Konten

Pendahuluan

Anda bekerja di sebuah startup yang menjual produk makanan. Anda perlu mencari tahu perilaku pengguna aplikasi dari perusahaan tersebut. Perilaku dari pengguna akan dilihat dengan melakukan percobaan A/A testing dan A/B testing pada pengubahan Fot dari tulisan yang sama. Tujuannya adalah untuk mengetahui metode apa yang paling banyak diminati oleh pelanggan.

Import Library

In [3]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
from plotly import graph_objects as go
import plotly.express as px
from scipy import stats
import math

import warnings
warnings.filterwarnings('ignore')
```

Pra Pemrosesan Data

In [4]:
```
df = pd.read_csv('/datasets/logs_exp_us.csv', sep='\t')
```

In [5]:
```
df.head()
```

Out[5]:

	EventName	DeviceIDHash	EventTimestamp	ExpId
0	MainScreenAppear	4575588528974610257	1564029816	246
1	MainScreenAppear	7416695313311560658	1564053102	246
2	PaymentScreenSuccessful	3518123091307005509	1564054127	248
3	CartScreenAppear	3518123091307005509	1564054127	248
4	PaymentScreenSuccessful	6217807653094995999	1564055322	248

In [6]:
```
df.shape
```

Out[6]:
```
(244126, 4)
```

In [7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 244126 entries, 0 to 244125
Data columns (total 4 columns):
 #   Column          Non-Null Count   Dtype 
---  ------          --------------   ----- 
 0   EventName       244126 non-null  object
 1   DeviceIDHash    244126 non-null  int64 
 2   EventTimestamp  244126 non-null  int64 
 3   ExpId           244126 non-null  int64 
dtypes: int64(3), object(1)
memory usage: 7.5+ MB
```

Mengubah Nama Tabel

In [8]:
```
df.rename(columns={
    'EventName': 'event',
    'DeviceIDHash': 'user_id',
    'EventTimestamp': 'timestamp',
```

```
    'ExpId': 'exp_id'
}, inplace=True)
```

In [9]:
```
df.columns
```

Out[9]:
```
Index(['event', 'user_id', 'timestamp', 'exp_id'], dtype='object')
```

Mencari Nilai Yang Hilang, Tipe Data, dan Duplikat

In [10]:
```
df.isna().sum()
```

Out[10]:
```
event        0
user_id      0
timestamp    0
exp_id       0
dtype: int64
```

In [11]:
```
df.dtypes
```

Out[11]:
```
event        object
user_id       int64
timestamp     int64
exp_id        int64
dtype: object
```

In [12]:
```
df.duplicated().sum()
```

Out[12]:
```
413
```

In [13]:
```
df = df.drop_duplicates().reset_index(drop=True)
```

Menambahkan Kolom Waktu Dan Tanggal

In [14]:
```
df['date_time'] = pd.to_datetime(df['timestamp'], unit='s')
```

In [15]:
```
df.head()
```

Out[15]:

	event	user_id	timestamp	exp_id	date_time
0	MainScreenAppear	4575588528974610257	1564029816	246	2019-07-25 04:43:36
1	MainScreenAppear	7416695313311560658	1564053102	246	2019-07-25 11:11:42
2	PaymentScreenSuccessful	3518123091307005509	1564054127	248	2019-07-25 11:28:47
3	CartScreenAppear	3518123091307005509	1564054127	248	2019-07-25 11:28:47
4	PaymentScreenSuccessful	6217807653094995999	1564055322	248	2019-07-25 11:48:42

In [16]:
```
df['date'] = df['date_time'].dt.floor('1D')
```

In [17]:
```
df.head()
```

Out[17]:

	event	user_id	timestamp	exp_id	date_time	date
0	MainScreenAppear	4575588528974610257	1564029816	246	2019-07-25 04:43:36	2019-07-25
1	MainScreenAppear	7416695313311560658	1564053102	246	2019-07-25 11:11:42	2019-07-25
2	PaymentScreenSuccessful	3518123091307005509	1564054127	248	2019-07-25 11:28:47	2019-07-25
3	CartScreenAppear	3518123091307005509	1564054127	248	2019-07-25 11:28:47	2019-07-25
4	PaymentScreenSuccessful	6217807653094995999	1564055322	248	2019-07-25 11:48:42	2019-07-25

Pada tahap 3, dilakukan pengubahan nama kolom tabel agar lebih mudah dalam mengakses kolom-kolom yanga da pada tabel tersebut. Selain itu terdapat nilai duplikat sebanyak 413 yang mana telah dihapus dari datase. Dalam dataset tidak terdapat nilai null.

Mempelajari dan Memeriksa Data

Banyak Peristiwa Dalam Log

In [18]:
```
events = len(df)
print(f'{events} events')
```

```
243713 events
```

Banyak Pengguna Dalam Log

In [19]:
```
users = len(df['user_id'].unique())
print(f'{users} users')
```

```
7551 users
```

Rata-Rata Peristiwa Per Pengguna

In [20]:
```
event_user = events / users
print(f'{round(event_user, 0)} event per user')
```

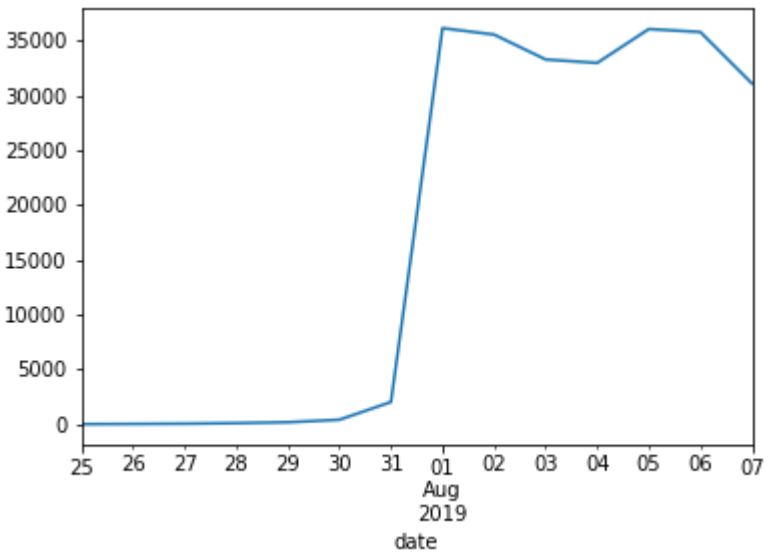
```
32.0 event per user
```

In [21]:
```
user_group_date = df.groupby('date')['user_id'].count()
user_group_date
```

Out[21]:
```
date
2019-07-25        9
2019-07-26       31
2019-07-27       55
2019-07-28      105
2019-07-29      184
2019-07-30      412
2019-07-31     2030
2019-08-01    36141
2019-08-02    35554
2019-08-03    33282
2019-08-04    32968
2019-08-05    36058
2019-08-06    35788
2019-08-07    31096
Name: user_id, dtype: int64
```

In [22]:
```
user_group_date.plot()
```

Out[22]:
```
<AxesSubplot:xlabel='date'>
```

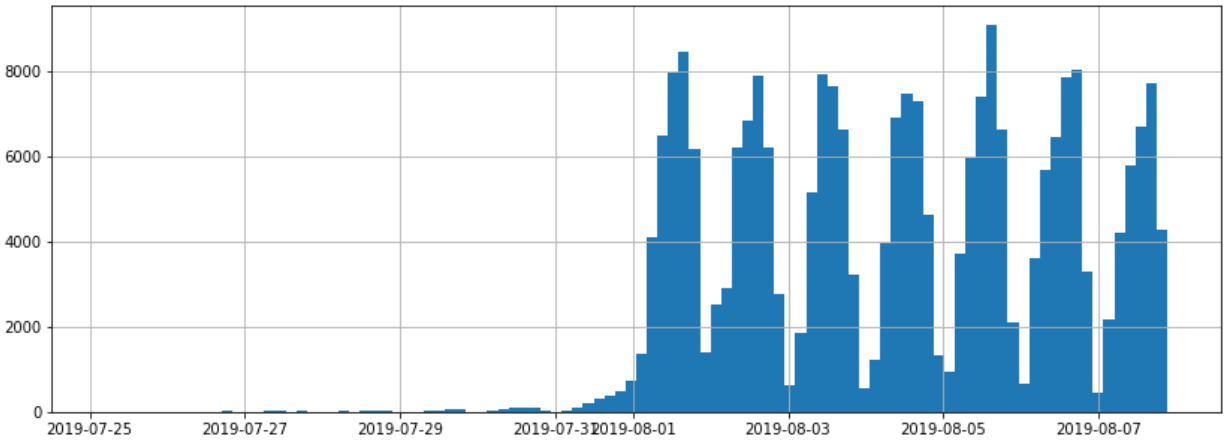


Periode Yang Tercakup Data

In [23]:
```
print(df['date_time'].min())
print(df['date_time'].max())
```

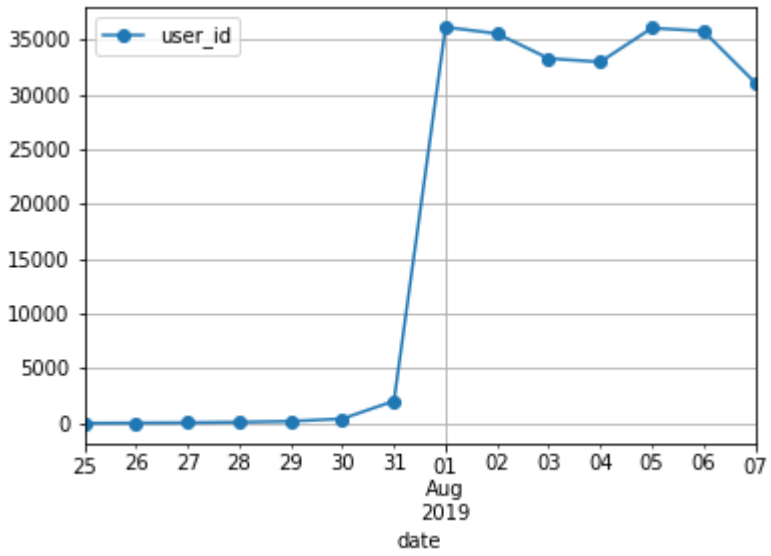
```
2019-07-25 04:43:36
2019-08-07 21:15:17
```

In [24]:
```
df['date_time'].hist(bins=100, figsize=(14, 5));
```



In [25]:
```
df.pivot_table(index='date', values='user_id', aggfunc='count').plot(style='o-', grid=
```

Out[25]:
```
<AxesSubplot:xlabel='date'>
```



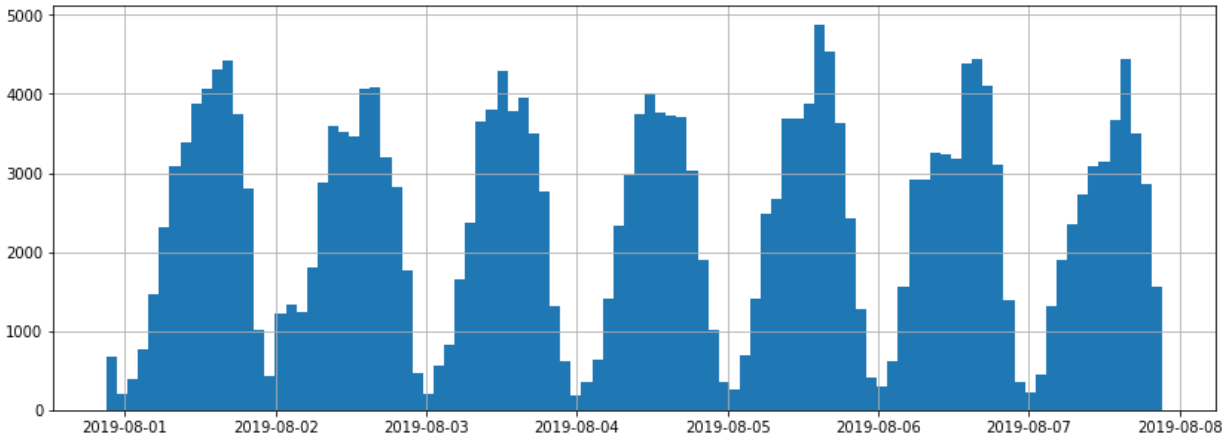
In [26]:
```
df_filtered = df.query('date_time > "2019-07-31 21:00"')
```

In [27]:
```
df_filtered.head()
```

Out[27]:

	event	user_id	timestamp	exp_id	date_time	date
1989	MainScreenAppear	7701922487875823903	1564606857	247	2019-07-31 21:00:57	2019-07-31
1990	MainScreenAppear	2539077412200498909	1564606905	247	2019-07-31 21:01:45	2019-07-31
1991	OffersScreenAppear	3286987355161301427	1564606941	248	2019-07-31 21:02:21	2019-07-31
1992	OffersScreenAppear	3187166762535343300	1564606943	247	2019-07-31 21:02:23	2019-07-31
1993	MainScreenAppear	1118952406011435924	1564607005	248	2019-07-31 21:03:25	2019-07-31

In [28]:
```
df_filtered['date_time'].hist(bins=100, figsize=(14, 5));
```



In [29]:
```
events_new = len(df_filtered)
users_new = len(df_filtered['user_id'].unique())
event_users_new = events_new / users_new
print(f'{events_new} events')
print(f'{users_new} users')
print(f'{event_users_new} event per user')
```

```
241724 events
7538 users
32.06739188113558 event per user
```

Banyak Data Yang HIlang Saat Menyingkirkan Data Lama

In [30]:
```
((df.shape[0] - df_filtered.shape[0]) / len(df)) * 100
```

Out[30]:
```
0.8161238834202524
```

Jumlah Pengguna Pada Setiap Langkah

In [31]:
```
df['exp_id'].value_counts()
```

Out[31]:
```
248    85582
246    80181
247    77950
Name: exp_id, dtype: int64
```

In [32]:
```
df_filtered['exp_id'].value_counts()
```

Out[32]:
```
248    84875
246    79556
247    77293
Name: exp_id, dtype: int64
```

In [33]:
```
(df_filtered['exp_id'].value_counts()) / (df['exp_id'].value_counts())
```

Out[33]:
```
248    0.991739
246    0.992205
247    0.991572
Name: exp_id, dtype: float64
```

Dari data yang sudah dibersihkan, dapat dilihat bahwa masing-masing kelompok memiliki sisa data diatas 99% yang mana berarti data tersebut masih sangat layak untuk digunakan. Setiap

kelompok pun kehilangan data tidak sampai 1%.

Corong Peristiwa

Peristiwa Yang Ada Dalam Log dan Banyak Frekuensi Kemunculannya

In [34]:
```
df_filtered.pivot_table(index='event', values='user_id', aggfunc='count').sort_values(
```

Out[34]:

event	user_id
MainScreenAppear	117889
OffersScreenAppear	46531
CartScreenAppear	42343
PaymentScreenSuccessful	33951
Tutorial	1010

Jumlah Pengguna Yang Melakukan Setiap Tindakan

In [35]:
```
user_per_event = (
    df_filtered.pivot_table(
        index='event',
        values='user_id',
        aggfunc='nunique').sort_values('user_id', ascending = False))
```

In [36]:
```
user_per_event
```

Out[36]:

event	user_id
MainScreenAppear	7423
OffersScreenAppear	4597
CartScreenAppear	3736
PaymentScreenSuccessful	3540
Tutorial	843

In [37]:
```
user_per_event / df_filtered['user_id'].nunique()
```

Out[37]:

event	user_id
MainScreenAppear	0.984744
OffersScreenAppear	0.609843
CartScreenAppear	0.495622
PaymentScreenSuccessful	0.469621
Tutorial	0.111833

Urutan Peristiwa Yang Terjadi

Peristiwa yang terjadi dapat diurutkan sebagai berikut:

1. Pembeli masuk terlebih dahulu ke MainScreenAppear, tapi ada beberapa pembeli yang masuk terlebih dahulu ke dalam Tutorial.
2. Pembeli akan diarahkan ke halaman OffersScreenAppear yang mana lanjutan dari MainScreenAppear.
3. Selanjutnya diarahkan ke CartScreenAppear.
4. Terakhir adalah PaymentScreenSuccessful.

Persentase Pengguna Yang Terus Berlanjut Dari Satu Tahap Ke Tahap Berikutnya

In [38]:
```
user_per_event
```

Out[38]:

event	user_id
MainScreenAppear	7423
OffersScreenAppear	4597
CartScreenAppear	3736
PaymentScreenSuccessful	3540
Tutorial	843

In [39]:
```
users_funnel = user_per_event[:-1]
```

In [40]:
```
users_funnel
```

Out[40]:

event	user_id
MainScreenAppear	7423
OffersScreenAppear	4597
CartScreenAppear	3736
PaymentScreenSuccessful	3540

In [41]:
```
(users_funnel / users_funnel.shift()).fillna(1)
```

Out[41]:

event	user_id
MainScreenAppear	1.000000
OffersScreenAppear	0.619291
CartScreenAppear	0.812704
PaymentScreenSuccessful	0.947537

Tahap Paling Banyak Kehilangan Pengguna

Tahapan yang paling banyak kehilangan pengguna adalah pada tahapan MainScreenAppear ke OfferScreenAppear, yang mana jika dilihat dari pengolahan sebelumnya hanya sebesar 0.6 dari total pembeli awal yang melanjutkan proses.

Persentase Pengguna Yang Berhasil Menyelesaikan Seluruh Tahapan Yang Ada

In [42]:
```
((user_per_event.loc['PaymentScreenSuccessful'] / user_per_event.loc['MainScreenAppear
```

Out[42]:
```
47.68961336386906
```

Sebanyak 47% pembeli berhasil menyelesaikan proses dari awal sampai akhir.

Pelajari Hasil Eksperimen

Pengguna Yang Ada Di Setiap Kelompok

In [43]:
```
user_per_group = df_filtered.pivot_table(index='exp_id',
                                         values='user_id',
                                         aggfunc='nunique')
user_per_group
```

Out[43]:

exp_id	user_id
246	2484
247	2517
248	2537

Melihat Perbedaan Antara Sampel 246 dan 247 Dari Sisi Statistik

In [44]:
```
user_event_per_group = df_filtered.pivot_table(index='event',
                                               values='user_id',
                                               columns='exp_id',
                                               aggfunc='nunique').sort_values(by=246,
```

In [45]:
```
user_event_per_group
```

Out[45]:

event	exp_id	246	247	248
MainScreenAppear		2450	2479	2494
OffersScreenAppear		1542	1524	1531
CartScreenAppear		1266	1239	1231
PaymentScreenSuccessful		1200	1158	1182
Tutorial		278	284	281

In [46]:
```
def check_hypothesis(successes1, successes2, trials1, trials2, alpha=0.01):

    p1 = successes1/trials1

    p2 = successes2/trials2

    p_combined = (successes1 + successes2) / (trials1 + trials2)

    difference = p1 - p2

    z_value = difference / math.sqrt(p_combined * (1 - p_combined) * (1/trials1 + 1/tr

    distr = stats.norm(0, 1)

    z_value = difference / math.sqrt(p_combined * (1 - p_combined) * (1/trials1 + 1/tr

    p_value = (1 - distr.cdf(abs(z_value))) * 2

    print('p-value: ', p_value)

    if (p_value < alpha):
        print('Reject the null hypothesis: there is a significant difference between t
    else:
        print('Failed to reject the null hypothesis, there is no reason to consider th
```

Selanjutnya melakukan uji hipotesis dengan H0 dan H1 sebagai berikut:

- H0 adalah kondisi dimana id 246 dan 247 SAMA
- H1 adalah kondisi dimana id 246 dan 247 TIDAK SAMA

In [47]:
```
check_hypothesis(user_event_per_group.loc['MainScreenAppear', 246],
                 user_event_per_group.loc['MainScreenAppear', 247],
                 user_per_group.loc[246],
                 user_per_group.loc[247])
```

```
p-value:  [0.67562177]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

In [48]:
```
def check_event_hypothesis(user_event_per_group, user_per_group,
                           event,
                           exp1, exp2
                          ):
    frac1 = user_event_per_group.loc[event, exp1] / user_per_group.loc[exp1]
    frac2 = user_event_per_group.loc[event, exp2] / user_per_group.loc[exp2]
    print(f'{frac1} event {event} group {exp1}')
    print(f'{frac2} event {event} group {exp2}')
    check_hypothesis(user_event_per_group.loc[event, exp1],
                     user_event_per_group.loc[event, exp2],
                     user_per_group.loc[exp1],
                     user_per_group.loc[exp2],
                    )
```

In [49]:
```
for event in user_event_per_group.index:
    check_event_hypothesis(user_event_per_group, user_per_group, event, 246, 247)
    print()
```

```
user_id    0.986312
Name: 246, dtype: float64 event MainScreenAppear group 246
user_id    0.984903
Name: 247, dtype: float64 event MainScreenAppear group 247
p-value:  [0.67562177]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.620773
Name: 246, dtype: float64 event OffersScreenAppear group 246
user_id    0.605483
Name: 247, dtype: float64 event OffersScreenAppear group 247
p-value:  [0.26698769]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.509662
Name: 246, dtype: float64 event CartScreenAppear group 246
user_id    0.492253
Name: 247, dtype: float64 event CartScreenAppear group 247
p-value:  [0.21828121]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.483092
Name: 246, dtype: float64 event PaymentScreenSuccessful group 246
user_id    0.460072
Name: 247, dtype: float64 event PaymentScreenSuccessful group 247
p-value:  [0.10298395]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.111916
Name: 246, dtype: float64 event Tutorial group 246
user_id    0.112833
Name: 247, dtype: float64 event Tutorial group 247
p-value:  [0.91827903]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

Membandingkan Satu Kelompok Dengan Kelompok Lainnya

Uji hipotesis dilakukan dengan kondisi sebagai berikut:

- H0 kondisi dimana id 246 dan 247 adalah SAMA
- H1 kondisi dimana id 246 dan 247 adalah TIDAK SAMA

In [50]:
```
for event in user_event_per_group.index:
    check_event_hypothesis(user_event_per_group, user_per_group, event, 246, 247)
    print()
```

```
user_id    0.986312
Name: 246, dtype: float64 event MainScreenAppear group 246
user_id    0.984903
Name: 247, dtype: float64 event MainScreenAppear group 247
p-value:  [0.67562177]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.620773
Name: 246, dtype: float64 event OffersScreenAppear group 246
user_id    0.605483
Name: 247, dtype: float64 event OffersScreenAppear group 247
p-value:  [0.26698769]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.509662
Name: 246, dtype: float64 event CartScreenAppear group 246
user_id    0.492253
Name: 247, dtype: float64 event CartScreenAppear group 247
p-value:  [0.21828121]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.483092
Name: 246, dtype: float64 event PaymentScreenSuccessful group 246
user_id    0.460072
Name: 247, dtype: float64 event PaymentScreenSuccessful group 247
p-value:  [0.10298395]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.111916
Name: 246, dtype: float64 event Tutorial group 246
user_id    0.112833
Name: 247, dtype: float64 event Tutorial group 247
p-value:  [0.91827903]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

Uji hipotesis dilakukan untuk kondisi sebagai berikut:

- H0 jika id 246 dan 248 adalah SAMA
- H1 jika id 246 dan 248 adalah TIDAK SAMA

In [51]:
```
for event in user_event_per_group.index:
    check_event_hypothesis(user_event_per_group, user_per_group, event, 246, 248)
    print()
```

```
user_id    0.986312
Name: 246, dtype: float64 event MainScreenAppear group 246
user_id    0.983051
Name: 248, dtype: float64 event MainScreenAppear group 248
p-value:  [0.34705881]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.620773
Name: 246, dtype: float64 event OffersScreenAppear group 246
user_id    0.603469
Name: 248, dtype: float64 event OffersScreenAppear group 248
p-value:  [0.20836205]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.509662
Name: 246, dtype: float64 event CartScreenAppear group 246
user_id    0.485219
Name: 248, dtype: float64 event CartScreenAppear group 248
p-value:  [0.08328413]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.483092
Name: 246, dtype: float64 event PaymentScreenSuccessful group 246
user_id    0.465905
Name: 248, dtype: float64 event PaymentScreenSuccessful group 248
p-value:  [0.22269359]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.111916
Name: 246, dtype: float64 event Tutorial group 246
user_id    0.110761
Name: 248, dtype: float64 event Tutorial group 248
p-value:  [0.89644896]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

Uji hipotesis dilakukan untuk kondisi sebagai berikut:

- H0 jika id 247 dan 248 adalah SAMA
- H1 jika id 247 dan 248 adalah TIDAK SAMA

In [52]:
```
for event in user_event_per_group.index:
    check_event_hypothesis(user_event_per_group, user_per_group, event, 247, 248)
    print()
```

```
user_id    0.984903
Name: 247, dtype: float64 event MainScreenAppear group 247
user_id    0.983051
Name: 248, dtype: float64 event MainScreenAppear group 248
p-value:  [0.60016616]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.605483
Name: 247, dtype: float64 event OffersScreenAppear group 247
user_id    0.603469
Name: 248, dtype: float64 event OffersScreenAppear group 248
p-value:  [0.88359567]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.492253
Name: 247, dtype: float64 event CartScreenAppear group 247
user_id    0.485219
Name: 248, dtype: float64 event CartScreenAppear group 248
p-value:  [0.61695175]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.460072
Name: 247, dtype: float64 event PaymentScreenSuccessful group 247
user_id    0.465905
Name: 248, dtype: float64 event PaymentScreenSuccessful group 248
p-value:  [0.67754136]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.112833
Name: 247, dtype: float64 event Tutorial group 247
user_id    0.110761
Name: 248, dtype: float64 event Tutorial group 248
p-value:  [0.8151967]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

In [53]:
```
user_event_per_group_control = user_event_per_group.copy()
user_event_per_group_control.loc[:,247] += user_event_per_group_control.loc[:,246]
user_event_per_group_control.drop(columns=246, inplace=True)
```

In [54]:
```
user_event_per_group_control
```

Out[54]:

exp_id	247	248
event		
MainScreenAppear	4929	2494
OffersScreenAppear	3066	1531
CartScreenAppear	2505	1231
PaymentScreenSuccessful	2358	1182
Tutorial	562	281

In [55]:
```
user_per_group_control = user_per_group.copy()
user_per_group_control.loc[247] += user_per_group_control.loc[246]
user_per_group_control.drop(246, inplace=True)
user_per_group_control
```

Out[55]:

exp_id	user_id
247	5001
248	2537

Uji hipotesis dilakukan untuk kondisi sebagai berikut:

- H0 jika id gabungan (246 dan 247) dan 248 adalah SAMA
- H1 jika id gabungan (246 dan 247) dan 248 adalah TIDAK SAMA

In [56]:
```
for event in user_event_per_group.index:
    check_event_hypothesis(user_event_per_group_control, user_per_group_control, event
    print()
```

```
user_id    0.985603
Name: 247, dtype: float64 event MainScreenAppear group 247
user_id    0.983051
Name: 248, dtype: float64 event MainScreenAppear group 248
p-value:  [0.39298915]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.613077
Name: 247, dtype: float64 event OffersScreenAppear group 247
user_id    0.603469
Name: 248, dtype: float64 event OffersScreenAppear group 248
p-value:  [0.41899828]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.5009
Name: 247, dtype: float64 event CartScreenAppear group 247
user_id    0.485219
Name: 248, dtype: float64 event CartScreenAppear group 248
p-value:  [0.19819341]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.471506
Name: 247, dtype: float64 event PaymentScreenSuccessful group 247
user_id    0.465905
Name: 248, dtype: float64 event PaymentScreenSuccessful group 248
p-value:  [0.64520577]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent

user_id    0.112378
Name: 247, dtype: float64 event Tutorial group 247
user_id    0.110761
Name: 248, dtype: float64 event Tutorial group 248
p-value:  [0.83330491]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

Mengganti NIlai Alpha Untuk Melihat Signfikansi

Nilai alpha pada fungsi awal adalah 0.01 dan diganti dengan 0.5

In [61]:

```
def check_hypothesis_new(successes1, successes2, trials1, trials2, alpha=0.5):

    p1 = successes1/trials1

    p2 = successes2/trials2

    p_combined = (successes1 + successes2) / (trials1 + trials2)

    difference = p1 - p2

    z_value = difference / math.sqrt(p_combined * (1 - p_combined) * (1/trials1 + 1/tr

    distr = stats.norm(0, 1)
```

```
    z_value = difference / math.sqrt(p_combined * (1 - p_combined) * (1/trials1 + 1/tr

    p_value = (1 - distr.cdf(abs(z_value))) * 2

    print('p-value: ', p_value)

    if (p_value < alpha):
        print('Reject the null hypothesis: there is a significant difference between t
    else:
        print('Failed to reject the null hypothesis, there is no reason to consider th
```

Uji hipotesis dilakukan untuk kondisi sebagai berikut:

- H0 jika id 246 dan 247 adalah SAMA
- H1 jika id 246 dan 247 adalah TIDAK SAMA

In [63]:
```
check_hypothesis_new(user_event_per_group.loc['MainScreenAppear', 246],
                     user_event_per_group.loc['MainScreenAppear', 247],
                     user_per_group.loc[246],
                     user_per_group.loc[247])
```

```
p-value:  [0.67562177]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

Uji hipotesis dilakukan untuk kondisi sebagai berikut:

- H0 jika id 246 dan 248 adalah SAMA
- H1 jika id 246 dan 248 adalah TIDAK SAMA

In [64]:
```
check_hypothesis_new(user_event_per_group.loc['MainScreenAppear', 246],
                     user_event_per_group.loc['MainScreenAppear', 248],
                     user_per_group.loc[246],
                     user_per_group.loc[248])
```

```
p-value:  [0.34705881]
Reject the null hypothesis: there is a significant difference between the shares
```

Uji hipotesis dilakukan untuk kondisi sebagai berikut:

- H0 jika id 247 dan 248 adalah SAMA
- H1 jika id 247 dan 248 adalah TIDAK SAMA

In [66]:
```
check_hypothesis_new(user_event_per_group.loc['MainScreenAppear', 247],
                     user_event_per_group.loc['MainScreenAppear', 248],
                     user_per_group.loc[247],
                     user_per_group.loc[248])
```

```
p-value:  [0.60016616]
Failed to reject the null hypothesis, there is no reason to consider the shares diffe
rent
```

Kesimpulan

Dari beberapa langkah pemrosesan data diatas, dapat diambil beberapa kesimpulan seperti:

- Terdapat beberapa data duplikat pada tabel, yang telah dihilangkan.
- Peningkatan jumlah pengguna meningkat pada tanggal 1 Agustus.
- Data yang diproses lebih lanjut adalah sebesar 99% dari total data awal.
- ID 246 dan 247 memiliki jumlah pengguna dan keduanya SAMA secara pengujian hipotesis.
- ID 246 dan 248 memiliki jumlah pengguna dan keduanya SAMA secara pengujian hipotesis.
- ID 247 dan 248 memiliki jumlah pengguna dan keduanya SAMA secara pengujian hipotesis.