Optimasi Anggaran Biaya Pemasaran

Konten

Pendahuluan

Anda berhasil menunjukkan kinerja yang cemerlang selama mengikuti kursus Practicum, dan Anda pun ditawarkan kesempatan untuk menjalani program magang di departemen analitik perusahaan Y.Afisha. Tugas pertama yang mereka berikan kepada Anda adalah membantu mengoptimalkan anggaran biaya pemasaran.

Kembali ke Daftar Isi

Import Library

In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from scipy import stats as st
import numpy as np
import warnings
warnings.filterwarnings('ignore')
```

Observasi Data

Tabel Visit

In [2]:
```
visits = pd.read_csv('/datasets/visits_log_us.csv')
orders = pd.read_csv('/datasets/orders_log_us.csv')
costs = pd.read_csv('/datasets/costs_us.csv')
```

In [3]:
```
visits.head()
```

Out[3]:

	Device	End Ts	Source Id	Start Ts	Uid
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214
4	desktop	2017-12-27 14:06:00	3	2017-12-27 14:06:00	9969694820036681168

In [4]:
```
visits.shape
```

Out[4]:
```
(359400, 5)
```

In [5]:
```
visits.columns
```

Out[5]:
```
Index(['Device', 'End Ts', 'Source Id', 'Start Ts', 'Uid'], dtype='object')
```

In [6]:
```
visits.columns = ['device', 'end_ts', 'source_id', 'start_ts', 'uid']
```

In [7]:
```
visits['end_ts'] = pd.to_datetime(visits['end_ts'])
visits['start_ts'] = pd.to_datetime(visits['start_ts'])
```

In [8]:
```
visits[visits['end_ts'] < visits['start_ts']]
```

Out[8]:

	device	end_ts	source_id	start_ts	uid
4181	desktop	2018-03-25 03:18:00	3	2018-03-25 03:50:00	13092152539246794986
177972	desktop	2018-03-25 03:09:00	9	2018-03-25 03:55:00	4621202742905035453

In [9]:
```
visits = visits[visits['end_ts'] >= visits['start_ts']]
```

In [10]:
```
visits.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 359398 entries, 0 to 359399
Data columns (total 5 columns):
 #   Column     Non-Null Count   Dtype
---  ------     --------------   -----
 0   device     359398 non-null  object
 1   end_ts     359398 non-null  datetime64[ns]
 2   source_id  359398 non-null  int64
 3   start_ts   359398 non-null  datetime64[ns]
 4   uid        359398 non-null  uint64
dtypes: datetime64[ns](2), int64(1), object(1), uint64(1)
memory usage: 16.5+ MB
```

Dari hasl observasi terhadap tabel visit, didapatkan kesimpulan seperti berikut:

- tipe data untuk kolom 'start_ts' dan 'end_ts' tidak dalam format datetime, sehingga diubah terlebih dahulu
- penyesuaian untuk setiap nama kolom pada tabel diubah ke huruf kecil
- terdapat anomali dimana terdapat dua buah baris yang data waktu 'end_ts' yang terjadi lebih dahulu dibandingkan dengan 'start_ts', data tersebut dihapus sehingga jumah baris yang awalnya 359400 menjadi 359398

Tabel Orders

In [11]:
```
orders.head()
```

Out[11]:

	Buy Ts	Revenue	Uid
0	2017-06-01 00:10:00	17.00	10329302124590727494
1	2017-06-01 00:25:00	0.55	11627257723692907447
2	2017-06-01 00:27:00	0.37	17903680561304213844
3	2017-06-01 00:29:00	0.55	16109239769442553005
4	2017-06-01 07:58:00	0.37	14200605875248379450

In [12]:
```
orders.columns = ['buy_ts', 'revenue', 'uid']
```

In [13]:
```
orders['buy_ts'] = pd.to_datetime(orders['buy_ts'])
```

In [14]:
```
orders.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50415 entries, 0 to 50414
Data columns (total 3 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
 0   buy_ts   50415 non-null  datetime64[ns]
 1   revenue  50415 non-null  float64
 2   uid      50415 non-null  uint64
dtypes: datetime64[ns](1), float64(1), uint64(1)
memory usage: 1.2 MB
```

Dari pengamatan terhadap tabel orders hanya terdapat kesalahan tipe data pada kolom 'buy_ts' yang mana seharusnya memiliki tipe data datetime.

Tabel Costs

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

Out[15]:

	source_id	dt	costs
0	1	2017-06-01	75.20
1	1	2017-06-02	62.25
2	1	2017-06-03	36.53
3	1	2017-06-04	55.00
4	1	2017-06-05	57.08

In [16]:
```
costs['dt'] = pd.to_datetime(costs['dt'])
```

In [17]:
```
costs.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2542 entries, 0 to 2541
Data columns (total 3 columns):
 #   Column     Non-Null Count  Dtype         
---  ------     --------------  -----         
 0   source_id  2542 non-null   int64         
 1   dt         2542 non-null   datetime64[ns]
 2   costs      2542 non-null   float64       
dtypes: datetime64[ns](1), float64(1), int64(1)
memory usage: 59.7 KB
```

Sama dengan tabel orders, tabel costs memiliki kesalahan pada tipe data di kolom 'dt' yang mana seharusnya adalah datetime.

Menyusun Laporan dan Menghitung Metrik

Produk

Orang Yang Menggunakan Produk Setiap Hari, Minggu, dan Bulan

In [18]:
```
visits.head()
```

Out[18]:

	device	end_ts	source_id	start_ts	uid
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214
4	desktop	2017-12-27 14:06:00	3	2017-12-27 14:06:00	9969694820036681168

In [19]:
```
visits['session_year'] = visits['start_ts'].astype('datetime64[Y]')
visits['session_month'] = visits['start_ts'].astype('datetime64[M]')
visits['session_week'] = visits['start_ts'].astype('datetime64[W]')
visits['session_date'] = visits['start_ts'].dt.date
```

In [20]:
```
visits.head()
```

Out[20]:

	device	end_ts	source_id	start_ts	uid	session_year	session_month	session_
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062	2017-01-01	2017-12-01	2017-
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740	2018-01-01	2018-02-01	2018-
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527	2017-01-01	2017-07-01	2017-
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214	2018-01-01	2018-05-01	2018-
4	desktop	2017-12-27 14:06:00	3	2017-12-27 14:06:00	9969694820036681168	2017-01-01	2017-12-01	2017-

In [21]:
```
dau_total = visits.groupby('session_date').agg({'uid': 'nunique'}).mean()
wau_total = visits.groupby('session_week').agg({'uid': 'nunique'}).mean()
mau_total = visits.groupby('session_month').agg({'uid': 'nunique'}).mean()

print('Rata-rata pengguna harian adalah', int(dau_total))
print('Rata-rata pengguna mingguan adalah', int(wau_total))
print('Rata-rata pengguna bulan adalah', int(mau_total))
```

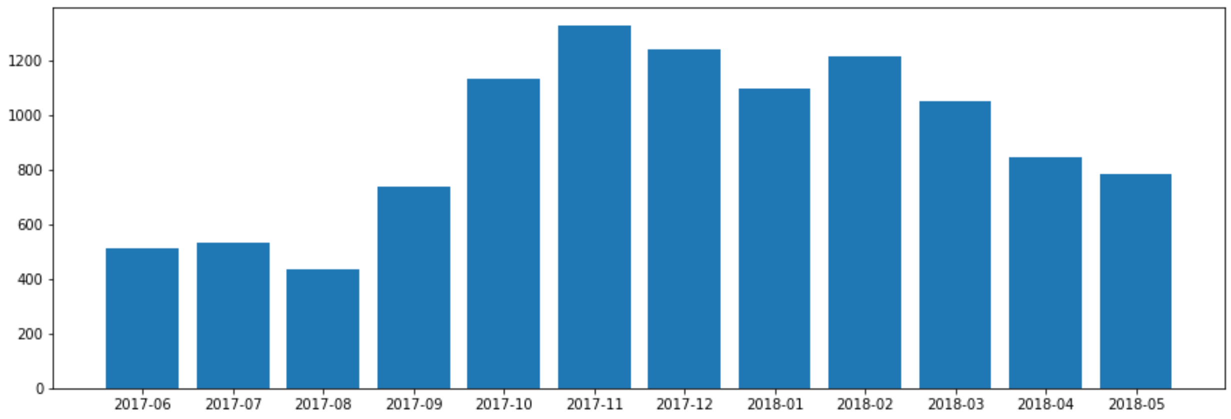
```
Rata-rata pengguna harian adalah 907
Rata-rata pengguna mingguan adalah 5724
Rata-rata pengguna bulan adalah 23228
```

In [22]:
```
dau_monthly = {}

for month, df in visits.groupby('session_month'):
    key = month.strftime('%Y-%m')
    value = df.groupby('session_date').agg({'uid': 'nunique'}).mean()
    dau_monthly[key] = int(value)
```

In [23]:
```
dau_monthly
```

Out[23]:
```
{'2017-06': 510,
 '2017-07': 532,
 '2017-08': 433,
 '2017-09': 739,
 '2017-10': 1133,
 '2017-11': 1328,
 '2017-12': 1240,
 '2018-01': 1096,
 '2018-02': 1217,
 '2018-03': 1052,
 '2018-04': 845,
 '2018-05': 786}
```

In [24]:
```
x = [x.replace(' 00:00:00', '') for x in dau_monthly.keys()]
y = dau_monthly.values()

plt.figure(figsize=(15,5))
plt.bar(x,y)
plt.show()
```



Dari pengolahan terhadap jumlah pengguna, didapatkan kesimpulan sebagai berikut:

- Rata-rata pengguna harian adalah 907 users
- Rata-rata pengguna mingguan adalah 5724 users
- Rata-rata pengguna bulanan adalah 23228 users
- Berdasarkan pengurutan data terhadap bulan, paling banyak pengguna terdapat di bulan November dan Desember, yang kemungkinan banyak user yang ingin berbelanja di akhir tahun.

Jumlah Sesi Per Harinya

In [25]:
```
visits.head()
```

Out[25]:

	device	end_ts	source_id	start_ts	uid	session_year	session_month	session_
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062	2017-01-01	2017-12-01	2017-
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740	2018-01-01	2018-02-01	2018-
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527	2017-01-01	2017-07-01	2017-
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214	2018-01-01	2018-05-01	2018-
4	desktop	2017-12-27 14:06:00	3	2017-12-27 14:06:00	9969694820036681168	2017-01-01	2017-12-01	2017-

In [26]:
```python
session_per_user = visits.groupby('session_date').agg({'uid': ['count', 'nunique']})
session_per_user.columns = ['n_sessions', 'n_users']
session_per_user['sees_per_user'] = session_per_user['n_sessions'] / session_per_user
```

In [27]:
```python
session_per_user.sort_values('sees_per_user')
```

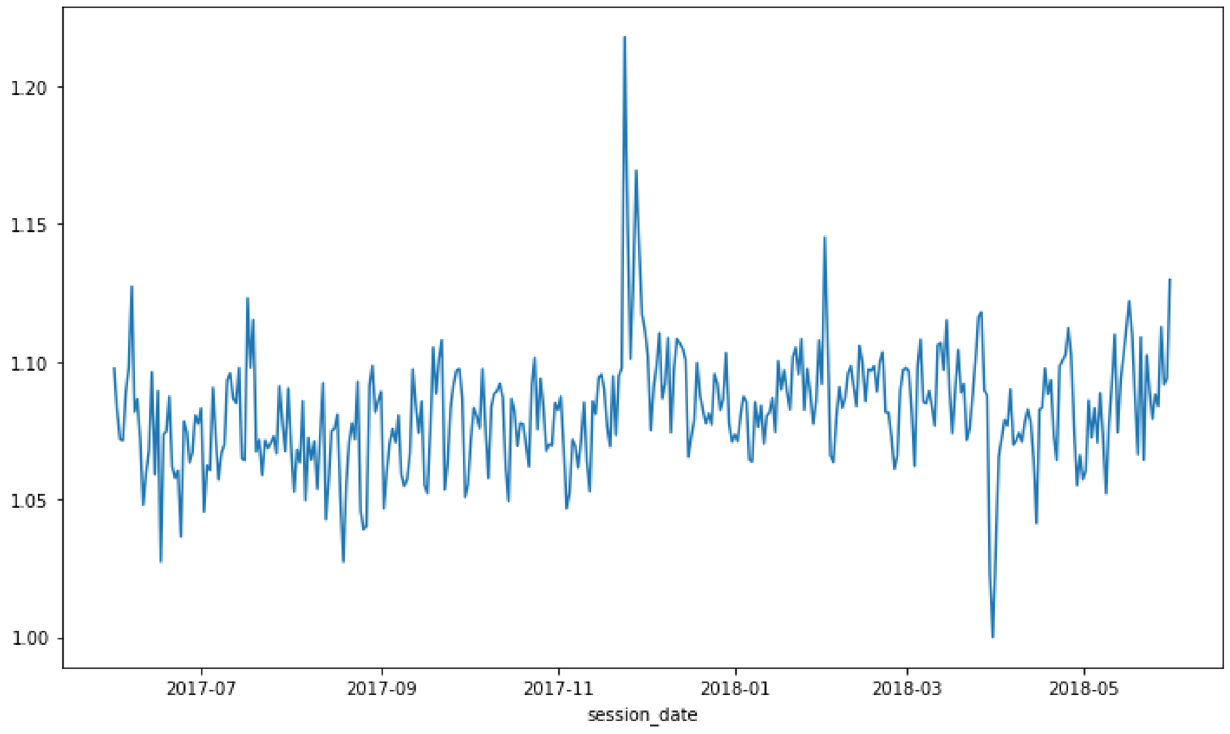
Out[27]:

	n_sessions	n_users	sees_per_user
session_date			
2018-03-31	1	1	1.000000
2018-03-30	134	131	1.022901
2017-08-19	300	292	1.027397
2017-06-17	337	328	1.027439
2017-06-24	340	328	1.036585
...	...	...	...
2017-11-29	1480	1296	1.141975
2018-02-01	1878	1640	1.145122
2017-11-25	2089	1817	1.149697
2017-11-28	1746	1493	1.169457
2017-11-24	4042	3319	1.217837

364 rows × 3 columns

In [28]:
```python
session_per_user['sees_per_user'].plot(kind='line', figsize=(12,7))
```

Out[28]:
```
<AxesSubplot:xlabel='session_date'>
```



Jumlah sesi dibandingkan dengan pengguna paling banyak ditemukan pada tanggal 24 November yaitu sebesar 1.217, bisa dikatakan bahwa sebanyak 0,2 dari user pada tanggal tersebut melakukan akses sebanyak dua kali. Paling sedikit ada pada tanggal 31 Desember yaitu 1.

Durasi Untuk Setiap Sesi

In [29]:
```
visits.head()
```

Out[29]:

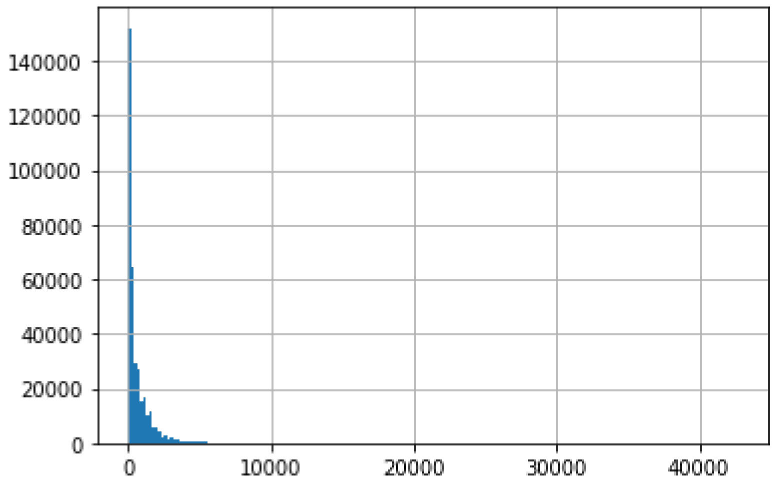
	device	end_ts	source_id	start_ts	uid	session_year	session_month	session_
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062	2017-01-01	2017-12-01	2017-
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740	2018-01-01	2018-02-01	2018-
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527	2017-01-01	2017-07-01	2017-
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214	2018-01-01	2018-05-01	2018-
4	desktop	2017-12-27 14:06:00	3	2017-12-27 14:06:00	9969694820036681168	2017-01-01	2017-12-01	2017-

In [30]:
```
visits['duration_sec'] = (visits['end_ts'] - visits['start_ts']).dt.seconds
```

```
In [31]: visits['duration_sec'].describe()
```

```
Out[31]: count    359398.000000
         mean        643.042287
         std         997.105212
         min           0.000000
         25%         120.000000
         50%         300.000000
         75%         840.000000
         max       42660.000000
         Name: duration_sec, dtype: float64
```

```
In [32]: visits['duration_sec'].hist(bins=200);
```



```
In [33]: print('Rata-rata waktu penggunaan: {:.2f} detik'.format(visits['duration_sec'].mean()
         print('Median waktu penggunaan: {:.2f} detik'.format(visits['duration_sec'].median())
         print('Modus waktu penggunaan: {:.2f} detik'.format(visits['duration_sec'].mode()[0])
```

```
Rata-rata waktu penggunaan: 643.04 detik
Median waktu penggunaan: 300.00 detik
Modus waktu penggunaan: 60.00 detik
```

Frekuensi Pengguna Kembali Menggunakan Produk

```
In [34]: visits.head()
```

Out[34]:

	device	end_ts	source_id	start_ts	uid	session_year	session_month	session_
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062	2017-01-01	2017-12-01	2017-
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740	2018-01-01	2018-02-01	2018-
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527	2017-01-01	2017-07-01	2017-
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214	2018-01-01	2018-05-01	2018-
4	desktop	2017-12-27 14:06:00	3	2017-12-27 14:06:00	9969694820036681168	2017-01-01	2017-12-01	2017-

In [35]:
```python
first_visits = visits.groupby('uid').agg({'start_ts': 'min'}).reset_index()
first_visits.columns = ['uid', 'first_start_visit']
```

In [36]:
```python
first_visits
```

Out[36]:

	uid	first_start_visit
0	11863502262781	2018-03-01 17:27:00
1	49537067089222	2018-02-06 15:55:00
2	297729379853735	2017-06-07 18:47:00
3	313578113262317	2017-09-18 22:49:00
4	325320750514679	2017-09-30 14:29:00
...	...	...
228164	18446403737806311543	2017-11-30 03:36:00
228165	18446424184725333426	2017-12-06 20:32:00
228166	18446556406699109058	2018-01-01 16:29:00
228167	18446621818809592527	2017-12-27 13:27:00
228168	18446676030785672386	2017-10-04 16:01:00

228169 rows × 2 columns

In [37]:
```python
first_visits['first_session_date'] = first_visits['first_start_visit'].dt.date
first_visits['first_session_week'] = first_visits['first_start_visit'].astype('datetim
first_visits['first_session_month'] = first_visits['first_start_visit'].astype('dateti
first_visits['first_session_year'] = first_visits['first_start_visit'].astype('datetim
```

In [38]:
```python
first_visits
```

Out[38]:

	uid	first_start_visit	first_session_date	first_session_week	first_session_mon
0	11863502262781	2018-03-01 17:27:00	2018-03-01	2018-03-01	2018-03-
1	49537067089222	2018-02-06 15:55:00	2018-02-06	2018-02-01	2018-02-
2	297729379853735	2017-06-07 18:47:00	2017-06-07	2017-06-01	2017-06-
3	313578113262317	2017-09-18 22:49:00	2017-09-18	2017-09-14	2017-09-
4	325320750514679	2017-09-30 14:29:00	2017-09-30	2017-09-28	2017-09-
...	...	...	...	...	
228164	18446403737806311543	2017-11-30 03:36:00	2017-11-30	2017-11-30	2017-11-
228165	18446424184725333426	2017-12-06 20:32:00	2017-12-06	2017-11-30	2017-12-
228166	18446556406699109058	2018-01-01 16:29:00	2018-01-01	2017-12-28	2018-01-
228167	18446621818809592527	2017-12-27 13:27:00	2017-12-27	2017-12-21	2017-12-
228168	18446676030785672386	2017-10-04 16:01:00	2017-10-04	2017-09-28	2017-10-

228169 rows × 6 columns

In [39]:

```
vis = pd.merge(visits, first_visits, on='uid')

vis['age_days'] = (vis['session_date'] - vis['first_session_date']).dt.days
vis['age_months'] = round(vis['age_days'] / 30).astype('int')
```

In [40]:

```
vis
```

Out[40]:

	device	end_ts	source_id	start_ts	uid	session_year	session_month	se
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062	2017-01-01	2017-12-01	
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740	2018-01-01	2018-02-01	
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527	2017-01-01	2017-07-01	
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214	2018-01-01	2018-05-01	
4	desktop	2018-03-09 20:33:00	4	2018-03-09 20:05:00	16174680259334210214	2018-01-01	2018-03-01	
...	...	...	...	...	...	...	...	
359393	desktop	2018-04-23 21:19:00	10	2018-04-23 21:11:00	12734910664455613822	2018-01-01	2018-04-01	
359394	desktop	2017-11-08 13:39:00	4	2017-11-08 13:39:00	6761309174945977743	2017-01-01	2017-11-01	
359395	desktop	2017-07-31 12:31:00	3	2017-07-31 12:13:00	11102751930812818282	2017-01-01	2017-07-01	
359396	desktop	2018-03-20 15:25:00	4	2018-03-20 15:11:00	272012551460639309	2018-01-01	2018-03-01	
359397	touch	2018-04-03 11:23:00	5	2018-04-03 11:19:00	3266363999948772866	2018-01-01	2018-04-01	

359398 rows × 17 columns

In [41]:
```python
cohorts = vis.pivot_table(index='first_session_month',
                          columns='age_months',
                          values='uid',
                          aggfunc='nunique')
```

In [42]:
```python
cohorts.fillna('')
```

Out[42]:

age_months	0	1	2	3	4	5	6	7	8	9	10	
first_session_month												
2017-06-01	13259.0	955.0	720.0	775.0	944.0	847.0	875.0	713.0	746.0	659.0	576.0	51
2017-07-01	13140.0	716.0	688.0	675.0	767.0	609.0	606.0	619.0	527.0	379.0	337.0	11
2017-08-01	10181.0	691.0	634.0	577.0	547.0	412.0	438.0	340.0	299.0	243.0	58.0	
2017-09-01	16704.0	1239.0	1117.0	816.0	683.0	642.0	571.0	420.0	366.0	61.0		
2017-10-01	25977.0	1858.0	1384.0	960.0	975.0	787.0	565.0	478.0	120.0			
2017-11-01	27248.0	1849.0	1270.0	1016.0	900.0	639.0	520.0	107.0				
2017-12-01	25268.0	1257.0	1057.0	719.0	577.0	400.0	101.0					
2018-01-01	22624.0	1191.0	830.0	557.0	421.0	47.0						
2018-02-01	22197.0	1039.0	602.0	407.0	67.0							
2018-03-01	20589.0	835.0	533.0	81.0								
2018-04-01	15709.0	614.0	82.0									
2018-05-01	15273.0	100.0										

In [43]:
```
retention = pd.DataFrame()
for col in cohorts.columns:
    retention = pd.concat([retention, cohorts[col]/cohorts[0]*100], axis=1)
retention.columns = cohorts.columns
```

In [44]:
```
retention.fillna('')
```

Out[44]:

age_months	0	1	2	3	4	5	6	7	8	
2017-06-01 00:00:00	100.0	7.202655	5.430274	5.845086	7.119692	6.388114	6.599291	5.377479	5.626367	4.9
2017-07-01 00:00:00	100.0	5.449011	5.235921	5.136986	5.837139	4.634703	4.611872	4.710807	4.010654	2.8
2017-08-01 00:00:00	100.0	6.787153	6.227286	5.66742	5.372753	4.046754	4.302131	3.339554	2.936843	2.3
2017-09-01 00:00:00	100.0	7.417385	6.687021	4.885057	4.088841	3.843391	3.418343	2.514368	2.191092	0.3
2017-10-01 00:00:00	100.0	7.152481	5.32779	3.695577	3.75332	3.029603	2.175001	1.840089	0.461947	
2017-11-01 00:00:00	100.0	6.785819	4.660893	3.728714	3.302995	2.345126	1.908397	0.392689		
2017-12-01 00:00:00	100.0	4.974672	4.183157	2.845496	2.283521	1.58303	0.399715			
2018-01-01 00:00:00	100.0	5.264321	3.66867	2.461987	1.860856	0.207744				
2018-02-01 00:00:00	100.0	4.680813	2.712078	1.833581	0.301843					
2018-03-01 00:00:00	100.0	4.055564	2.588761	0.393414						
2018-04-01 00:00:00	100.0	3.908587	0.521994							
2018-05-01 00:00:00	100.0	0.654750								

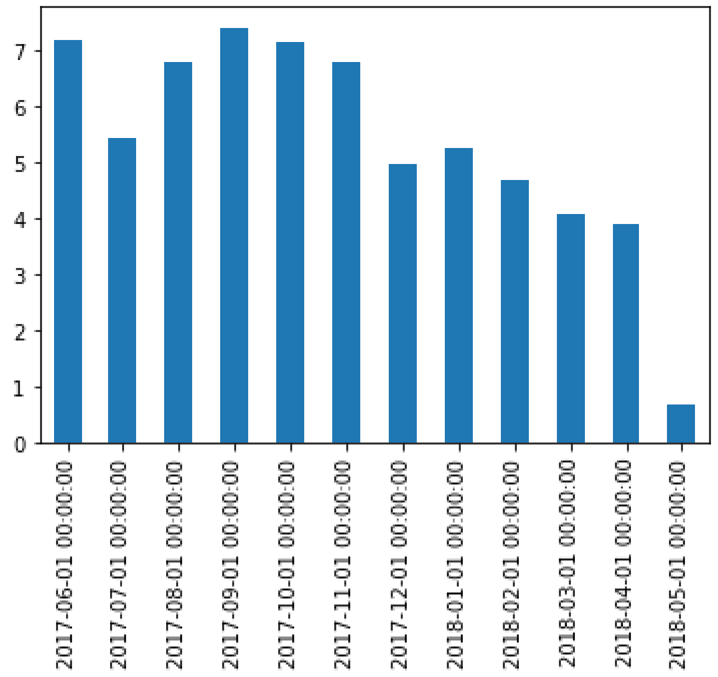
```
In [45]: retention[1].mean()
```

```
Out[45]: 5.361100820922162
```

```
In [46]: retention[2].mean()
```

```
Out[46]: 4.294894935690882
```

```
In [47]: retention[1].plot(kind='bar');
```



In [48]:
```
print('Rata-rata pengguna yang kembali setelah kunjungan pertama mereka', retention[1
```

```
Rata-rata pengguna yang kembali setelah kunjungan pertama mereka 5.361100820922162 %
```

Penjualan

Waktu Pengguna Melakukan Pembelian

In [49]:
```
orders.head()
```

Out[49]:

	buy_ts	revenue	uid
0	2017-06-01 00:10:00	17.00	10329302124590727494
1	2017-06-01 00:25:00	0.55	11627257723692907447
2	2017-06-01 00:27:00	0.37	17903680561304213844
3	2017-06-01 00:29:00	0.55	16109239769442553005
4	2017-06-01 07:58:00	0.37	14200605875248379450

In [50]:
```
first_orders = orders.groupby('uid').agg({'buy_ts': 'min'}).reset_index()
first_orders.columns = ['uid', 'first_order_ts']

first_orders['first_order_date'] = first_orders['first_order_ts'].dt.date
first_orders['first_order_month'] = first_orders['first_order_ts'].astype('datetime64[
first_orders['first_order_week'] = first_orders['first_order_ts'].astype('datetime64[Y
```

In [51]:
```
first_orders.head()
```

Out[51]:

	uid	first_order_ts	first_order_date	first_order_month	first_order_week
0	313578113262317	2018-01-03 21:51:00	2018-01-03	2018-01-01	2018-01-01
1	1575281904278712	2017-06-03 10:13:00	2017-06-03	2017-06-01	2017-01-01
2	2429014661409475	2017-10-11 18:33:00	2017-10-11	2017-10-01	2017-01-01
3	2464366381792757	2018-01-28 15:54:00	2018-01-28	2018-01-01	2018-01-01
4	2551852515556206	2017-11-24 10:14:00	2017-11-24	2017-11-01	2017-01-01

In [52]:
```
first_visits.head()
```

Out[52]:

	uid	first_start_visit	first_session_date	first_session_week	first_session_month	first_ses
0	11863502262781	2018-03-01 17:27:00	2018-03-01	2018-03-01	2018-03-01	2
1	49537067089222	2018-02-06 15:55:00	2018-02-06	2018-02-01	2018-02-01	2
2	297729379853735	2017-06-07 18:47:00	2017-06-07	2017-06-01	2017-06-01	2
3	313578113262317	2017-09-18 22:49:00	2017-09-18	2017-09-14	2017-09-01	2
4	325320750514679	2017-09-30 14:29:00	2017-09-30	2017-09-28	2017-09-01	2

In [53]:
```
first_buy = pd.merge(first_visits, first_orders, on='uid')
```

In [54]:
```
first_buy.head()
```

Out[54]:

	uid	first_start_visit	first_session_date	first_session_week	first_session_month	first_se
0	313578113262317	2017-09-18 22:49:00	2017-09-18	2017-09-14	2017-09-01	
1	1575281904278712	2017-06-03 10:13:00	2017-06-03	2017-06-01	2017-06-01	
2	2429014661409475	2017-10-11 17:14:00	2017-10-11	2017-10-05	2017-10-01	
3	2464366381792757	2018-01-27 20:10:00	2018-01-27	2018-01-25	2018-01-01	
4	2551852515556206	2017-11-24 10:14:00	2017-11-24	2017-11-23	2017-11-01	

In [55]:
```
first_buy.dtypes
```

Out[55]:
```
uid                            uint64
first_start_visit      datetime64[ns]
first_session_date             object
first_session_week     datetime64[ns]
first_session_month    datetime64[ns]
first_session_year     datetime64[ns]
first_order_ts         datetime64[ns]
first_order_date               object
first_order_month      datetime64[ns]
first_order_week       datetime64[ns]
dtype: object
```

In [56]:
```
first_buy['first_order_date'] = pd.to_datetime(first_buy['first_order_date'])
first_buy['first_session_date'] = pd.to_datetime(first_buy['first_session_date'])

first_buy['day_first_purchase'] = (first_buy['first_order_date'] - first_buy['first_se
```

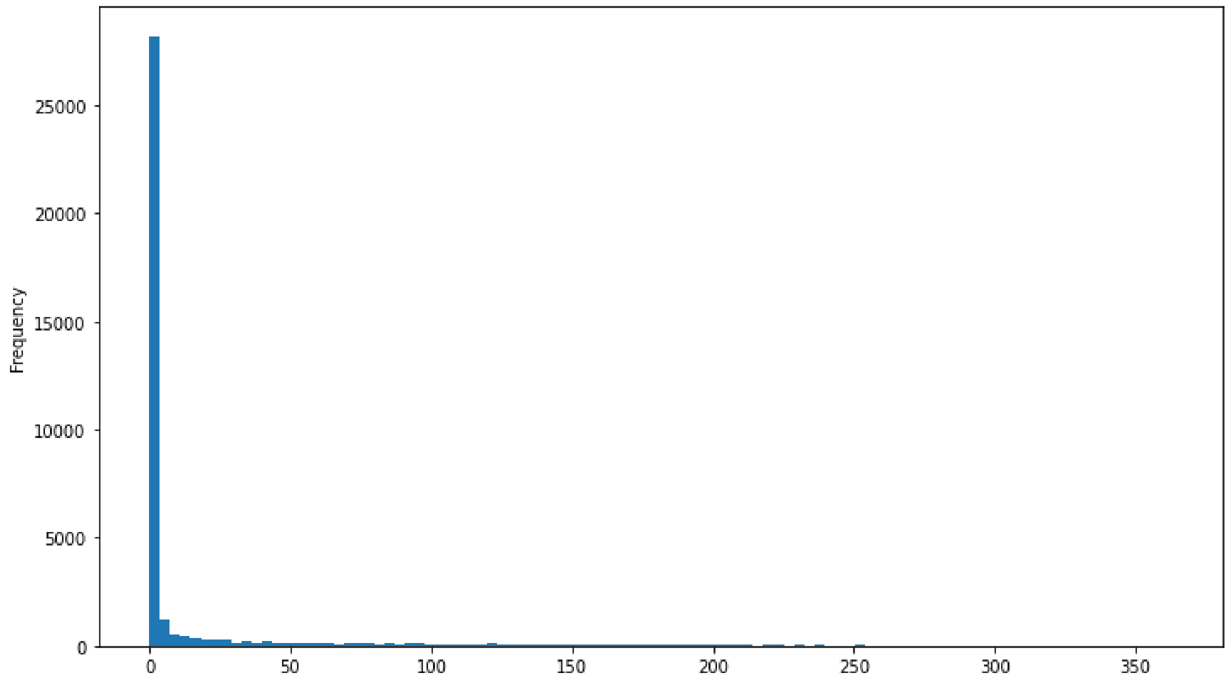
In [57]:
```
first_buy.head()
```

Out[57]:

	uid	first_start_visit	first_session_date	first_session_week	first_session_month	first_se
0	313578113262317	2017-09-18 22:49:00	2017-09-18	2017-09-14	2017-09-01	
1	1575281904278712	2017-06-03 10:13:00	2017-06-03	2017-06-01	2017-06-01	
2	2429014661409475	2017-10-11 17:14:00	2017-10-11	2017-10-05	2017-10-01	
3	2464366381792757	2018-01-27 20:10:00	2018-01-27	2018-01-25	2018-01-01	
4	2551852515556206	2017-11-24 10:14:00	2017-11-24	2017-11-23	2017-11-01	

In [58]:
```
first_buy['day_first_purchase'].plot(kind='hist', bins=100, figsize=(12,7))
```

Out[58]:
```
<AxesSubplot:ylabel='Frequency'>
```



In [59]:
```
first_buy['day_first_purchase'].describe()
```

Out[59]:
```
count    36523.000000
mean        16.895901
std         47.071200
min          0.000000
25%          0.000000
50%          0.000000
75%          2.000000
max        363.000000
Name: day_first_purchase, dtype: float64
```

In [60]:
```
first_buy['day_first_purchase'].value_counts()
```

Out[60]:
```
0      25039
1       1966
2        685
3        452
4        386
       ...  
314        1
309        1
299        1
358        1
341        1
Name: day_first_purchase, Length: 349, dtype: int64
```

Paling banyak pengguna melakukan pembelian pertama mereka di hari ke-0 atau kurang dari 24 jam sejak mereka masuk ke dalam situs. setelahnya diikuti oleh pelanggan yang melakukan pembelian pada hari pertama sejak mereka pertama kali mengunjungi situs.

Jumlah Pesanan Yang Mereka Buat Selama Periode Waktu Tertentu

- Periode waktu yang diambil adalah 6 bulan

In [61]:
```
orders['order_date'] = orders['buy_ts'].dt.date
orders['order_month'] = orders['buy_ts'].astype('datetime64[M]')
orders['order_week'] = orders['buy_ts'].astype('datetime64[W]')
```

In [62]:
```
orders.head()
```

Out[62]:

	buy_ts	revenue	uid	order_date	order_month	order_week
0	2017-06-01 00:10:00	17.00	10329302124590727494	2017-06-01	2017-06-01	2017-06-01
1	2017-06-01 00:25:00	0.55	11627257723692907447	2017-06-01	2017-06-01	2017-06-01
2	2017-06-01 00:27:00	0.37	17903680561304213844	2017-06-01	2017-06-01	2017-06-01
3	2017-06-01 00:29:00	0.55	16109239769442553005	2017-06-01	2017-06-01	2017-06-01
4	2017-06-01 07:58:00	0.37	14200605875248379450	2017-06-01	2017-06-01	2017-06-01

In [63]:
```
orders_agg = orders.groupby(['uid']).agg({'buy_ts': 'count', 'revenue': 'sum'})
```

In [64]:
```
orders_agg.columns = ['count_transaction', 'sum_revenue']
```

In [65]:
```
orders_agg
```

Out[65]:

	count_transaction	sum_revenue
uid		
313578113262317	1	0.55
1575281904278712	2	3.05
2429014661409475	1	73.33
2464366381792757	1	2.44
2551852515556206	2	10.99
...	...	...
18445147675727495770	1	3.05
18445407535914413204	3	0.88
18445601152732270159	1	4.22
18446156210226471712	1	9.78
18446167067214817906	1	7.94

36523 rows × 2 columns

In [66]:
```
orders_agg.describe()
```

Out[66]:

	count_transaction	sum_revenue
count	36523.000000	36523.000000
mean	1.380363	6.901328
std	3.454461	88.128535
min	1.000000	0.000000
25%	1.000000	1.470000
50%	1.000000	3.050000
75%	1.000000	5.800000
max	239.000000	11810.180000

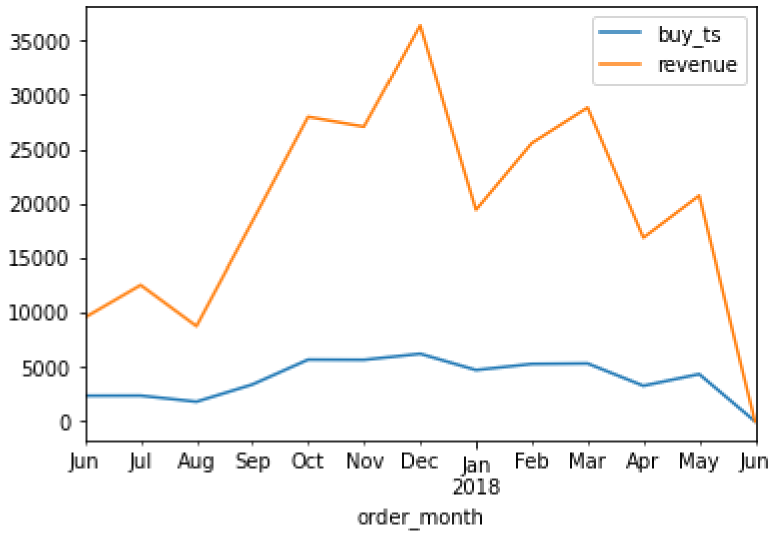
In [67]:
```
orders.groupby(['order_month']).agg({'buy_ts': 'count', 'revenue': 'sum'})
```

Out[67]:

	buy_ts	revenue
order_month		
2017-06-01	2354	9557.49
2017-07-01	2363	12539.47
2017-08-01	1807	8758.78
2017-09-01	3387	18345.51
2017-10-01	5679	27987.70
2017-11-01	5659	27069.93
2017-12-01	6218	36388.60
2018-01-01	4721	19417.13
2018-02-01	5281	25560.54
2018-03-01	5326	28834.59
2018-04-01	3273	16858.06
2018-05-01	4346	20735.98
2018-06-01	1	3.42

In [68]:
```
orders.groupby(['order_month']).agg({'buy_ts': 'count', 'revenue': 'sum'}).plot()
```

Out[68]:
```
<AxesSubplot:xlabel='order_month'>
```



Jumlah transaksi dan revenue terbesar didapatkan pada bulan Desember dan selanjutnya pada bulan Oktober. Dapat disimpulkan bahwa banyak user yang melakukan transaksi di akhir tahun, dimana mungkin ada banyak diskon dan clereance sale.

Besaran Rata-Rata Pembelian

In [69]:
```
print('Rata-rata pembelian: ', round(orders['revenue'].mean()))
```

```
Rata-rata pembelian:  5
```

Jumlah Uang Yang Mereka Kontribusikan (LTV)

In [70]:
```
first_buy.head()
```

Out[70]:

	uid	first_start_visit	first_session_date	first_session_week	first_session_month	first_se
0	313578113262317	2017-09-18 22:49:00	2017-09-18	2017-09-14	2017-09-01	
1	1575281904278712	2017-06-03 10:13:00	2017-06-03	2017-06-01	2017-06-01	
2	2429014661409475	2017-10-11 17:14:00	2017-10-11	2017-10-05	2017-10-01	
3	2464366381792757	2018-01-27 20:10:00	2018-01-27	2018-01-25	2018-01-01	
4	2551852515556206	2017-11-24 10:14:00	2017-11-24	2017-11-23	2017-11-01	

In [71]:
```
cohort_sizes = first_buy.groupby('first_order_month').agg({'uid': 'nunique'}).reset_ir
cohort_sizes.rename(columns={'uid': 'n_buyers'}, inplace=True)
```

In [72]:
```
cohort_sizes
```

Out[72]:

	first_order_month	n_buyers
0	2017-06-01	2023
1	2017-07-01	1923
2	2017-08-01	1370
3	2017-09-01	2581
4	2017-10-01	4340
5	2017-11-01	4081
6	2017-12-01	4383
7	2018-01-01	3373
8	2018-02-01	3651
9	2018-03-01	3533
10	2018-04-01	2276
11	2018-05-01	2988
12	2018-06-01	1

In [73]:
```
cohorts_1 = pd.merge(orders, first_buy, how='inner', on='uid')
cohorts_1_agg = cohorts_1.groupby(['first_order_month', 'order_month']).agg({'revenue'
```

In [74]:
```
cohorts_1.head()
```

Out[74]:

	buy_ts	revenue	uid	order_date	order_month	order_week	first_start_visit	fi
0	2017-06-01 00:10:00	17.00	10329302124590727494	2017-06-01	2017-06-01	2017-06-01	2017-06-01 00:09:00	
1	2017-06-01 00:25:00	0.55	11627257723692907447	2017-06-01	2017-06-01	2017-06-01	2017-06-01 00:14:00	
2	2017-06-01 00:27:00	0.37	17903680561304213844	2017-06-01	2017-06-01	2017-06-01	2017-06-01 00:25:00	
3	2017-06-01 00:29:00	0.55	16109239769442553005	2017-06-01	2017-06-01	2017-06-01	2017-06-01 00:14:00	
4	2017-06-01 07:58:00	0.37	14200605875248379450	2017-06-01	2017-06-01	2017-06-01	2017-06-01 07:31:00	

In [75]:
```
cohort_sizes.head()
```

Out[75]:

	first_order_month	n_buyers
0	2017-06-01	2023
1	2017-07-01	1923
2	2017-08-01	1370
3	2017-09-01	2581
4	2017-10-01	4340

In [76]:
```
cohorts_1_agg.head()
```

Out[76]:

	first_order_month	order_month	revenue
0	2017-06-01	2017-06-01	9557.49
1	2017-06-01	2017-07-01	981.82
2	2017-06-01	2017-08-01	885.34
3	2017-06-01	2017-09-01	1931.30
4	2017-06-01	2017-10-01	2068.58

In [77]:
```
cohorts_1_agg['age_month'] = (cohorts_1_agg['order_month'] - cohorts_1_agg['first_orde
cohorts_1_agg['age_month'] = round(cohorts_1_agg['age_month']/30,0).astype('int')
cohorts_1_agg.columns = ['first_order_month', 'order_month', 'revenue', 'age_month']
cohorts_1_agg.head()
```

Out[77]:

	first_order_month	order_month	revenue	age_month
0	2017-06-01	2017-06-01	9557.49	0
1	2017-06-01	2017-07-01	981.82	1
2	2017-06-01	2017-08-01	885.34	2
3	2017-06-01	2017-09-01	1931.30	3
4	2017-06-01	2017-10-01	2068.58	4

In [78]:
```
margin_rate = 0.5

cohorts_report = pd.merge(cohort_sizes, cohorts_1_agg, on='first_order_month')
cohorts_report['gp'] = cohorts_report['revenue'] * margin_rate
cohorts_report['ltv'] = cohorts_report['revenue'] / cohorts_report['n_buyers']
```

In [79]:
```
cohorts_report
```

Out[79]:

	first_order_month	n_buyers	order_month	revenue	age_month	gp	ltv
0	2017-06-01	2023	2017-06-01	9557.49	0	4778.745	4.724414
1	2017-06-01	2023	2017-07-01	981.82	1	490.910	0.485329
2	2017-06-01	2023	2017-08-01	885.34	2	442.670	0.437637
3	2017-06-01	2023	2017-09-01	1931.30	3	965.650	0.954671
4	2017-06-01	2023	2017-10-01	2068.58	4	1034.290	1.022531
...	...	...	...	...	...	...	...
74	2018-03-01	3533	2018-05-01	1114.87	2	557.435	0.315559
75	2018-04-01	2276	2018-04-01	10600.69	0	5300.345	4.657597
76	2018-04-01	2276	2018-05-01	1209.92	1	604.960	0.531599
77	2018-05-01	2988	2018-05-01	13925.76	0	6962.880	4.660562
78	2018-06-01	1	2018-06-01	3.42	0	1.710	3.420000

79 rows × 7 columns

In [80]:
```
cohorts_ltv = cohorts_report.pivot_table(
    index='first_order_month',
    columns='age_month',
    values='ltv',
    aggfunc='mean',
)
```

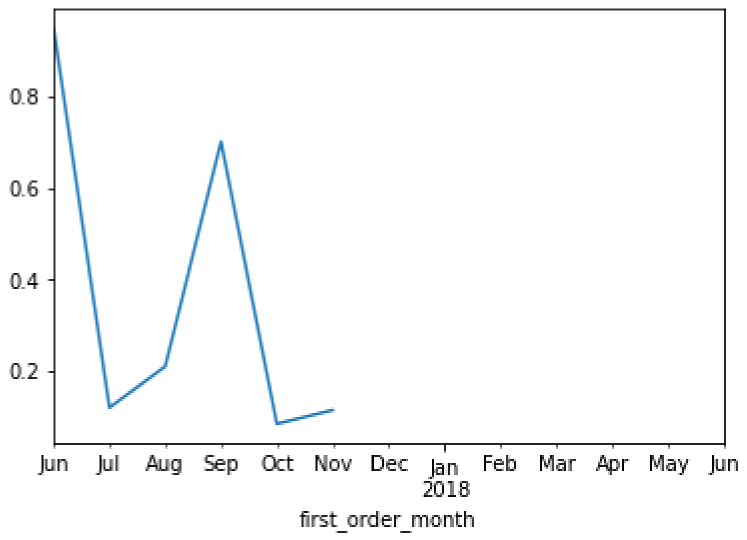
In [81]:
```
cohorts_ltv.round(2).fillna('')
```

Out[81]:

age_month first_order_month	0	1	2	3	4	5	6	7	8	9	10	11
2017-06-01	4.72	0.49	0.44	0.95	1.02	0.74	0.95	0.58	0.55	0.61	0.57	0.26
2017-07-01	6.01	0.34	0.62	0.36	0.18	0.16	0.12	0.14	0.16	0.15	0.16	
2017-08-01	5.28	0.47	0.46	0.39	0.49	0.28	0.21	0.41	0.29	0.19		
2017-09-01	5.64	1.12	0.52	3.98	0.4	0.65	0.7	0.24	0.18			
2017-10-01	5.00	0.54	0.19	0.16	0.15	0.12	0.08	0.12				
2017-11-01	5.15	0.4	0.2	0.32	0.15	0.05	0.11					
2017-12-01	4.74	0.26	0.93	1.07	0.31	0.34						
2018-01-01	4.14	0.29	0.3	0.14	0.06							
2018-02-01	4.16	0.28	0.08	0.07								
2018-03-01	4.84	0.3	0.32									
2018-04-01	4.66	0.53										
2018-05-01	4.66											
2018-06-01	3.42											

In [82]:
```
print('Rata-rata LTV untuk 6 bulan adalah', round(cohorts_ltv[6].mean(),2))
```
```
Rata-rata LTV untuk 6 bulan adalah 0.36
```

In [83]:
```
cohorts_ltv[6].plot();
```



In [84]:
```
print('Rata-rata LTV untuk bulan yang sama', round(cohorts_ltv[11].mean(),2))
```
```
Rata-rata LTV untuk bulan yang sama 0.26
```

Pemasaran

Jumlah Uang Yang Dihabiskan

In [85]:
```
print('Total penjualan: {}'.format(costs['costs'].sum()))
```
```
Total penjualan: 329131.62
```

In [86]:
```
print('Total penjualan: {}'.format(costs['costs'].mean()))
```
```
Total penjualan: 129.47742722265932
```

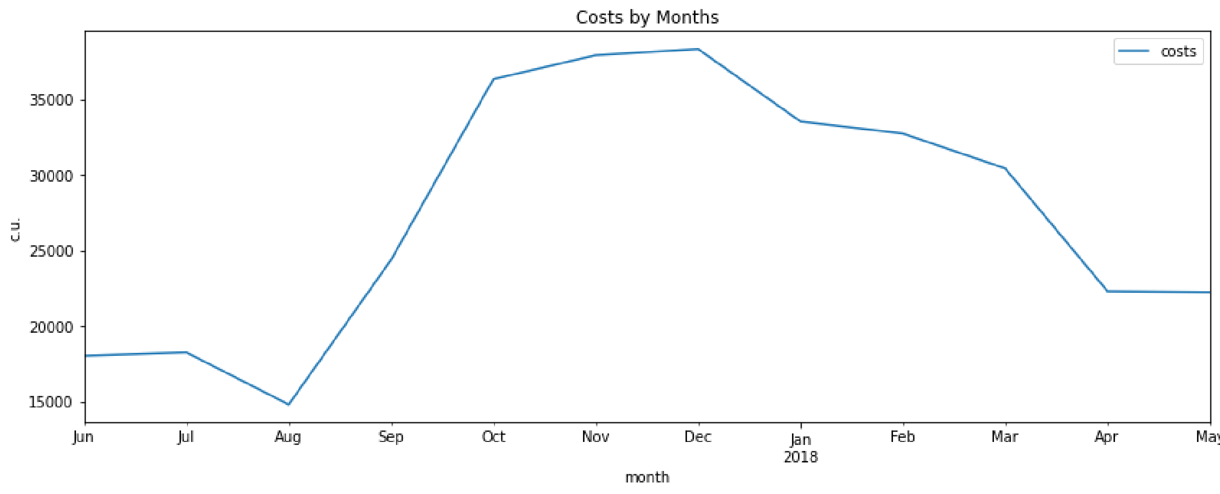
In [87]:
```
costs['costs_month'] = costs['dt'].astype('datetime64[M]')
```

In [88]:
```
costs.head()
```

Out[88]:

	source_id	dt	costs	costs_month
0	1	2017-06-01	75.20	2017-06-01
1	1	2017-06-02	62.25	2017-06-01
2	1	2017-06-03	36.53	2017-06-01
3	1	2017-06-04	55.00	2017-06-01
4	1	2017-06-05	57.08	2017-06-01

In [89]:
```
(costs.pivot_table(index='costs_month', values='costs', aggfunc='sum')
    .plot(figsize=(14,5), title='Costs by Months', xlabel='month', ylabel='c.u.'))
plt.show()
```



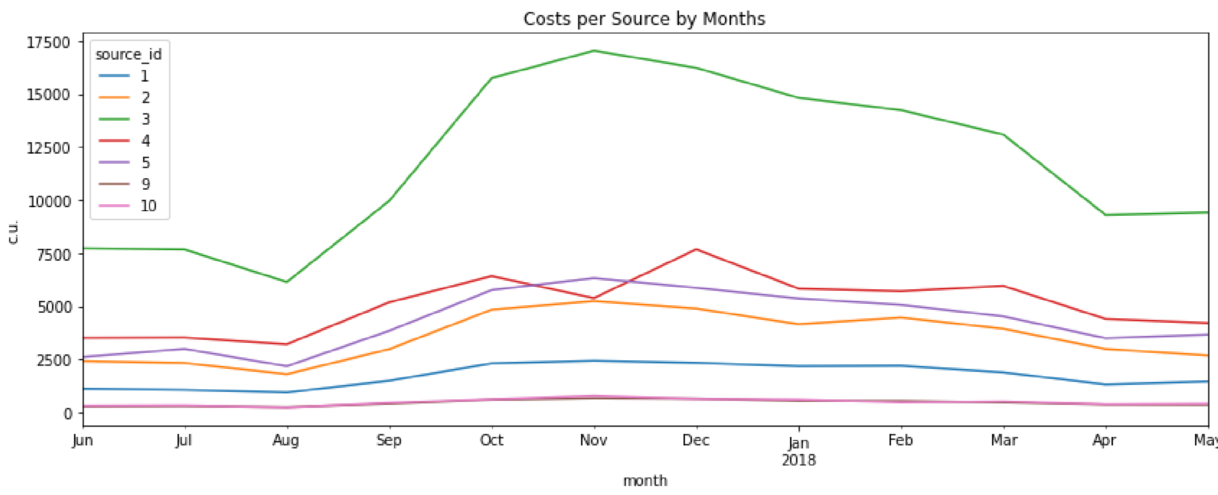
In [90]:
```
print(costs.groupby('costs_month').agg({'costs': 'sum'}))
```

```
                costs
costs_month          
2017-06-01   18015.00
2017-07-01   18240.59
2017-08-01   14790.54
2017-09-01   24368.91
2017-10-01   36322.88
2017-11-01   37907.88
2017-12-01   38315.35
2018-01-01   33518.52
2018-02-01   32723.03
2018-03-01   30415.27
2018-04-01   22289.38
2018-05-01   22224.27
```

In [91]:
```
print(costs.groupby('source_id').agg({'costs': 'sum'}))
```

```
               costs
source_id           
1           20833.27
2           42806.04
3          141321.63
4           61073.60
5           51757.10
9            5517.49
10           5822.49
```

In [92]:
```
(costs.pivot_table(index='costs_month', columns='source_id', values='costs', aggfunc='
    .plot(figsize=(14,5), title='Costs per Source by Months', xlabel='month', ylabel='
plt.show()
```



Jumlah uang yang dihabiskan paling banyak adalah pada source 3 sebanyak 141321.63 dan paling besar biaya dihabiskan di bulan Desember. Ini sejalan dengan jumlah transaksi yang terjadi di bulan Desember dimana menjadi bulan yang paling tinggi transaksinya.

Biaya Akuisisi Pelanggan Dari Masing-Masing Sumber

In [93]:
```
costs.head()
```

Out[93]:

	source_id	dt	costs	costs_month
0	1	2017-06-01	75.20	2017-06-01
1	1	2017-06-02	62.25	2017-06-01
2	1	2017-06-03	36.53	2017-06-01
3	1	2017-06-04	55.00	2017-06-01
4	1	2017-06-05	57.08	2017-06-01

In [94]:
```
print('Rata-rata CAC adalah', round(costs['costs'].sum() / orders['uid'].nunique(), 2
```
```
Rata-rata CAC adalah 9.01
```

In [95]:
```
vis.head()
```

Out[95]:

	device	end_ts	source_id	start_ts	uid	session_year	session_month	session_
0	touch	2017-12-20 17:38:00	4	2017-12-20 17:20:00	16879256277535980062	2017-01-01	2017-12-01	2017-
1	desktop	2018-02-19 17:21:00	2	2018-02-19 16:53:00	104060357244891740	2018-01-01	2018-02-01	2018-
2	touch	2017-07-01 01:54:00	5	2017-07-01 01:54:00	7459035603376831527	2017-01-01	2017-07-01	2017-
3	desktop	2018-05-20 11:23:00	9	2018-05-20 10:59:00	16174680259334210214	2018-01-01	2018-05-01	2018-
4	desktop	2018-03-09 20:33:00	4	2018-03-09 20:05:00	16174680259334210214	2018-01-01	2018-03-01	2018-

In [96]:
```
user = vis.sort_values('start_ts').groupby('uid').first()
user = user[['source_id']]
buyer = pd.merge(first_buy, user, left_on='uid', right_index=True)
```

In [97]:
```
user
```

Out[97]:

	source_id
uid	
11863502262781	3
49537067089222	2
297729379853735	3
313578113262317	2
325320750514679	5
...	...
18446403737806311543	5
18446424184725333426	4
18446556406699109058	3
18446621818809592527	4
18446676030785672386	3

228169 rows × 1 columns

In [98]:
```
buyer_daily = buyer.groupby(['source_id', 'first_order_date']).agg({'uid': 'count'}).r
buyer_daily.rename(columns={'uid': 'n_buyer'}, inplace=True)
buyer_daily['first_order_date'] = pd.to_datetime(buyer_daily['first_order_date'])
```

In [99]:
```
buyer_daily.head()
```

Out[99]:

	source_id	first_order_date	n_buyer
0	1	2017-06-01	14
1	1	2017-06-02	7
2	1	2017-06-03	7
3	1	2017-06-04	3
4	1	2017-06-05	18

In [100…
```
cost = pd.merge(buyer_daily, costs, left_on=['source_id', 'first_order_date'], right_c
cost['cac'] = cost['costs'] / cost['n_buyer']
```

In [101…
```
cost.head()
```

Out[101]:

	source_id	first_order_date	n_buyer	dt	costs	costs_month	cac
0	1	2017-06-01	14	2017-06-01	75.20	2017-06-01	5.371429
1	1	2017-06-02	7	2017-06-02	62.25	2017-06-01	8.892857
2	1	2017-06-03	7	2017-06-03	36.53	2017-06-01	5.218571
3	1	2017-06-04	3	2017-06-04	55.00	2017-06-01	18.333333
4	1	2017-06-05	18	2017-06-05	57.08	2017-06-01	3.171111

In [102…

```
cost.groupby('source_id').agg({'cac': 'mean'}).round(2)
```

Out[102]:

source_id	cac
1	9.49
2	16.29
3	15.58
4	7.27
5	8.34
9	6.84
10	6.56

CAC berdasarkan sumber 2 memiliki nilai tertinggi yang berarti biaya untuk mendapatkan pelanggan baru terbilang lebih besar dari yang lainnya, dimana tidak sejalan dengan biaya yang dihabiskan per sumber. Jika melihat per sumber maka sumber 3 adalah sumber yang memakan biaya paling besar.

ROI

In [103…

```
month_revenue = orders.groupby(['uid', 'order_month']).agg({'revenue': 'sum'}).reset_i
buyer = buyer.merge(month_revenue, on='uid')
```

In [104…

```
cohorts_report
```

Out[104]:

	first_order_month	n_buyers	order_month	revenue	age_month	gp	ltv
0	2017-06-01	2023	2017-06-01	9557.49	0	4778.745	4.724414
1	2017-06-01	2023	2017-07-01	981.82	1	490.910	0.485329
2	2017-06-01	2023	2017-08-01	885.34	2	442.670	0.437637
3	2017-06-01	2023	2017-09-01	1931.30	3	965.650	0.954671
4	2017-06-01	2023	2017-10-01	2068.58	4	1034.290	1.022531
...	...	...	...	...	...	...	...
74	2018-03-01	3533	2018-05-01	1114.87	2	557.435	0.315559
75	2018-04-01	2276	2018-04-01	10600.69	0	5300.345	4.657597
76	2018-04-01	2276	2018-05-01	1209.92	1	604.960	0.531599
77	2018-05-01	2988	2018-05-01	13925.76	0	6962.880	4.660562
78	2018-06-01	1	2018-06-01	3.42	0	1.710	3.420000

79 rows × 7 columns

In [137…

```python
result = cohorts_report.pivot_table(
    index='first_order_month', columns='age_month', values='ltv', aggfunc='mean'
)
result = result.fillna('')
result
```

Out[137]:

age_month	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
first_order_month									
2017-06-01	4.724414	0.485329	0.437637	0.954671	1.022531	0.735502	0.95044	0.581592	0.55
2017-07-01	6.010218	0.335211	0.623531	0.358976	0.176791	0.156048	0.120208	0.14182	0.16
2017-08-01	5.276518	0.471993	0.458482	0.391277	0.494051	0.28354	0.210664	0.405007	0.29
2017-09-01	5.644529	1.117586	0.52093	3.975792	0.400558	0.647067	0.701608	0.24315	0.18
2017-10-01	5.003733	0.535763	0.191394	0.157145	0.15156	0.120362	0.084816	0.11547	
2017-11-01	5.154683	0.399233	0.199556	0.324952	0.148013	0.053879	0.114928		
2017-12-01	4.738191	0.260374	0.925097	1.065275	0.31293	0.338047			
2018-01-01	4.135636	0.294758	0.304281	0.142778	0.062698				
2018-02-01	4.156987	0.278274	0.078515	0.074144					
2018-03-01	4.838803	0.300892	0.315559						
2018-04-01	4.657597	0.531599							
2018-05-01	4.660562								
2018-06-01	3.420000								

In [147…

```
monthly_costs = costs.groupby('costs_month').sum()
monthly_costs.drop('source_id', axis=1)
```

Out[147]:

	costs
costs_month	
2017-06-01	18015.00
2017-07-01	18240.59
2017-08-01	14790.54
2017-09-01	24368.91
2017-10-01	36322.88
2017-11-01	37907.88
2017-12-01	38315.35
2018-01-01	33518.52
2018-02-01	32723.03
2018-03-01	30415.27
2018-04-01	22289.38
2018-05-01	22224.27

In [149…

```
report_ = pd.merge(
    cohorts_report, monthly_costs, left_on='first_order_month', right_on='costs_month'
)
report_
```

Out[149]:

	first_order_month	n_buyers	order_month	revenue	age_month	gp	ltv	source_id	
0	2017-06-01	2023	2017-06-01	9557.49	0	4778.745	4.724414	1020	1
1	2017-06-01	2023	2017-07-01	981.82	1	490.910	0.485329	1020	1
2	2017-06-01	2023	2017-08-01	885.34	2	442.670	0.437637	1020	1
3	2017-06-01	2023	2017-09-01	1931.30	3	965.650	0.954671	1020	1
4	2017-06-01	2023	2017-10-01	2068.58	4	1034.290	1.022531	1020	1
...	...	...	...	...	...	...	...	...	
73	2018-03-01	3533	2018-04-01	1063.05	1	531.525	0.300892	1025	3
74	2018-03-01	3533	2018-05-01	1114.87	2	557.435	0.315559	1025	3
75	2018-04-01	2276	2018-04-01	10600.69	0	5300.345	4.657597	986	2
76	2018-04-01	2276	2018-05-01	1209.92	1	604.960	0.531599	986	2
77	2018-05-01	2988	2018-05-01	13925.76	0	6962.880	4.660562	1054	2

78 rows × 9 columns

In [150…
```
report_['cac'] = report_['costs'] / report_['n_buyers']
report_['roi'] = report_['ltv'] / report_['cac']
```

In [151…
```
report_
```

Out[151]:
```
    first_order_month  n_buyers  order_month   revenue  age_month        gp       ltv  source_id
 0         2017-06-01      2023   2017-06-01   9557.49          0  4778.745  4.724414       1020  1
 1         2017-06-01      2023   2017-07-01    981.82          1   490.910  0.485329       1020  1
 2         2017-06-01      2023   2017-08-01    885.34          2   442.670  0.437637       1020  1
 3         2017-06-01      2023   2017-09-01   1931.30          3   965.650  0.954671       1020  1
 4         2017-06-01      2023   2017-10-01   2068.58          4  1034.290  1.022531       1020  1
...               ...       ...          ...       ...        ...       ...       ...        ...
73         2018-03-01      3533   2018-04-01   1063.05          1   531.525  0.300892       1025  3
74         2018-03-01      3533   2018-05-01   1114.87          2   557.435  0.315559       1025  3
75         2018-04-01      2276   2018-04-01  10600.69          0  5300.345  4.657597        986  2
76         2018-04-01      2276   2018-05-01   1209.92          1   604.960  0.531599        986  2
77         2018-05-01      2988   2018-05-01  13925.76          0  6962.880  4.660562       1054  2

78 rows × 11 columns
```

In [154…
```
output = report_.pivot_table(
    index='first_order_month', columns='age_month', values='roi', aggfunc='mean'
)
```

In [156…
```
output.cumsum(axis=1).round(2).fillna('')
```

Out[156]:

age_month	0	1	2	3	4	5	6	7	8	9	10	11
first_order_month												
2017-06-01	0.53	0.59	0.63	0.74	0.86	0.94	1.05	1.11	1.17	1.24	1.31	1.33
2017-07-01	0.63	0.67	0.73	0.77	0.79	0.81	0.82	0.84	0.85	0.87	0.88	
2017-08-01	0.49	0.53	0.57	0.61	0.66	0.68	0.7	0.74	0.77	0.78		
2017-09-01	0.60	0.72	0.77	1.19	1.23	1.3	1.38	1.4	1.42			
2017-10-01	0.60	0.66	0.68	0.7	0.72	0.74	0.75	0.76				
2017-11-01	0.55	0.6	0.62	0.65	0.67	0.68	0.69					
2017-12-01	0.54	0.57	0.68	0.8	0.84	0.87						
2018-01-01	0.42	0.45	0.48	0.49	0.5							
2018-02-01	0.46	0.49	0.5	0.51								
2018-03-01	0.56	0.6	0.63									
2018-04-01	0.48	0.53										
2018-05-01	0.63											

Kesimpulan

Dari pengolahan beberapa sumber data untuk optimasi anggaran biaya pemasaran adalah sebagai berikut:

- Tabel costs, orders, dan visit memiliki kesalahan di tipe data untuk waktu
- Rata-rata pengguna harian, mingguan, dan bulanan secara berturut-turut adalah 907, 5724, dan 23228 users
- Jumlah sesi dibandingkan dengan pengguna paling banyak ditemukan pada tanggal 24 November yaitu sebesar 1.217
- Rata-rata pengguna yang kembali setelah kunjungan pertama mereka 5.36%
- Paling banyak pengguna melakukan pembelian pertama mereka di hari ke-0 atau kurang dari 24 jam sejak mereka masuk ke dalam situs. Setelahnya diikuti oleh pelanggan yang melakukan pembelian pada hari pertama sejak mereka pertama kali mengunjungi situs.
- Rata-rata pembelian: 5
- Rata-rata LTV untuk bulan yang sama 0.26
- Jumlah uang yang dihabiskan paling banyak adalah pada source 3 sebanyak 141321.63 dan paling besar biaya dihabiskan di bulan Desember. Ini sejalan dengan jumlah transaksi yang terjadi di bulan Desember dimana menjadi bulan yang paling tinggi transaksinya.
- CAC berdasarkan sumber 2 memiliki nilai tertinggi yang berarti biaya untuk mendapatkan pelanggan baru terbilang lebih besar dari yang lainnya, dimana tidak sejalan dengan biaya yang dihabiskan per sumber. Jika melihat per sumber maka sumber 3 adalah sumber yang memakan biaya paling besar.