In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:
```
df1 = pd.read_csv('train_wn75k28.csv')
df1.head()
```

Out[2]:

	id	created_at	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_v
0	1	2021-01-01	1	2	2.0	2020-09-24	0	0	
1	2	2021-01-01	2	1	2.0	2020-09-19	1	0	
2	3	2021-01-01	9	3	3.0	2021-08-11	1	0	
3	4	2021-01-01	6	7	2.0	2017-10-04	0	0	
4	5	2021-01-01	4	6	NaN	2020-06-08	0	0	

In [3]:
```
df2 = pd.read_csv('test_Wf7sxXF.csv')
df2.head()
```

Out[3]:

	id	created_at	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activi
0	39162	2022-01-01	2	2	NaN	2021-08-17	1	1	
1	39163	2022-01-01	4	7	3.0	2020-05-21	1	0	
2	39164	2022-01-01	8	7	NaN	NaN	0	0	
3	39165	2022-01-01	9	8	2.0	2020-06-22	0	0	
4	39166	2022-01-01	4	5	2.0	2021-03-10	1	0	

In [4]:
```
df3 = pd.read_csv('sample_submission_2zvVjBu.csv')
```

In [5]:
```
df3.head()
```

Out[5]:

	id	buy
0	39162	1
1	39163	1
2	39164	1
3	39165	1
4	39166	1

In [6]:
```
df = pd.merge(df1,df2,how ='left')
```

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

Out[7]:

	id	created_at	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_v
0	1	2021-01-01	1	2	2.0	2020-09-24	0	0	
1	2	2021-01-01	2	1	2.0	2020-09-19	1	0	
2	3	2021-01-01	9	3	3.0	2021-08-11	1	0	
3	4	2021-01-01	6	7	2.0	2017-10-04	0	0	
4	5	2021-01-01	4	6	NaN	2020-06-08	0	0	

In [8]:
```
df.tail()
```

Out[8]:

	id	created_at	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_a
39156	39157	2021-12-31	11	11	2.0	2017-10-19	1	0	
39157	39158	2021-12-31	3	9	3.0	NaN	0	0	
39158	39159	2021-12-31	8	7	2.0	NaN	1	0	
39159	39160	2021-12-31	7	12	2.0	NaN	0	0	
39160	39161	2021-12-31	2	5	NaN	2019-08-11	1	0	

In [9]:
```
df=pd.merge(df,df3,how='left')
```

In [10]:
```
df.head()
```

Out[10]:

	id	created_at	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_v
0	1	2021-01-01	1	2	2.0	2020-09-24	0	0	
1	2	2021-01-01	2	1	2.0	2020-09-19	1	0	
2	3	2021-01-01	9	3	3.0	2021-08-11	1	0	
3	4	2021-01-01	6	7	2.0	2017-10-04	0	0	
4	5	2021-01-01	4	6	NaN	2020-06-08	0	0	

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

Out[11]:
```
(39161, 19)
```

In [12]:
```
df.columns
```

Out[12]:
```
Index(['id', 'created_at', 'campaign_var_1', 'campaign_var_2',
       'products_purchased', 'signup_date', 'user_activity_var_1',
       'user_activity_var_2', 'user_activity_var_3', 'user_activity_var_4',
       'user_activity_var_5', 'user_activity_var_6', 'user_activity_var_7',
       'user_activity_var_8', 'user_activity_var_9', 'user_activity_var_10',
       'user_activity_var_11', 'user_activity_var_12', 'buy'],
      dtype='object')
```

In [13]:
```
df.isnull().sum()
```

Out[13]:
```
id                         0
created_at                 0
campaign_var_1             0
campaign_var_2             0
products_purchased     20911
signup_date            15113
user_activity_var_1        0
user_activity_var_2        0
user_activity_var_3        0
user_activity_var_4        0
user_activity_var_5        0
user_activity_var_6        0
user_activity_var_7        0
user_activity_var_8        0
user_activity_var_9        0
user_activity_var_10       0
user_activity_var_11       0
user_activity_var_12       0
buy                        0
dtype: int64
```

In [14]:
```
df=df.dropna()
```

In [15]:
```
df.isnull().sum()
```

Out[15]:
```
id                      0
created_at              0
campaign_var_1          0
campaign_var_2          0
products_purchased      0
signup_date             0
user_activity_var_1     0
user_activity_var_2     0
user_activity_var_3     0
user_activity_var_4     0
user_activity_var_5     0
user_activity_var_6     0
user_activity_var_7     0
user_activity_var_8     0
user_activity_var_9     0
user_activity_var_10    0
user_activity_var_11    0
user_activity_var_12    0
buy                     0
dtype: int64
```

In [16]:
```
df.head()
```

Out[16]:

	id	created_at	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_v
0	1	2021-01-01	1	2	2.0	2020-09-24	0	0	
1	2	2021-01-01	2	1	2.0	2020-09-19	1	0	
2	3	2021-01-01	9	3	3.0	2021-08-11	1	0	
3	4	2021-01-01	6	7	2.0	2017-10-04	0	0	
5	6	2021-01-01	3	4	3.0	2019-07-02	0	0	

In [17]:
```
df.drop(['id'],axis=1,inplace =True)
```

In [18]:
```
df.drop(['created_at'],axis=1,inplace=True)
```

In [19]:
```
from sklearn.preprocessing import LabelEncoder
label_encoder=LabelEncoder()
```

In [20]:
```
cat_cols= df.select_dtypes(include=['object']).columns
```

In [21]:
```
df.head()
```

Out[21]:

	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_var_3	user_activ
0	1	2	2.0	2020-09-24	0	0	0	
1	2	1	2.0	2020-09-19	1	0	1	
2	9	3	3.0	2021-08-11	1	0	0	
3	6	7	2.0	2017-10-04	0	0	0	
5	3	4	3.0	2019-07-02	0	0	0	

In [22]:
```
cat_cols
```

Out[22]:
```
Index(['signup_date'], dtype='object')
```

In [23]:
```
en =LabelEncoder()
for i in cat_cols:
    df[i]=en.fit_transform(df[i])
```

In [24]:
```
df.head()
```

Out[24]:

	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_var_3	user_activ
0	1	2	2.0	1176	0	0	0	
1	2	1	2.0	1171	1	0	1	
2	9	3	3.0	1497	1	0	0	
3	6	7	2.0	161	0	0	0	
5	3	4	3.0	726	0	0	0	

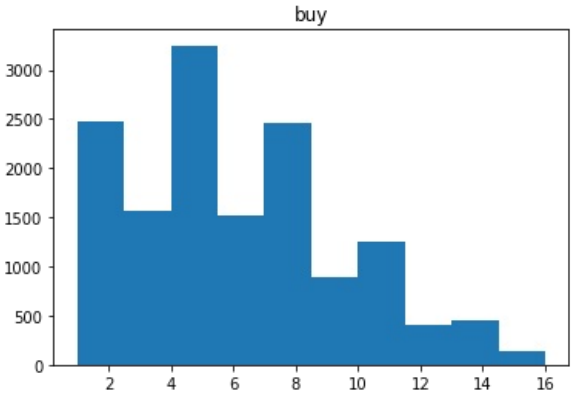
In [25]:
```
df['products_purchased'].value_counts()
```

Out[25]:
```
2.0    6971
3.0    3953
1.0    2902
4.0     572
Name: products_purchased, dtype: int64
```

In [26]:
```
df['campaign_var_1'].value_counts()
```

Out[26]:
```
2     1648
5     1626
4     1623
3     1564
6     1524
7     1305
8     1153
9      884
1      828
10     720
11     538
12     398
13     297
14     155
15      99
16      36
Name: campaign_var_1, dtype: int64
```

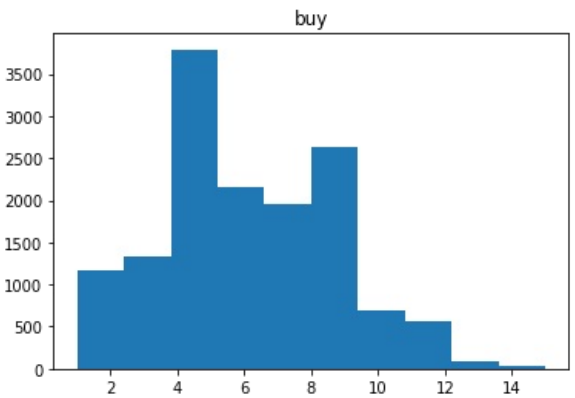
In [27]:
```
plt.hist(x='campaign_var_1',data=df)
plt.title("buy")
plt.show()
```



In [28]:
```
df['campaign_var_2'].value_counts()
```

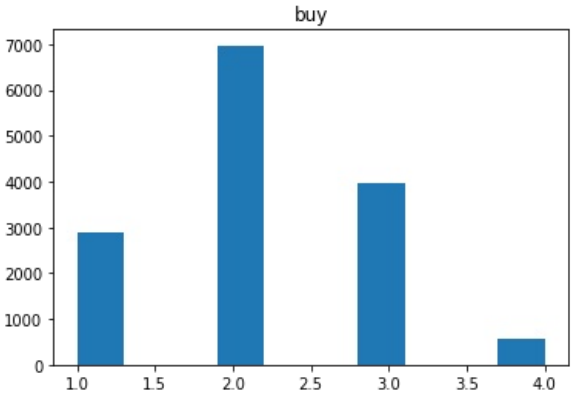
Out[28]:
```
6     2164
5     2092
7     1949
4     1699
8     1527
3     1338
9     1103
2      874
10     685
11     362
1      292
12     193
13      89
14      29
15       2
Name: campaign_var_2, dtype: int64
```

In [29]:
```
plt.hist(x = "campaign_var_2",data=df)
plt.title("buy")
plt.show()
```



In [30]:
```
plt.hist(x = "products_purchased",data=df)
```

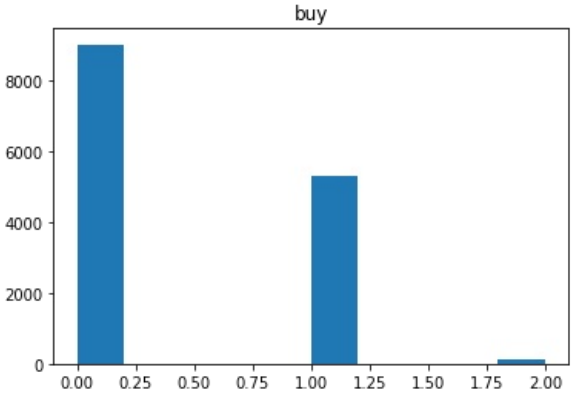
```
plt.title("buy")
plt.show()
```



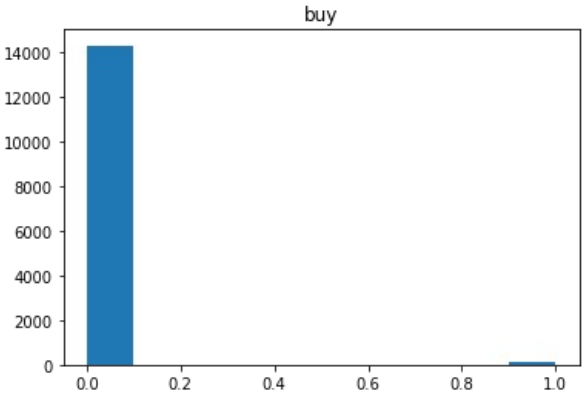
In [31]:
```
df['user_activity_var_1'].value_counts()
```

Out[31]:
```
0    8997
1    5282
2     119
Name: user_activity_var_1, dtype: int64
```

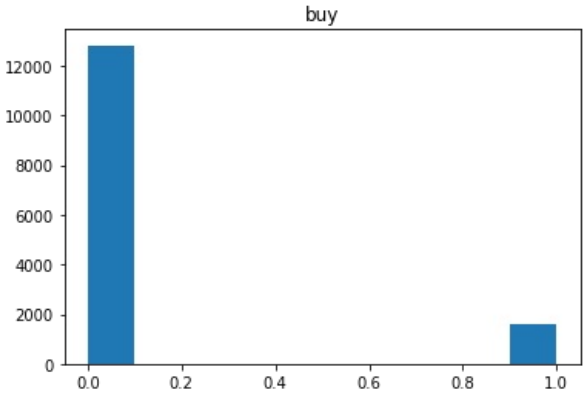
In [32]:
```
plt.hist(x = "user_activity_var_1",data=df)
plt.title("buy")
plt.show()
```



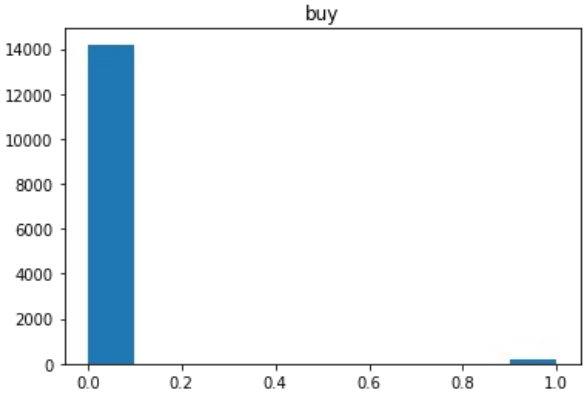
In [33]:
```
plt.hist(x = "user_activity_var_2",data=df)
plt.title("buy")
plt.show()
```



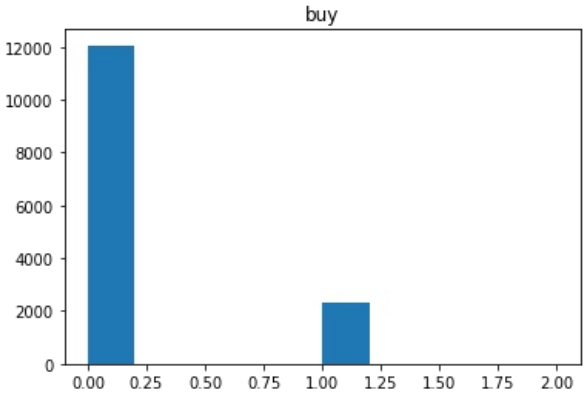
In [34]:
```
plt.hist(x = "user_activity_var_3",data=df)
plt.title("buy")
plt.show()
```



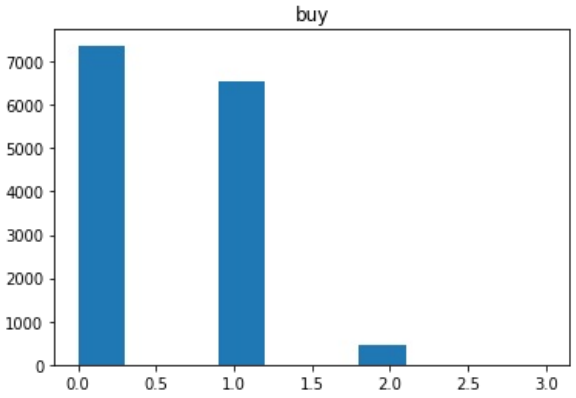
In [35]:
```
plt.hist(x = "user_activity_var_4",data=df)
plt.title("buy")
plt.show()
```



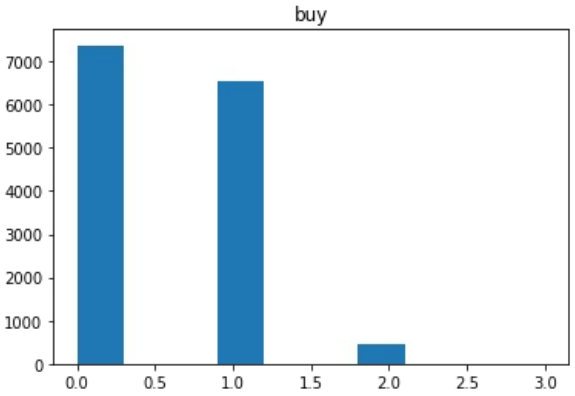
In [36]:
```
plt.hist(x = "user_activity_var_5",data=df)
plt.title("buy")
plt.show()
```



In [37]:
```
plt.hist(x = "user_activity_var_6",data=df)
plt.title("buy")
plt.show()
```



In [38]:
```
plt.hist(x = "user_activity_var_6",data=df)
plt.title("buy")
plt.show()
```

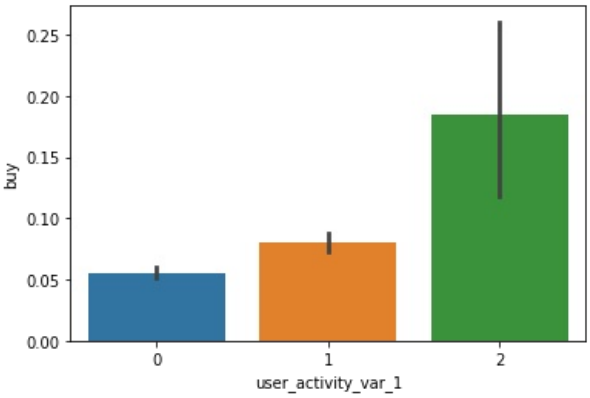


In [39]:
```
import seaborn as sns
```

In [40]:
```
sns.barplot(df['user_activity_var_1'],df['buy'])
```

```
C:\Users\sajid\.conda\envs\sajid\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following
variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and pass
ing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

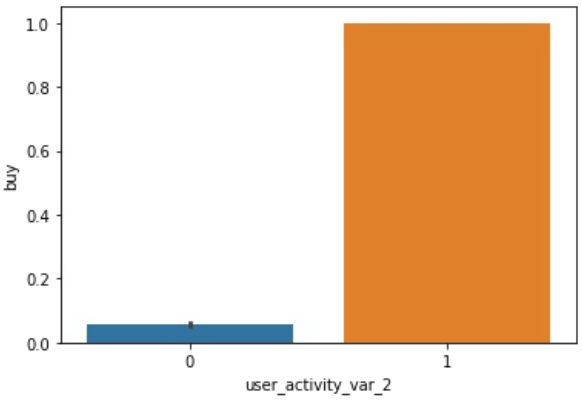
Out[40]:
```
<AxesSubplot:xlabel='user_activity_var_1', ylabel='buy'>
```



In [41]:
```
sns.barplot(df['user_activity_var_2'],df['buy'])
```

```
C:\Users\sajid\.conda\envs\sajid\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following
variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and pass
ing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

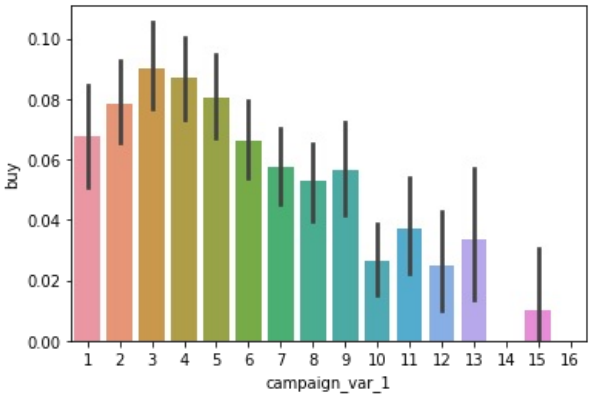
Out[41]:
```
<AxesSubplot:xlabel='user_activity_var_2', ylabel='buy'>
```



In [42]:
```
sns.barplot(df['campaign_var_1'],df['buy'])
```

```
C:\Users\sajid\.conda\envs\sajid\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following
variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and pass
ing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

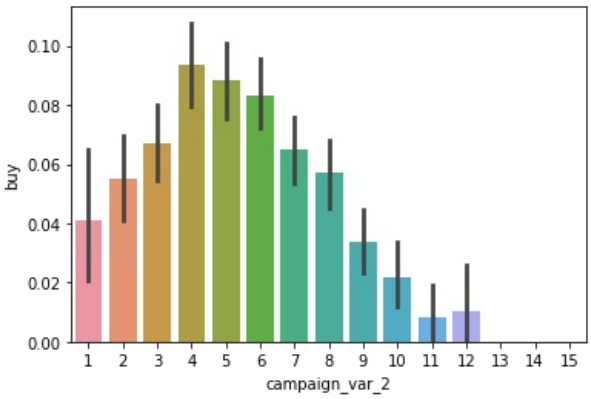
Out[42]:
```
<AxesSubplot:xlabel='campaign_var_1', ylabel='buy'>
```



In [43]:
```
sns.barplot(df['campaign_var_2'],df['buy'])
```

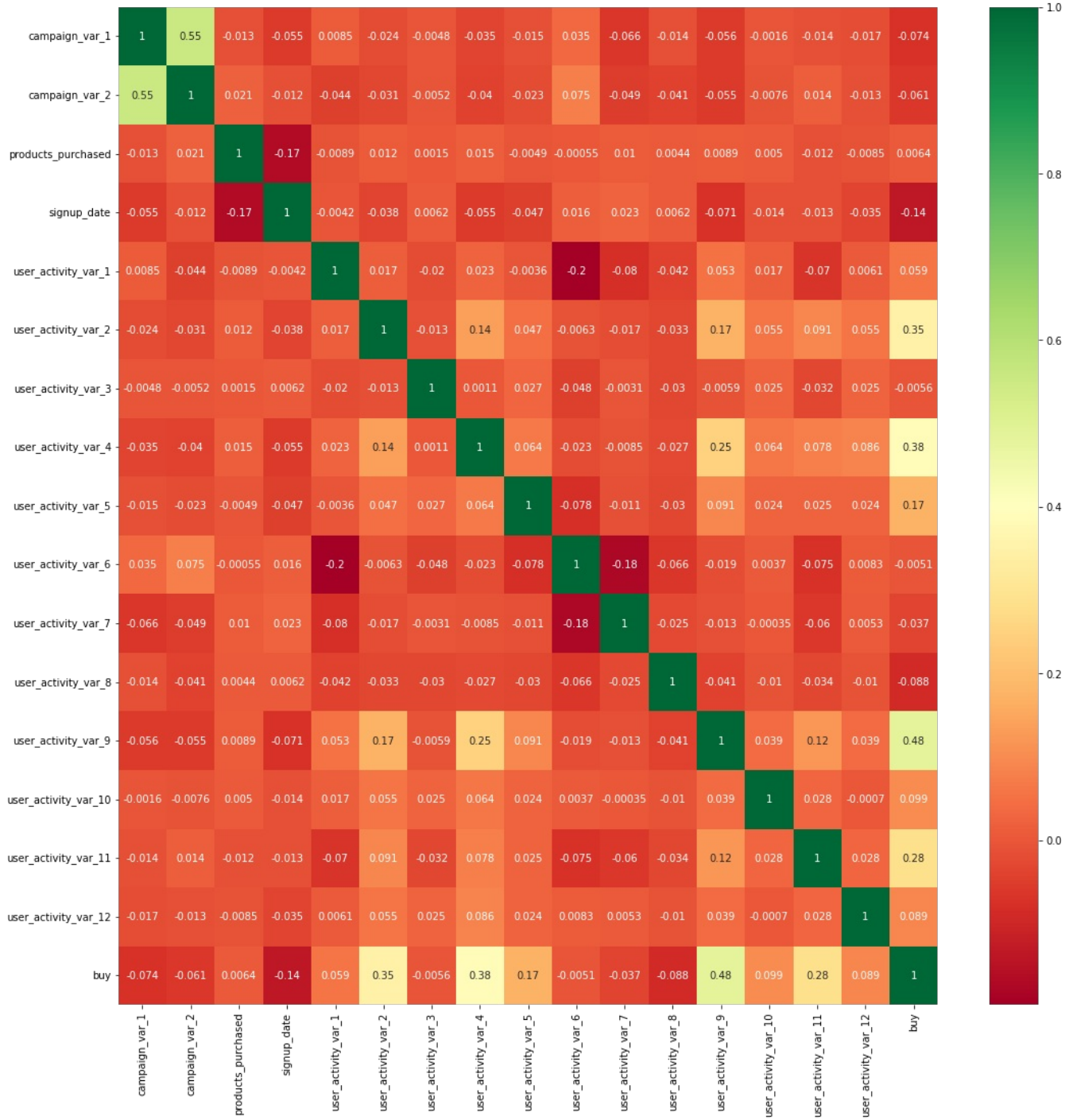
```
C:\Users\sajid\.conda\envs\sajid\lib\site-packages\seaborn\_decorators.py:36: FutureWarning: Pass the following
variables as keyword args: x, y. From version 0.12, the only valid positional argument will be `data`, and pass
ing other arguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

Out[43]:
```
<AxesSubplot:xlabel='campaign_var_2', ylabel='buy'>
```



In [44]:
```
plt.figure(figsize=(18,18))
sns.heatmap(df.corr(), annot = True, cmap = "RdYlGn")

plt.show()
```



In [45]:
```
X = df.drop('buy',axis=1)
y= df['buy']
```

In [46]:
```
X
```

Out[46]:

	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_var_3	user_
0	1	2	2.0	1176	0	0	0	
1	2	1	2.0	1171	1	0	1	
2	9	3	3.0	1497	1	0	0	
3	6	7	2.0	161	0	0	0	
5	3	4	3.0	726	0	0	0	
...	...	...	...	...	...	...	...	
39141	5	7	1.0	1014	0	0	0	
39145	14	10	3.0	706	0	0	0	
39149	1	5	3.0	1414	0	0	0	
39154	7	11	3.0	1216	0	0	0	
39156	11	11	2.0	171	1	0	0	

14398 rows × 16 columns

In [47]:
```
y
```

In [47]:
```
y
```

Out[47]:
```
0        0
1        0
2        0
3        0
5        0
        ..
39141    0
39145    0
39149    0
39154    0
39156    0
Name: buy, Length: 14398, dtype: int64
```

In [48]:
```
from sklearn.model_selection import train_test_split
```

In [49]:
```
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.20,random_state=42)
```

In [50]:
```
X_train
```

Out[50]:

	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_var_3	user_
33957	10	9	2.0	1532	1	0	0	
22073	5	7	3.0	602	1	0	0	
9811	4	2	3.0	1395	0	0	0	
32178	9	10	2.0	587	1	0	0	
36757	6	8	2.0	1613	1	0	0	
...	...	...	...	...	...	...	...	...
12264	3	2	2.0	1260	0	0	0	
36111	7	2	1.0	1521	1	0	0	
12763	8	9	1.0	1388	0	0	0	
1788	1	3	2.0	1137	0	0	0	
17683	7	6	3.0	1473	0	0	0	

11518 rows × 16 columns

In [51]:
```
X_train.shape
```

Out[51]:
```
(11518, 16)
```

In [52]:
```
y_train
```

Out[52]:
```
33957    0
22073    0
9811     0
32178    0
36757    0
        ..
12264    0
36111    0
12763    0
1788     0
17683    0
Name: buy, Length: 11518, dtype: int64
```

In [53]:
```
y_train.shape
```

Out[53]:
```
(11518,)
```

In [54]:
```
X_test
```

Out[54]:

	campaign_var_1	campaign_var_2	products_purchased	signup_date	user_activity_var_1	user_activity_var_2	user_activity_var_3	user_
6792	5	8	3.0	881	0	0	0	
17438	8	2	1.0	1429	0	0	1	
7967	9	8	2.0	865	0	0	0	
16116	2	4	1.0	545	0	0	0	
32696	10	8	3.0	573	1	0	0	
...	...	...	...	...	...	...	...	
19587	4	8	1.0	1303	0	0	0	
24516	1	1	1.0	309	1	1	0	
31446	2	3	3.0	1561	1	0	0	
27018	9	7	3.0	1305	0	0	0	
12756	2	8	2.0	1436	0	0	0	

2880 rows × 16 columns

In [55]:
```
y_test
```

Out[55]:
```
6792     0
17438    0
7967     1
16116    0
32696    0
        ..
19587    0
24516    1
31446    0
27018    0
12756    0
Name: buy, Length: 2880, dtype: int64
```

In [56]:
```
from sklearn.linear_model import LogisticRegression
```

In [57]:
```
model = LogisticRegression()
```

In [58]:
```
model.fit(X_train,y_train)
```

```
C:\Users\sajid\.conda\envs\sajid\lib\site-packages\sklearn\linear_model\_logistic.py:814: ConvergenceWarning: l
bfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
  n_iter_i = _check_optimize_result(
```

Out[58]:
```
LogisticRegression()
```

In [59]:
```
y_predict = model.predict(X_test)
y_predict
```

Out[59]:
```
array([0, 0, 0, ..., 0, 0, 0], dtype=int64)
```

In [60]:
```
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
```

In [61]:
```
accuracy_score(y_test,y_predict)
```

Out[61]:
```
0.9631944444444445
```

In [62]:
```
print(classification_report(y_test,y_predict))
```

```
              precision    recall  f1-score   support

           0       0.97      0.99      0.98      2710
           1       0.85      0.46      0.60       170

    accuracy                           0.96      2880
   macro avg       0.91      0.73      0.79      2880
weighted avg       0.96      0.96      0.96      2880
```

In [63]:
```
confusion_matrix(y_test,y_predict)
```

Out[63]:
```
array([[2696,   14],
       [  92,   78]], dtype=int64)
```

In [64]:
```
print("Training Accuracy:", model.score(X_train,y_train))
print('Testing Accuracy:',model.score(X_test,y_test))
```

```
Training Accuracy: 0.9583260982809515
Testing Accuracy: 0.9631944444444445
```

In [65]:
```
from sklearn.tree import DecisionTreeClassifier
```

In [66]:
```
model = DecisionTreeClassifier()
model.fit(X_train,y_train)
y_predict = model.predict(X_test)
accuracy_score(y_test,y_predict)
```

Out[66]:
```
0.9451388888888889
```

In [67]:
```
DecisionTreeClassifier()
```

Out[67]:
```
DecisionTreeClassifier()
```

In [68]:
```
y_predict = model.predict(X_test)
y_predict
```

Out[68]:
```
array([0, 0, 1, ..., 0, 0, 0], dtype=int64)
```

In [69]:
```
y_test
```

Out[69]:
```
6792     0
17438    0
7967     1
16116    0
32696    0
        ..
19587    0
24516    1
31446    0
27018    0
12756    0
Name: buy, Length: 2880, dtype: int64
```

In [70]:
```
accuracy_score(y_test,y_predict)
```

Out[70]:
```
0.9451388888888889
```

In [71]:
```
print(classification_report(y_test,y_predict))
```

```
              precision    recall  f1-score   support

           0       0.98      0.96      0.97      2710
           1       0.53      0.65      0.58       170

    accuracy                           0.95      2880
   macro avg       0.75      0.81      0.78      2880
weighted avg       0.95      0.95      0.95      2880
```

In [72]:
```
confusion_matrix(y_test,y_test)
```

Out[72]:
```
array([[2710,    0],
       [   0,  170]], dtype=int64)
```

In [73]:
```
print("Training Accuracy:", model.score(X_train,y_train))
print('Testing Accuracy:',model.score(X_test,y_test))
```

```
Training Accuracy: 1.0
Testing Accuracy: 0.9451388888888889
```

In [74]:
```
import matplotlib.pyplot as plt
```

In [75]:
```
from xgboost import XGBClassifier
```

In [76]:
```
model = XGBClassifier()
model.fit(X_train,y_train)
y_predict = model.predict(X_test)
accuracy_score(y_test,y_predict)
```

Out[76]:
```
0.9739583333333334
```

In [77]:
```
XGBClassifier()
```

Out[77]:
```
XGBClassifier(base_score=None, booster=None, callbacks=None,
              colsample_bylevel=None, colsample_bynode=None,
              colsample_bytree=None, early_stopping_rounds=None,
              enable_categorical=False, eval_metric=None, gamma=None,
              gpu_id=None, grow_policy=None, importance_type=None,
              interaction_constraints=None, learning_rate=None, max_bin=None,
              max_cat_to_onehot=None, max_delta_step=None, max_depth=None,
              max_leaves=None, min_child_weight=None, missing=nan,
              monotone_constraints=None, n_estimators=100, n_jobs=None,
              num_parallel_tree=None, predictor=None, random_state=None,
              reg_alpha=None, reg_lambda=None, ...)
```

In [78]:
```
y_predict = model.predict(X_test)
y_predict
```

Out[78]:
```
array([0, 0, 1, ..., 0, 0, 0])
```

In [79]:
```
accuracy_score(y_test,y_predict)
```

Out[79]:
```
0.9739583333333334
```

In [80]:
```
print(classification_report(y_test,y_predict))
```

```
              precision    recall  f1-score   support

           0       0.98      1.00      0.99      2710
           1       0.89      0.64      0.74       170

    accuracy                           0.97      2880
   macro avg       0.94      0.82      0.86      2880
weighted avg       0.97      0.97      0.97      2880
```

In [81]:
```
confusion_matrix(y_test,y_test)
```

Out[81]:
```
array([[2710,    0],
       [   0,  170]], dtype=int64)
```

In [82]:
```
print("Training Accuracy:", model.score(X_train,y_train))
print('Testing Accuracy:',model.score(X_test,y_test))
```

```
Training Accuracy: 0.9781212015974996
Testing Accuracy: 0.9739583333333334
```

In [83]:
```
from sklearn.ensemble import RandomForestClassifier
```

In [84]:
```
model = RandomForestClassifier()
model.fit(X_train,y_train)
y_predict = model.predict(X_test)
accuracy_score(y_test,y_predict)
```

Out[84]:
```
0.9725694444444445
```

In [85]:
```
model=RandomForestClassifier(n_estimators=80,max_depth=5,criterion='gini')
model.fit(X_train,y_train)
y_predict = model.predict(X_test)
accuracy_score(y_test,y_predict)
```

Out[85]:
```
0.9736111111111111
```

In [86]:
```
print(classification_report(y_test,y_predict))
```

```
              precision    recall  f1-score   support

           0       0.97      1.00      0.99      2710
           1       0.94      0.59      0.72       170

    accuracy                           0.97      2880
   macro avg       0.96      0.79      0.86      2880
weighted avg       0.97      0.97      0.97      2880
```

In [87]:
```
confusion_matrix(y_test,y_test)
```

Out[87]:
```
array([[2710,    0],
       [   0,  170]], dtype=int64)
```

In [88]:
```
print("Training Accuracy:", model.score(X_train,y_train))
print('Testing Accuracy:',model.score(X_test,y_test))
```

```
Training Accuracy: 0.9668345198819239
Testing Accuracy: 0.9736111111111111
```

In [91]:
```
input_data = (1,2,2.0,1176,0,0,0,0,0,0,1,1,0,0,0,0)

input_data_as_numpy_array = np.asarray(input_data)

input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)
```

```
prediction = model.predict(input_data_reshaped)
print(prediction)
```

```
[0]
C:\Users\sajid\.conda\envs\sajid\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feat
ure names, but RandomForestClassifier was fitted with feature names
  warnings.warn(
```

In [92]:
```
if (prediction[0])==0:
    print('buy')
else:
    print('not buy')
```

```
buy
```

In [93]:
```
import pickle
```

In [94]:
```
filename = 'trained_model.sav'
pickle.dump(model,open(filename,'wb'))
```

In [95]:
```
loaded_model = pickle.load(open('trained_model.sav','rb'))
```

In [98]:
```
input_data = (1,2,2.0,1176,0,0,0,0,0,0,1,1,0,0,0,0)

input_data_as_numpy_array = np.asarray(input_data)

input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)

prediction = model.predict(input_data_reshaped)
print(prediction)

if (prediction[0])==0:
    print('buy')
else:
    print('not buy')
```

```
[0]
buy
C:\Users\sajid\.conda\envs\sajid\lib\site-packages\sklearn\base.py:450: UserWarning: X does not have valid feat
ure names, but RandomForestClassifier was fitted with feature names
  warnings.warn(
```

In [ ]:
```

```