUNT(*) AS engagement
    FROM
         click_stream.events
   WHERE
         parameter_name = 'referrer'
   GROUP BY parameter_value),
referrer_pct AS
   (SELECT
          referrer,
          ROUND(engagement * 100
   / (SELECT SUM(engagement) FROM referrer_count), 1) AS referrer_engagement_pct
   FROM
        referrer_count
   ORDER BY referrer_engagement_pct DESC)
SELECT
 FROM
   referrer_pct;
```

Row	referrer	referrer_engagement_pct
1	home	33.1
2	shopping_cart	22.5
3	item_page	11.2
4	user_wishlist	11.2
5	google_search	11.1
6	promo_email_click	10.9



2. Conversion rate of view item event to an actual order in case of various referrers.

```
WITH view_item_events AS
   (SELECT DISTINCT
        event_id,
        event_time,
        user_id,
        MAX(CASE
                WHEN parameter_name = 'item_id' THEN parameter_value
                   END) AS item_id,
        MAX(CASE
                WHEN parameter_name = 'referrer' THEN parameter_value
                   END) AS referrer
   FROM
        click_stream.events
   WHERE
        event_name = 'view_item'
   GROUP BY event_id,
                 event_time,
             user_id),
ordered_vs_not_ordered AS
   (SELECT
         v.referrer,
         CASE
           WHEN o.invoice_id IS NULL THEN 0
            ELSE 1
        END AS ordered_item_binary,
        COUNT(*) AS event_count
   FROM
        view item events AS v
          LEFT JOIN
        click stream.orders AS o
                  ON CAST(v.user_id AS INT) = CAST(o.user_id AS INT)
                      AND CAST(v.item_id AS INT) = CAST(o.item_id AS INT)
AND DATETIME_DIFF(o.created_at, v.event_time, DAY) BETWEEN 0 AND 30
   GROUP BY v.referrer.
             ordered_item_binary
   ORDER BY v.referrer),
```

Row	referrer //	order_conversion_rate
1	home	0.15
2	shopping_cart	0.15
3	google_search	0.14
4	promo_email_click	0.15
5	user_wishlist	0.14
6	item_page	0.15

8. The data science team at our company want you to analyze the click stream data of customer activities and send a reminder email to those customers who viewed an item recently on our website but haven't ordered yet.

```
WITH last_viewed_items AS
   (SELECT
                temp table.user id,
                MAX(temp_table.last_viewed_item_id) AS last_viewed_item_id,
                MAX(temp table.event time) AS view item time
   FROM
               (SELECT
           user id,
           MAX(event time) OVER(PARTITION BY user id) AS event time,
   LAST_VALUE(parameter_value) OVER(PARTITION BY user_id ORDER BY event_time)
          AS last viewed item id
                FROM
          click stream.events
          WHERE
          event name = 'view item'
          AND parameter_name = 'item_id') AS temp_table
   GROUP BY temp table.user id
   ORDER BY temp table.user id),
user_reminder_email_data AS
   (SELECT
         v.user_id,
                v.view item time,
          v.last viewed item id,
          i.name AS item_name,
          u.email_address
   FROM
         last_viewed_items AS v
          LEFT JOIN
         click_stream.orders AS o ON v.user_id = o.user_id
AND CAST(v.last_viewed_item_id_AS_INT) = o.item_id_AND o.created_at >= v.view_item_time
                 JOIN
        click_stream.users AS u ON u.user_id = v.user_id
        click_stream.items AS i ON i.item_id = CAST(v.last_viewed_item_id AS INT)
   WHERE
        o.invoice_id IS NULL)
```

SELECT

FROM

user_reminder_email_data;

Result:

Row	user_id	view_item_time	last_viewed_item_id	item_name	email_address
1	4	2013-09-04T04:47:43	3924	organic device how-to-manual	LMurphy1964@earthlink.com
2	8	2013-07-26T10:42:32	2430	gadget refill	Hanah_Schmidt1965@gmail.edu
3	9	2013-03-11T12:12:31	3953	organic widget wrapper	AanyaLee@gmail.info
4	10	2013-03-19T01:15:17	3964	reflective device storage_unit	SonyaChen@outlook.biz
5	21	2013-08-29T03:58:35	36	matte mechanism cleaner	Lucas_Murphy1957@gmail.org
6	23	2013-06-14T20:24:32	3445	prize-winning mechanism carry	Mateo_Russell1969@inbox.com
7	24	2013-08-26T15:03:20	3348	rechargable gadget storage_unit	DiegoHuang@gmail.biz
8	34	2013-07-12T06:17:17	3605	aerodynamic module	Lisa_Petrov@gmail.org
9	41	2013-09-12T14:00:39	299	miniature widget how-to-manual	Mohamed_Gupta1970@inbox.i
10	45	2013-09-02T03:06:24	3033	widget opener	IreneFourie@gmail.edu
11	50	2013-03-11T07:36:22	603	aerodynamic instrument carryi	A_Martin2004@gmail.info

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9. Imagine you are the part of the data science team of the company and the company wants to run some promotional campaigns. The CEO of the company asks you to determine the customer engagement at different times during the day so that campaign can be planned accordingly. Please share the insights.

```
WITH view item events timeslots AS
   (SELECT
          CASE
           WHEN TIME (event time) BETWEEN '00:00:00' AND '03:00:00' THEN '00:00 - 03:00'
           WHEN TIME (event_time) BETWEEN '03:00:01' AND '06:00:00' THEN '03:00 - 06:00'
           WHEN TIME (event time) BETWEEN '06:00:01' AND '09:00:00' THEN '06:00 - 09:00'
           WHEN TIME (event time) BETWEEN '09:00:01' AND '12:00:00' THEN '09:00 - 12:00'
           WHEN TIME (event time) BETWEEN '12:00:01' AND '15:00:00' THEN '12:00 - 15:00'
           WHEN TIME (event time) BETWEEN '15:00:01' AND '18:00:00' THEN '15:00 - 18:00'
           WHEN TIME (event_time) BETWEEN '18:00:01' AND '21:00:00' THEN '18:00 - 21:00'
           WHEN TIME (event time) BETWEEN '21:00:01' AND '23:59:59' THEN '21:00 - 00:00'
        END AS timeslot.
        COUNT (DISTINCT event id) AS view item events
   FROM
        click stream.events
   WHERE
        event_name = 'view item'
   GROUP BY timeslot),
timeslot_proportion AS
   (SELECT
                timeslot,
          ROUND (view item events
                  / (SELECT SUM (view item events) FROM view item events timeslots), 2)
       AS proportion_of_total
   FROM
          view_item_events_timeslots
   ORDER BY timeslot)
SELECT
FROM
   timeslot_proportion;
```

Row	timeslot	proportion_of_total
1	00:00 - 03:00	0.13
2	03:00 - 06:00	0.12
3	06:00 - 09:00	0.13
4	09:00 - 12:00	0.12
5	12:00 - 15:00	0.13
6	15:00 - 18:00	0.13
7	18:00 - 21:00	0.12
8	21:00 - 00:00	0.13

- 10. We have conducted three A/B tests at different points of time and subjected few items to the control group and few to the treatment group. In these A/B tests, we ran a promotional scheme for the items in the treatment group and the items in the control group are as they were before. After that, we compared that how many of the items in the two groups (control & treatment) have been ordered.
 - 1. For A/B Test 1 in the item_test_assignments table, conclude the results and tell whether the effect is statistically significant or not?

```
WITH item_test_1_subjects AS
   (SELECT
    FROM
          click stream.item test assignments
     WHERE
         test_number = 'item_test_1'),
items_ordered_during_item_test_1 AS
   (SELECT DISTINCT
         item id
    FROM
          click stream.orders
   WHERE
          paid_at BETWEEN '2013-01-05 00:00:00' AND '2014-01-04 23:59:59'),
item order binary test 1 AS
   (SELECT
          s.item id,
          s.test_number,
          s.test assignment,
           CASE
            WHEN o.item id IS NOT NULL THEN 1
            ELSE 0
         END AS order_binary
    FROM
         item_test_1_subjects AS s
           LEFT JOIN
         items_ordered_during_item_test_1 AS o ON s.item_id = o.item_id),
```

```
a_b_test_1_results AS
   (SELECT
          test_number,
          test_assignment,
          CASE
           WHEN test_assignment = 0 THEN 'control'
           WHEN test_assignment = 1 THEN 'treatment'
           END AS assigned_group,
          COUNT(*) AS group_size,
          SUM(order_binary) AS ordered
   FROM
          item_order_binary_test_1
   GROUP BY test_number, test_assignment)
SELECT
FROM
   a_b_test_1_results;
```

Row	test_number	test_assignment //	assigned_group	group_size	ordered
1	item_test_1	0	control	1112	493
2	item_test_1	1	treatment	1086	515



Conclusion:

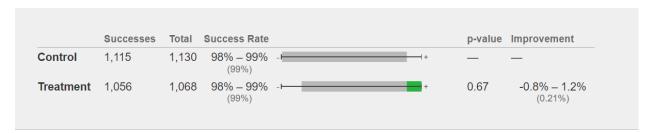
A relative lift of just -0.5 % - 1.1 % in treatment group with reference to the control group and p-Value of 0.44 clearly indicates that the results are statistically insignificant.

2. For A/B Test 2 in the item_test_assignments table, conclude the results and tell whether the effect is statistically significant or not?

```
WITH item_test_2_subjects AS
   (SELECT
    FROM
          click_stream.item_test_assignments
    WHERE
       test_number = 'item_test_2'),
items_ordered_during_item_test_2 AS
   (SELECT DISTINCT
         item_id
    FROM
          click_stream.orders
    WHERE
         paid_at BETWEEN '2015-03-14 00:00:00' AND '2016-03-13 23:59:59'),
item_order_binary_test_2 AS
   (SELECT
         s.item_id,
         s.test_number,
         s.test_assignment,
            WHEN o.item_id IS NOT NULL THEN 1
            ELSE 0
         END AS order_binary
    FROM
         item_test_2_subjects AS s
           LEFT JOIN
         items ordered during item test 2 AS o ON s.item id = o.item id),
```

```
a_b_test_2_results AS
   (SELECT
          test_number,
          test_assignment,
          CASE
            WHEN test_assignment = 0 THEN 'control'
            WHEN test_assignment = 1 THEN 'treatment'
          END AS assigned_group,
          COUNT(*) AS group_size,
          SUM(order_binary) AS ordered
    FROM
          item_order_binary_test_2
    GROUP BY test_number, test_assignment)
SELECT
FROM
   a_b_test_2_results;
```





Conclusion:

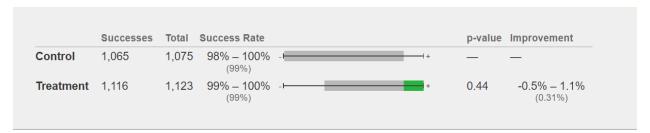
A relative lift of just -0.5 % - 1.1 % in treatment group with reference to the control group and p-Value of 0.44 clearly indicates that the results are statistically insignificant.

3. For A/B Test 3 in the item_test_assignments table, conclude the results and tell whether the effect is statistically significant or not?

```
WITH item_test_3_subjects AS
   (SELECT
    FROM
          click_stream.item_test_assignments
    WHERE
       test_number = 'item_test_3'),
items_ordered_during_item_test_3 AS
   (SELECT DISTINCT
          item_id
    FROM
          click_stream.orders
   WHERE
         paid_at BETWEEN '2016-01-07 00:00:00' AND '2017-01-06 23:59:59'),
item_order_binary_test_3 AS
   (SELECT
         s.item_id,
         s.test_number,
         s.test_assignment,
            WHEN o.item_id IS NOT NULL THEN 1
            ELSE 0
         END AS order_binary
    FROM
         item_test_3_subjects AS s
           LEFT JOIN
         items ordered during item test 3 AS o ON s.item id = o.item id),
```

```
a_b_test_3_results AS
   (SELECT
          test_number,
          test_assignment,
          CASE
            WHEN test_assignment = 0 THEN 'control'
            WHEN test_assignment = 1 THEN 'treatment'
           END AS assigned_group,
           COUNT(*) AS group_size,
          SUM(order_binary) AS ordered
 FROM
          item_order_binary_test_3
 GROUP BY test_number, test_assignment)
SELECT
FROM
   a_b_test_3_results;
```





Conclusion:

A relative lift of just -0.5 % - 1.1 % in treatment group with reference to the control group and p-Value of 0.44 clearly indicates that the results are statistically insignificant.