Food Demand Forecasting for Food Delivery Company using IBM Cloud

WHAT IS A MACHINE LEARNING MODEL:

A machine learning model is a file that is trained to read a specific dataset and recognize patterns within it. We provide it with an algorithm that it can use predict future outcomes of the dataset from the patterns it has learned to recognize.

APPLICATIONS OF MACHINE LEARNING MODEL:

Machine learning models can be created to make predictions about data in various fields. A few of its applications include traffic prediction in Google Maps, product recommendation in websites like Amazon, filtering spam email, virtual personal assisstant and much more.

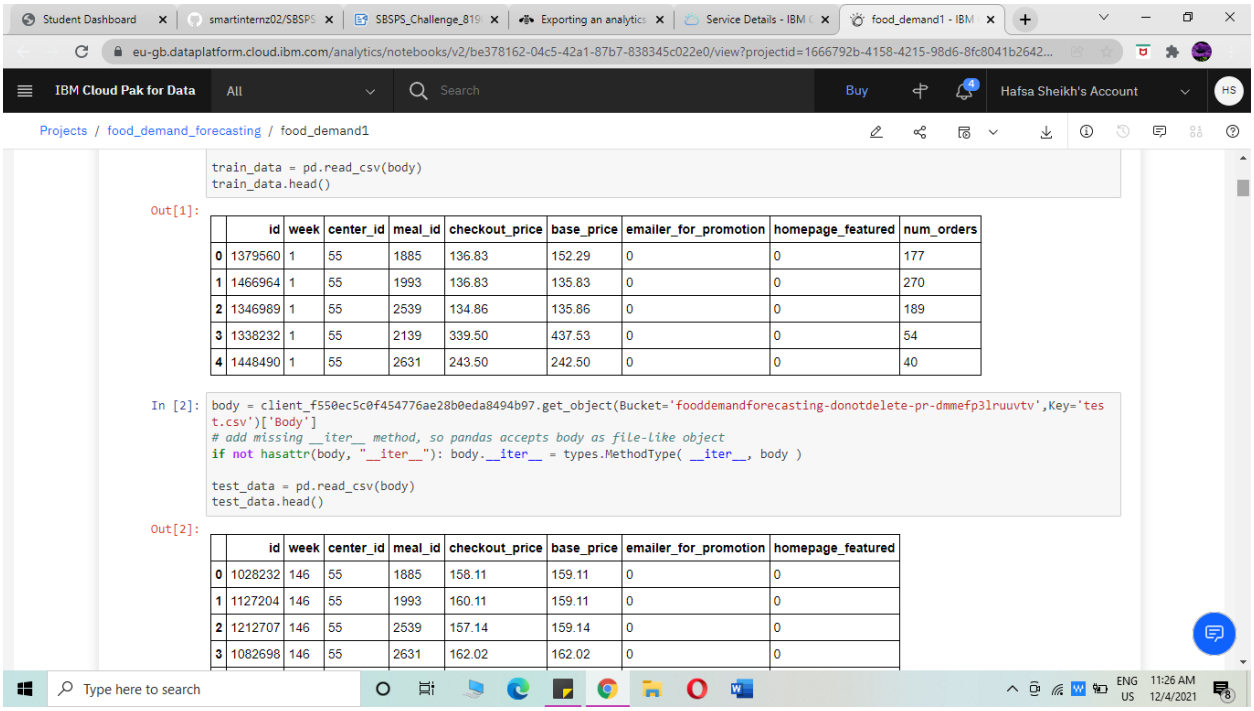
PROJECT DESCRIPTION:

This project was developed as part of the Smart Internz Challenge, named as 'Project Build-a-thon'.

The project is aimed at resolving the issues of a food delivery service on minimizing food wastage. Food items are perishable and become unfit for consumption and delivery within a short time . This will cause food wastage and thus the company carrying out the food delivery service will incur losses. Thus, it is crucial to forecast the number of orders of each meal that the company will receive from its customers in the upcoming weeks. By doing so, the food delivery service will be able to procure only the required number of meals, thus minimizing food wastage and avoiding losses. In order to achieve this, a machine learning model was developed using the IBM Watson machine learning service and AutoAI service. The model was trained and then deployed in the deployment space named as 'food_demand_deploy'. Simultaneously, an HTML front end was created which would accept various inputs such as the cuisine, the category of food, the city code, the region code, the area of operation of the delivery service, and these inputs are sent to the machine learning model. The machine learning model will predict the number of orders and display it on the front end webpage.

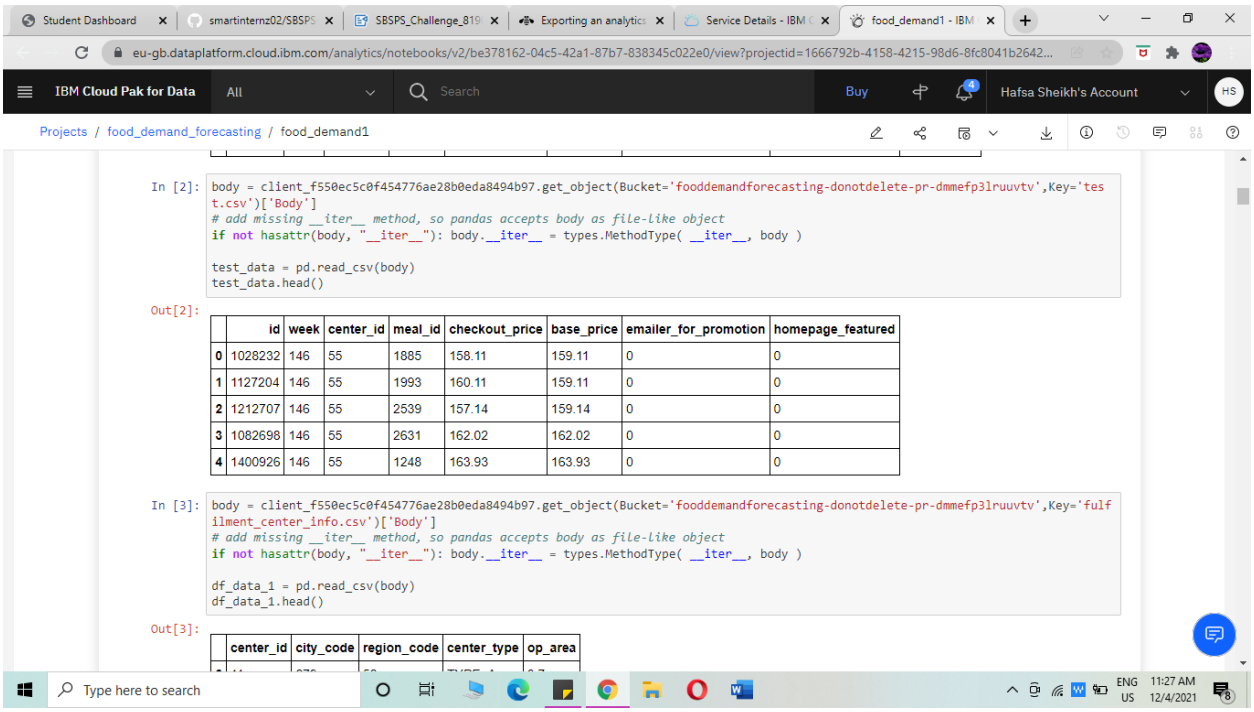
WORK FLOW:

- **Viewing the first five rows of out datasets**



	id	week	center_id	meal_id	checkout_price	base_price	emailer_for_promotion	homepage_featured	num_orders
0	1379560	1	55	1885	136.83	152.29	0	0	177
1	1466964	1	55	1993	136.83	135.83	0	0	270
2	1346989	1	55	2539	134.86	135.86	0	0	189
3	1338232	1	55	2139	339.50	437.53	0	0	54
4	1448490	1	55	2631	243.50	242.50	0	0	40

	id	week	center_id	meal_id	checkout_price	base_price	emailer_for_promotion	homepage_featured
0	1028232	146	55	1885	158.11	159.11	0	0
1	1127204	146	55	1993	160.11	159.11	0	0
2	1212707	146	55	2539	157.14	159.14	0	0
3	1082698	146	55	2631	162.02	162.02	0	0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In [2]:
body = client_f550ec5c0f454776ae28b0eda8494b97.get_object(Bucket='fooddemandforecasting-donotdelete-pr-dmmefp3lruuvtv',Key='test.csv')['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType(__iter__, body)
test_data = pd.read_csv(body)
test_data.head()
Out[2]:
id week center_id meal_id checkout_price base_price emailer_for_promotion homepage_featured
0 1028232 146 55 1885 158.11 159.11 0 0
1 1127204 146 55 1993 160.11 159.11 0 0
2 1212707 146 55 2539 157.14 159.14 0 0
3 1082698 146 55 2631 162.02 162.02 0 0
4 1400926 146 55 1248 163.93 163.93 0 0
In [3]:
body = client_f550ec5c0f454776ae28b0eda8494b97.get_object(Bucket='fooddemandforecasting-donotdelete-pr-dmmefp3lruuvtv',Key='fulfilment_center_info.csv')['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType(__iter__, body)
df_data_1 = pd.read_csv(body)
df_data_1.head()
Out[3]:
center_id city_code region_code center_type op_area
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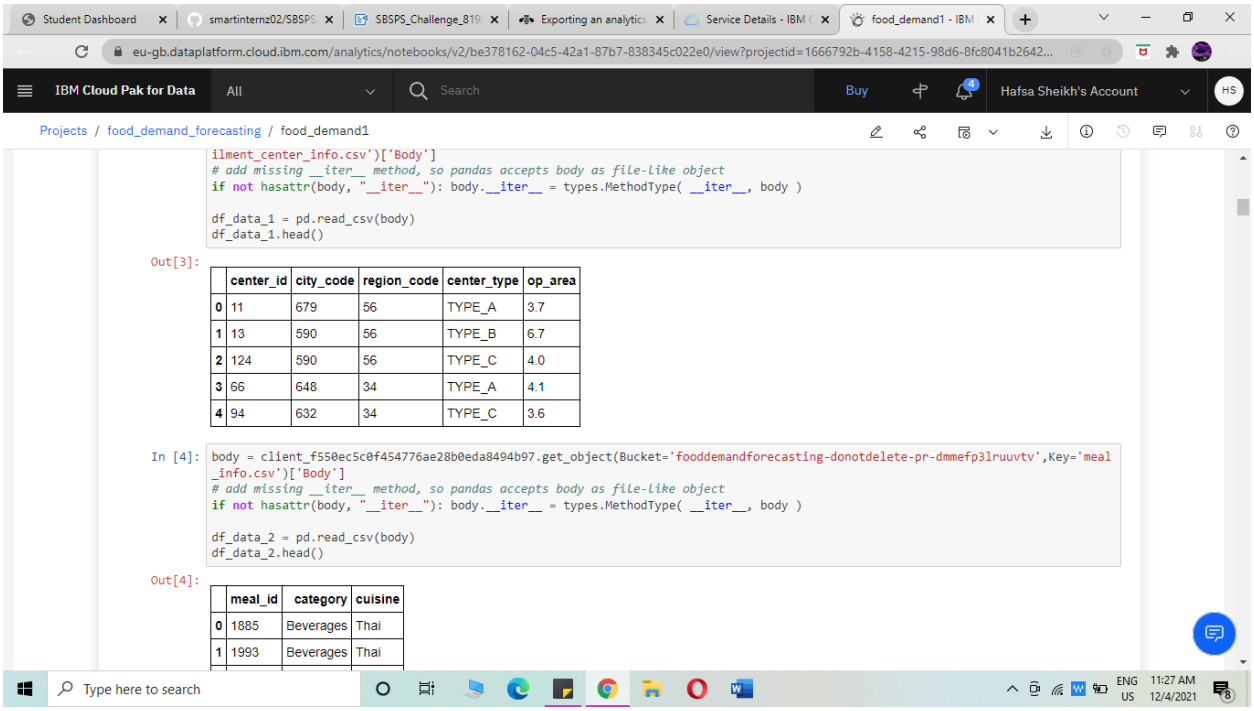
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add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType(__iter__, body)
df_data_1 = pd.read_csv(body)
df_data_1.head()
Out[3]:
center_id city_code region_code center_type op_area
0 11 679 56 TYPE_A 3.7
1 13 590 56 TYPE_B 6.7
2 124 590 56 TYPE_C 4.0
3 66 648 34 TYPE_A 4.1
4 94 632 34 TYPE_C 3.6
In [4]:
body = client_f550ec5c0f454776ae28b0eda8494b97.get_object(Bucket='fooddemandforecasting-donotdelete-pr-dmmefp3lruuvtv',Key='meal_info.csv')['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType(__iter__, body)
df_data_2 = pd.read_csv(body)
df_data_2.head()
Out[4]:
meal_id category cuisine
0 1885 Beverages Thai
1 1993 Beverages Thai
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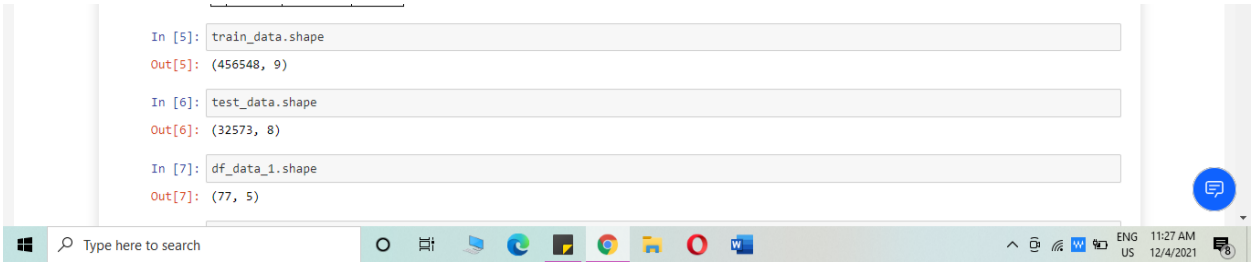
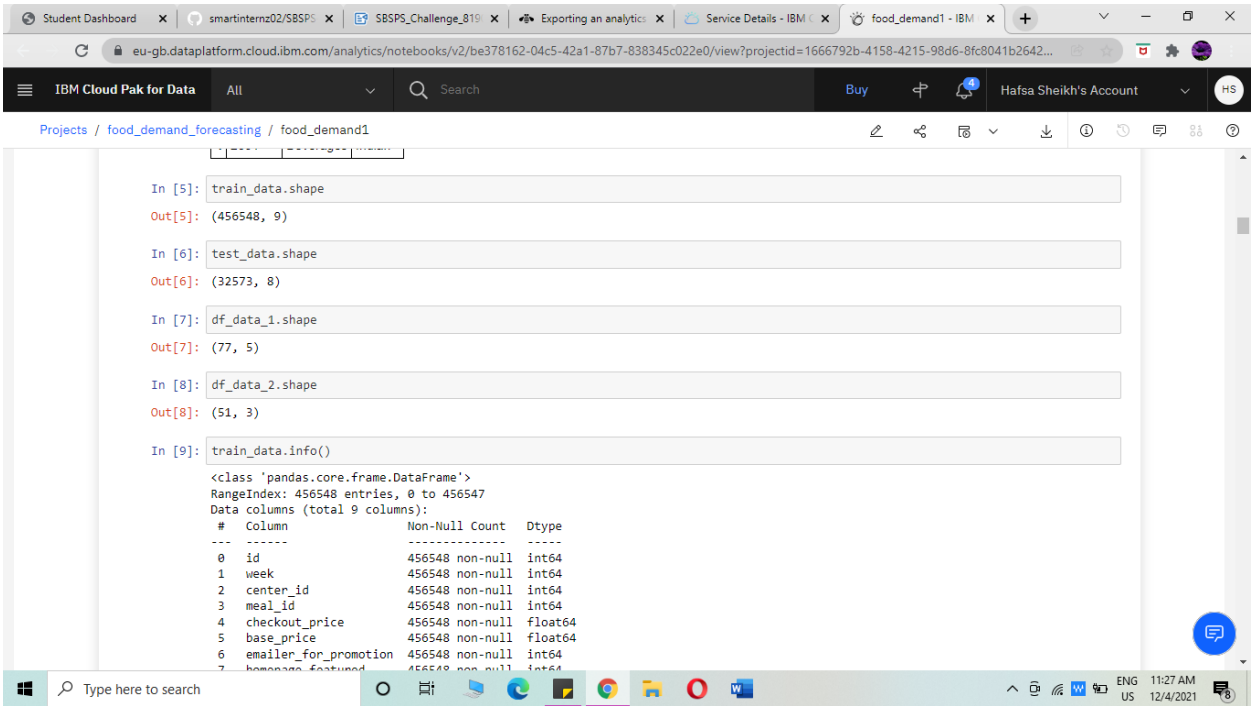
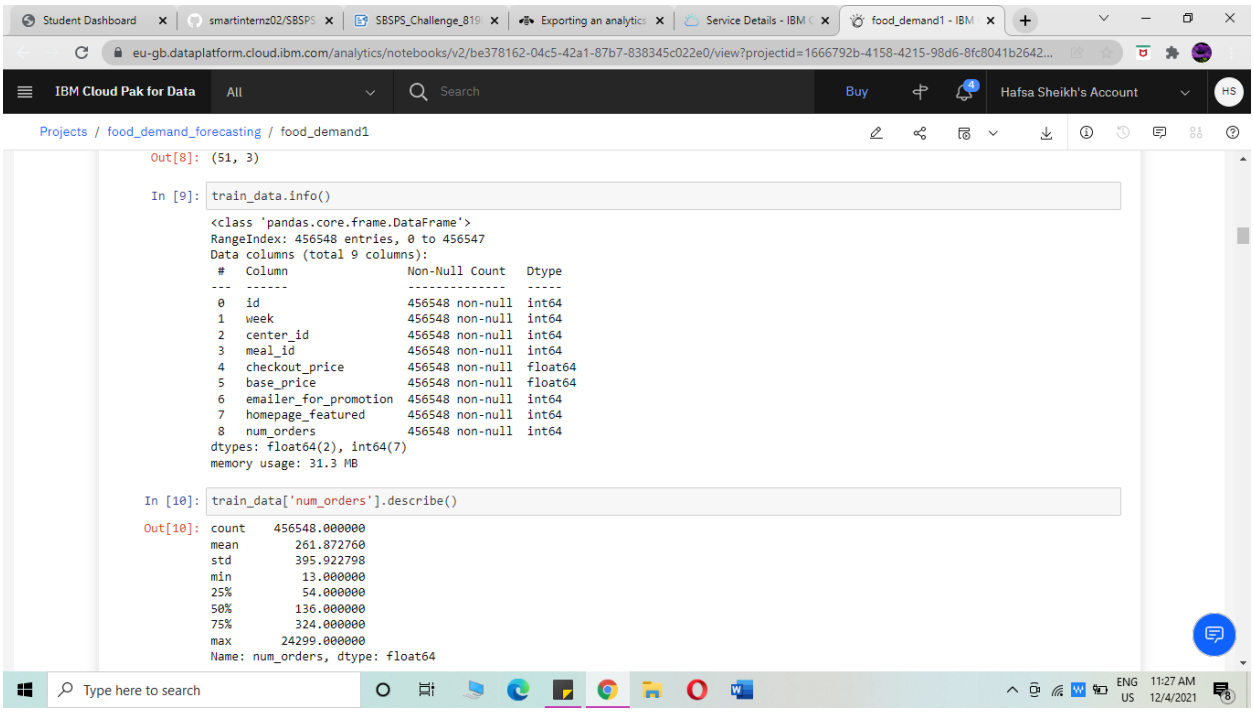
- **displaying number of columns and rows in the datasets and looking for null values**



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Out[8]: (51, 3)
In [9]: train_data.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 456548 entries, 0 to 456547
Data columns (total 9 columns):
Column Non-Null Count Dtype
0 id 456548 non-null int64
1 week 456548 non-null int64
2 center_id 456548 non-null int64
3 meal_id 456548 non-null int64
4 checkout_price 456548 non-null float64
5 base_price 456548 non-null float64
6 emailer_for_promotion 456548 non-null int64
7 homepage_featured 456548 non-null int64
8 num_orders 456548 non-null int64
dtypes: float64(2), int64(7)
memory usage: 31.3 MB
In [10]: train_data['num_orders'].describe()
Out[10]: count 456548.000000
mean 261.872760
std 395.922798
min 13.000000
25% 54.000000
50% 136.000000
75% 324.000000
max 24299.000000
Name: num_orders, dtype: float64
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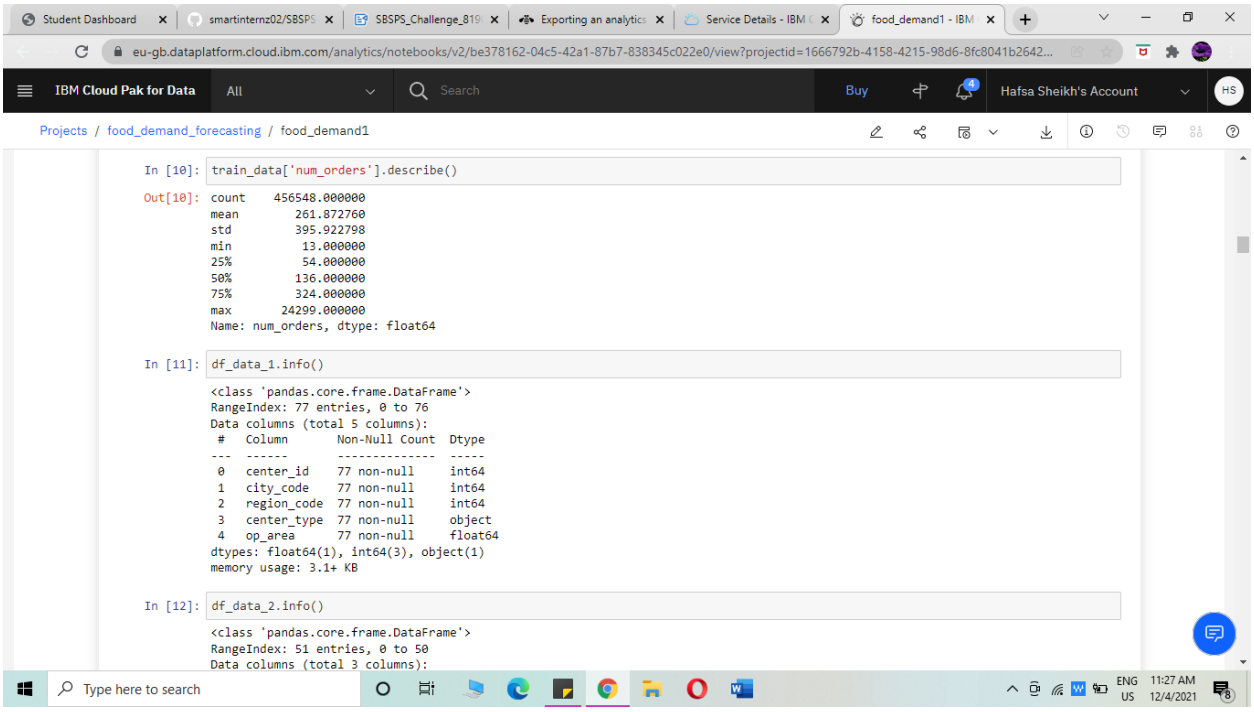
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In [10]: train_data['num_orders'].describe()
Out[10]: count 456548.000000
mean 261.872760
std 395.922798
min 13.000000
25% 54.000000
50% 136.000000
75% 324.000000
max 24299.000000
Name: num_orders, dtype: float64
In [11]: df_data_1.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 77 entries, 0 to 76
Data columns (total 5 columns):
Column Non-Null Count Dtype
0 center_id 77 non-null int64
1 city_code 77 non-null int64
2 region_code 77 non-null int64
3 center_type 77 non-null object
4 op_area 77 non-null float64
dtypes: float64(1), int64(3), object(1)
memory usage: 3.1+ KB
In [12]: df_data_2.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 51 entries, 0 to 50
Data columns (total 3 columns):
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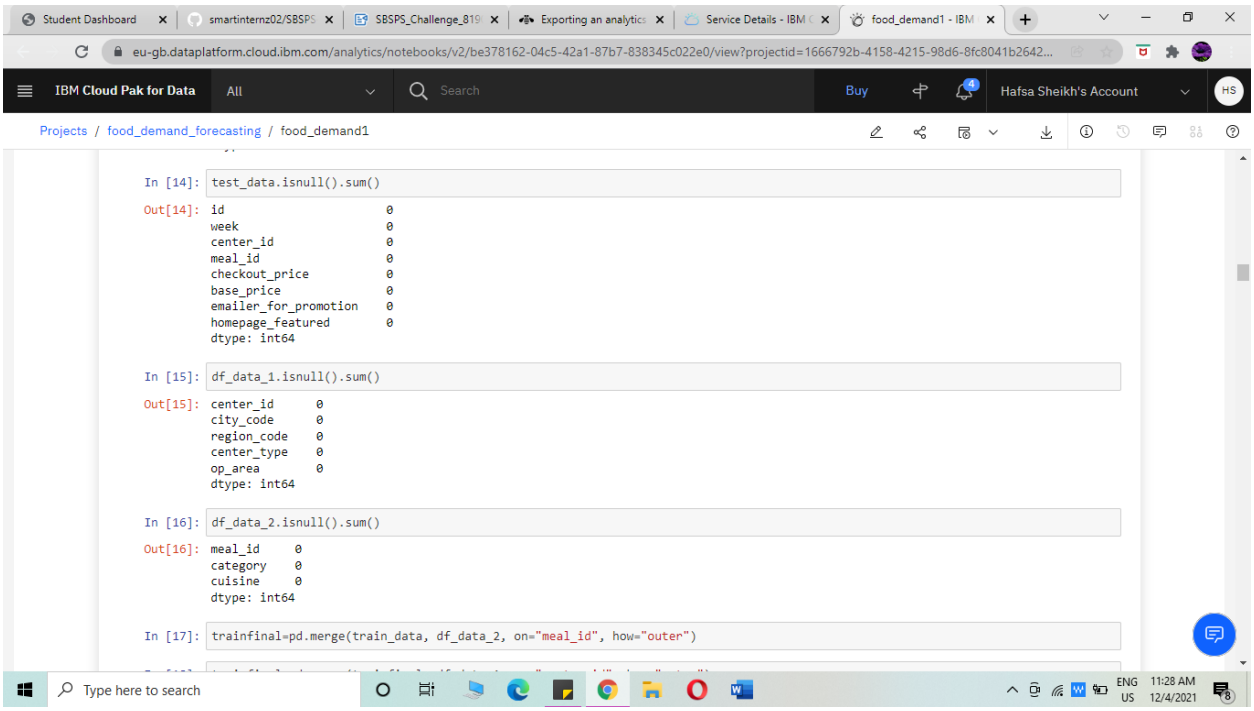
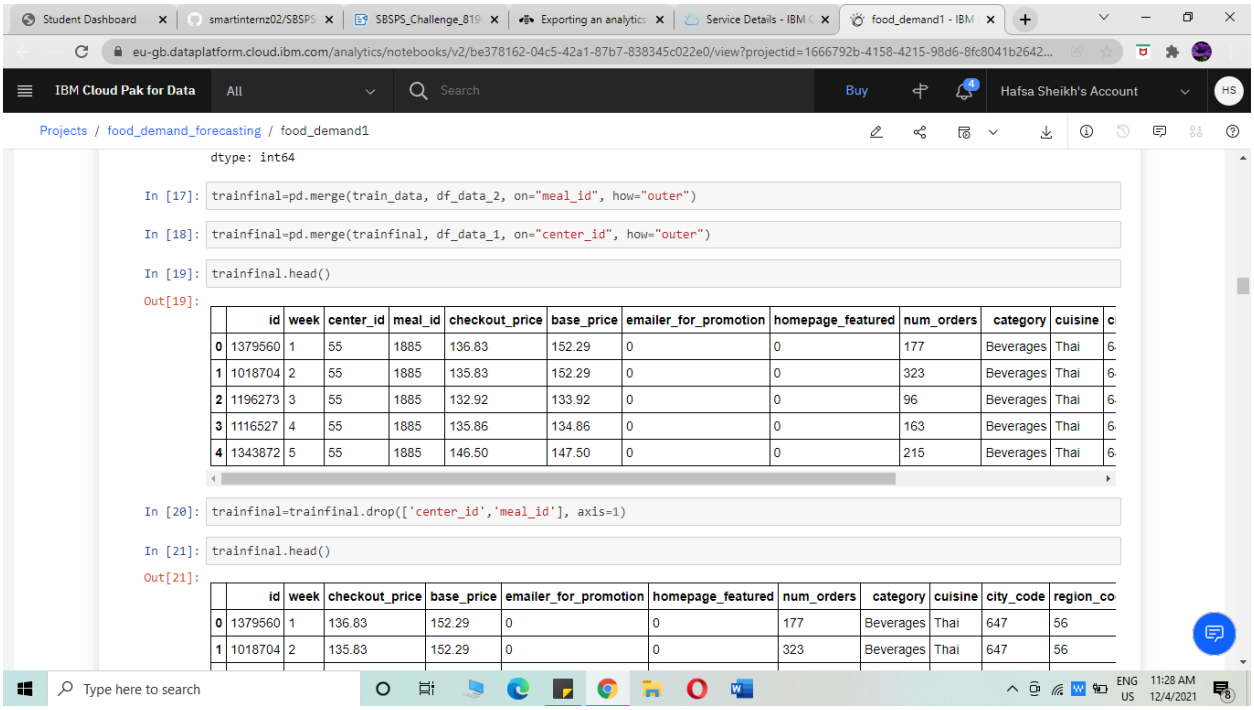
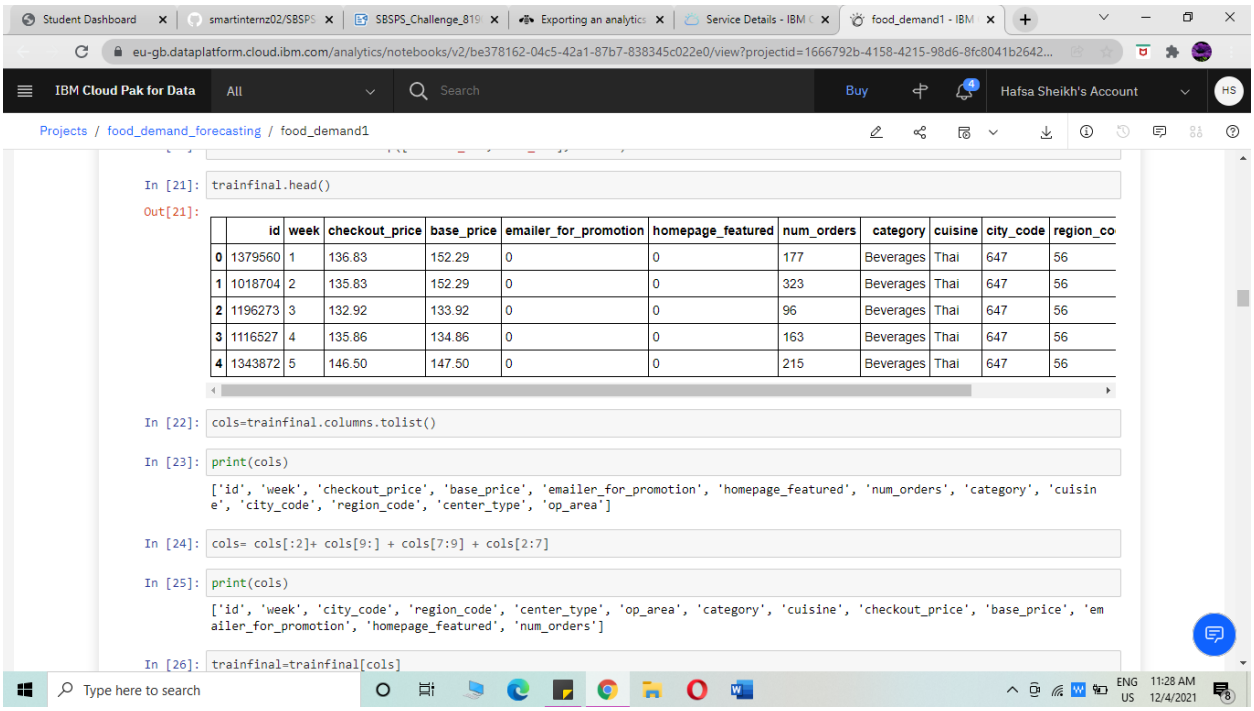


- **merging the columns of fulfilment_center.info.csv and meal_info.scv**





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

Out[21]:

	id	week	checkout_price	base_price	emailer_for_promotion	homepage_featured	num_orders	category	cuisine	city_code	region_co
0	1379560	1	136.83	152.29	0	0	177	Beverages	Thai	647	56
1	1018704	2	135.83	152.29	0	0	323	Beverages	Thai	647	56
2	1196273	3	132.92	133.92	0	0	96	Beverages	Thai	647	56
3	1116527	4	135.86	134.86	0	0	163	Beverages	Thai	647	56
4	1343872	5	146.50	147.50	0	0	215	Beverages	Thai	647	56

In [22]:
```
cols=trainfinal.columns.tolist()
```

In [23]:
```
print(cols)
```

```
['id', 'week', 'checkout_price', 'base_price', 'emailer_for_promotion', 'homepage_featured', 'num_orders', 'category', 'cuisin
e', 'city_code', 'region_code', 'center_type', 'op_area']
```

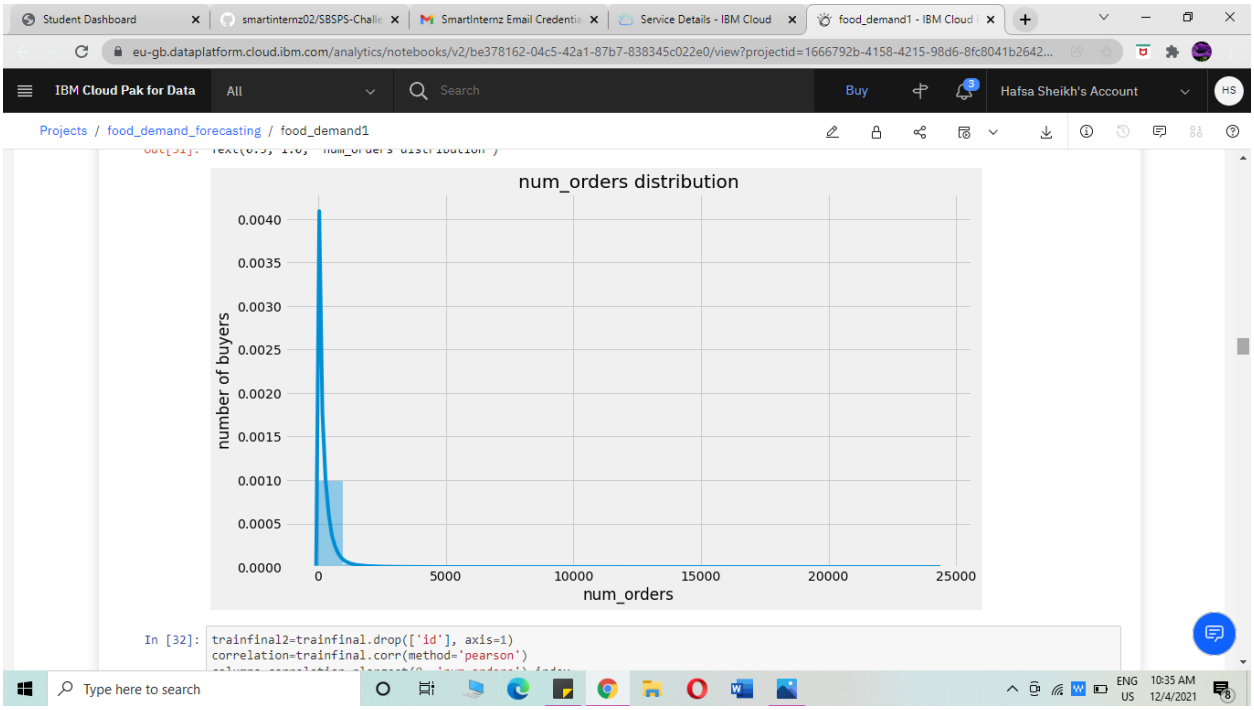
In [24]:
```
cols= cols[:2]+ cols[9:] + cols[7:9] + cols[2:7]
```

In [25]:
```
print(cols)
```

```
['id', 'week', 'city_code', 'region_code', 'center_type', 'op_area', 'category', 'cuisine', 'checkout_price', 'base_price', 'em
ailer_for_promotion', 'homepage_featured', 'num_orders']
```

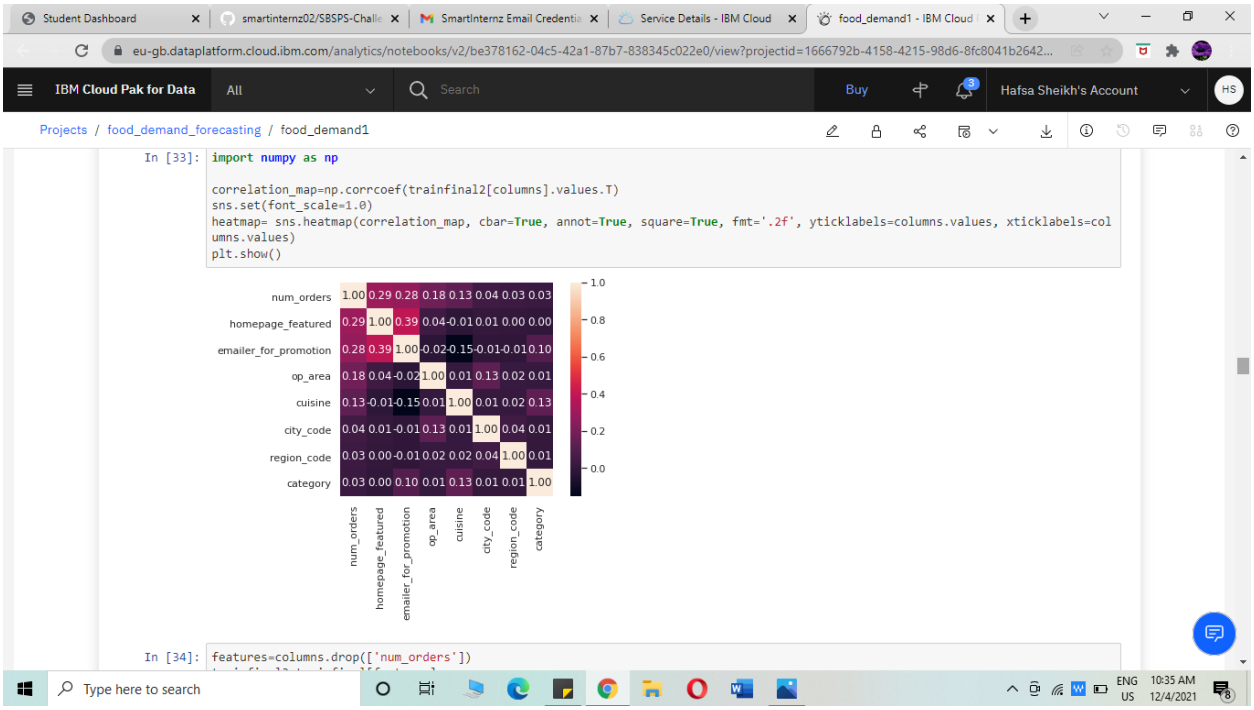
In [26]:
```
trainfinal=trainfinal[cols]
```

VISUALISING THE DATA

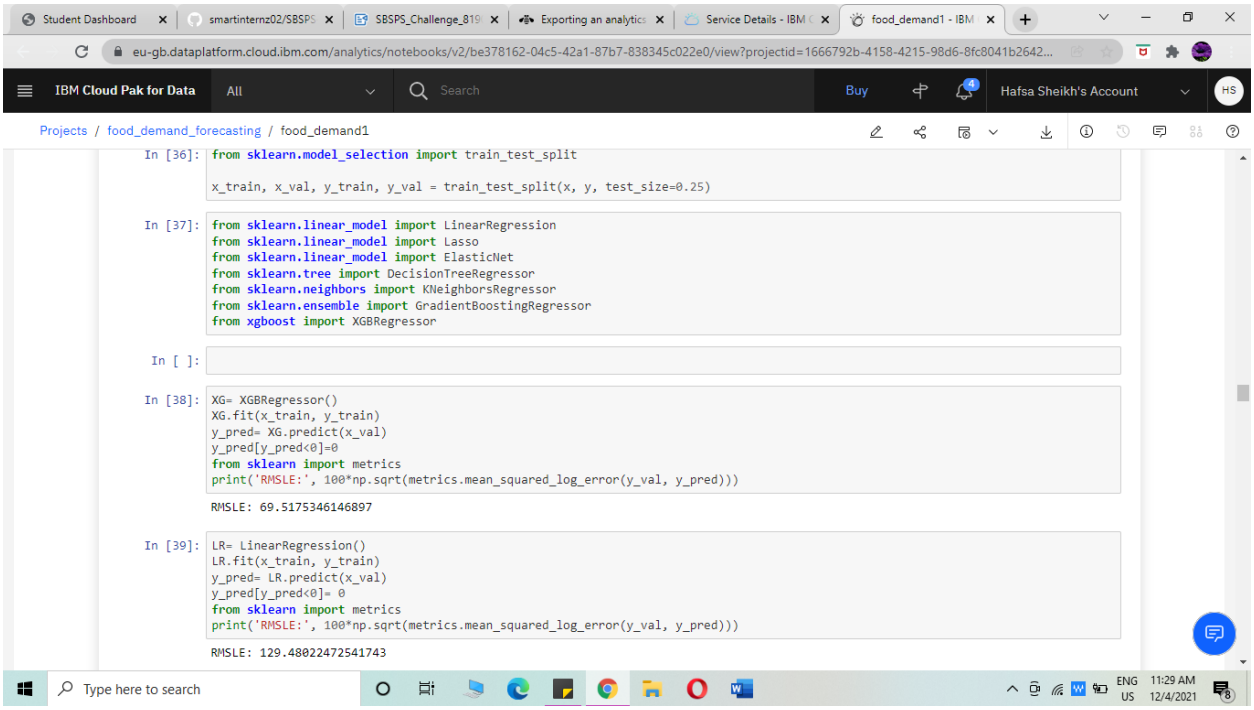


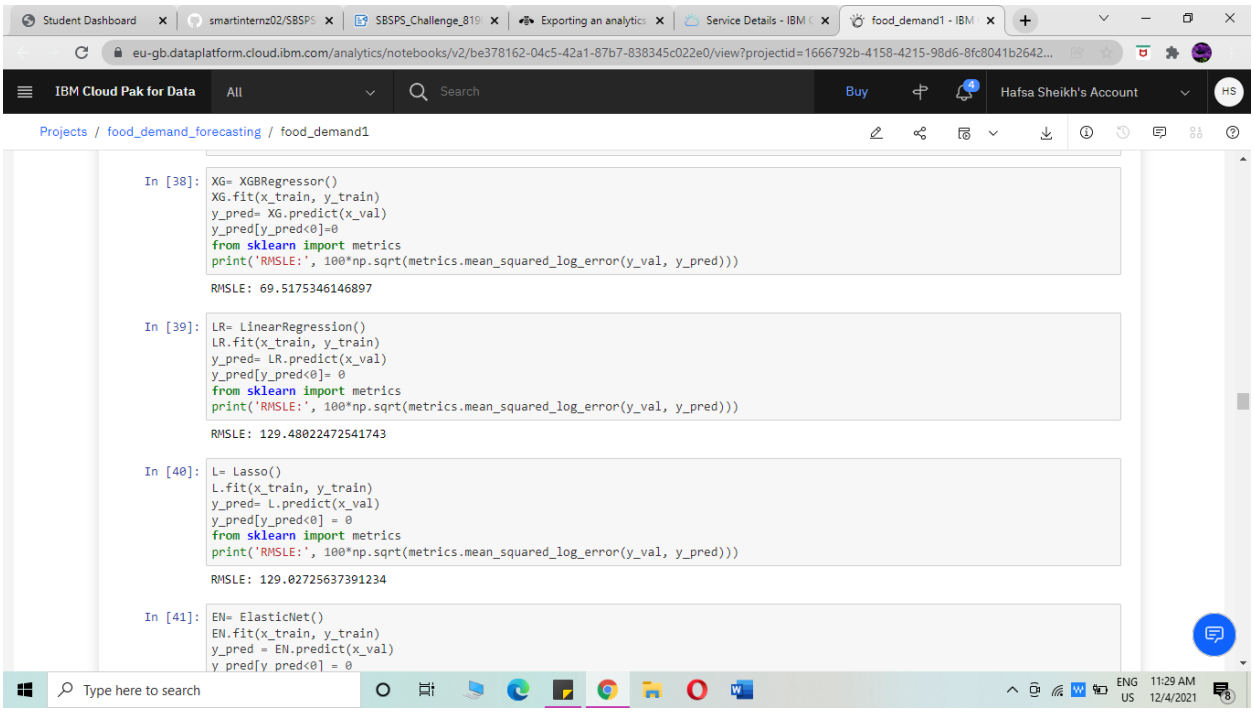
In [32]:
```
trainfinal2=trainfinal.drop(['id'], axis=1)
correlation=trainfinal.corr(method='pearson')
```

USING A HEATMAP TO VISUALIZE THE DATA



EVALUATING DATA MODELS TO FIND THE ONE WITH LEAST RMSLE VALUE:

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In [38]:
XG= XGBRegressor()
XG.fit(x_train, y_train)
y_pred= XG.predict(x_val)
y_pred[y_pred<0]=0
from sklearn import metrics
print('RMSLE:', 100*np.sqrt(metrics.mean_squared_log_error(y_val, y_pred)))
RMSLE: 69.5175346146897
In [39]:
LR= LinearRegression()
LR.fit(x_train, y_train)
y_pred= LR.predict(x_val)
y_pred[y_pred<0]= 0
from sklearn import metrics
print('RMSLE:', 100*np.sqrt(metrics.mean_squared_log_error(y_val, y_pred)))
RMSLE: 129.48022472541743
In [40]:
L= Lasso()
L.fit(x_train, y_train)
y_pred= L.predict(x_val)
y_pred[y_pred<0] = 0
from sklearn import metrics
print('RMSLE:', 100*np.sqrt(metrics.mean_squared_log_error(y_val, y_pred)))
RMSLE: 129.02725637391234
In [41]:
EN= ElasticNet()
EN.fit(x_train, y_train)
y_pred = EN.predict(x_val)
y_pred[y_pred<0] = 0
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ENG US
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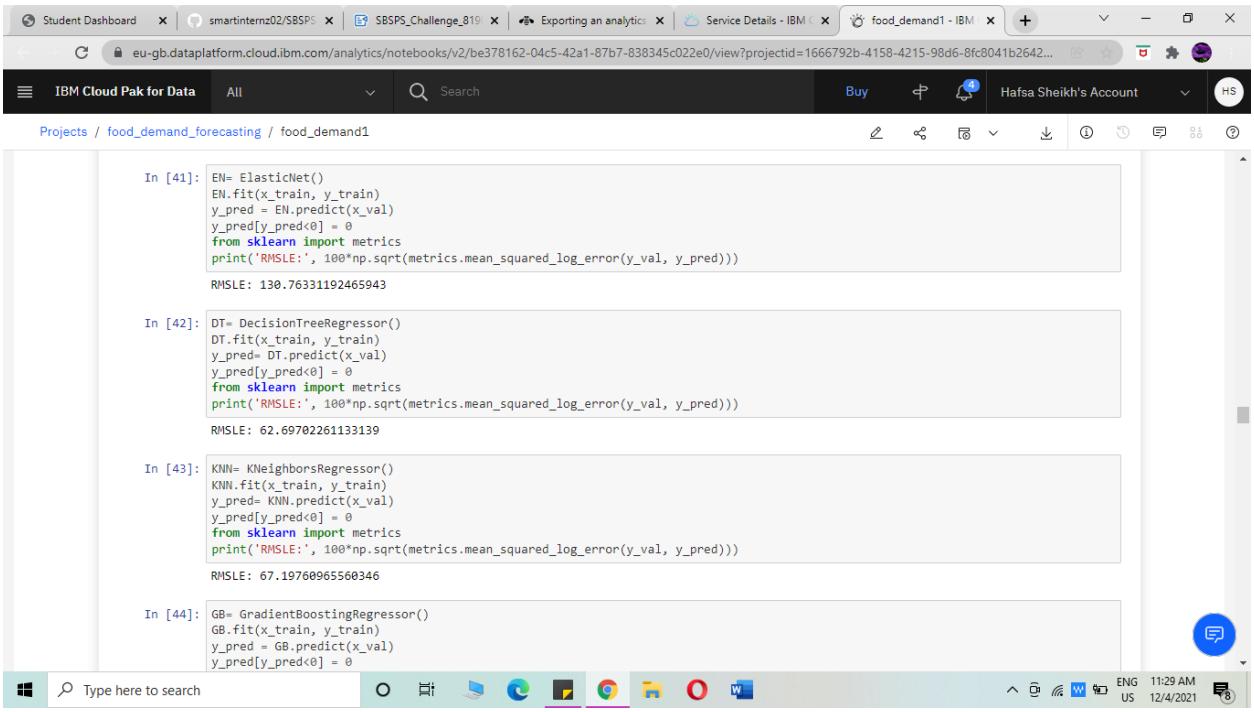
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In [41]:
EN= ElasticNet()
EN.fit(x_train, y_train)
y_pred = EN.predict(x_val)
y_pred[y_pred<0] = 0
from sklearn import metrics
print('RMSLE:', 100*np.sqrt(metrics.mean_squared_log_error(y_val, y_pred)))
RMSLE: 130.76331192465943
In [42]:
DT= DecisionTreeRegressor()
DT.fit(x_train, y_train)
y_pred= DT.predict(x_val)
y_pred[y_pred<0] = 0
from sklearn import metrics
print('RMSLE:', 100*np.sqrt(metrics.mean_squared_log_error(y_val, y_pred)))
RMSLE: 62.69702261133139
In [43]:
KNN= KNeighborsRegressor()
KNN.fit(x_train, y_train)
y_pred= KNN.predict(x_val)
y_pred[y_pred<0] = 0
from sklearn import metrics
print('RMSLE:', 100*np.sqrt(metrics.mean_squared_log_error(y_val, y_pred)))
RMSLE: 67.19760965560346
In [44]:
GB= GradientBoostingRegressor()
GB.fit(x_train, y_train)
y_pred = GB.predict(x_val)
y_pred[y_pred<0] = 0
Type here to search
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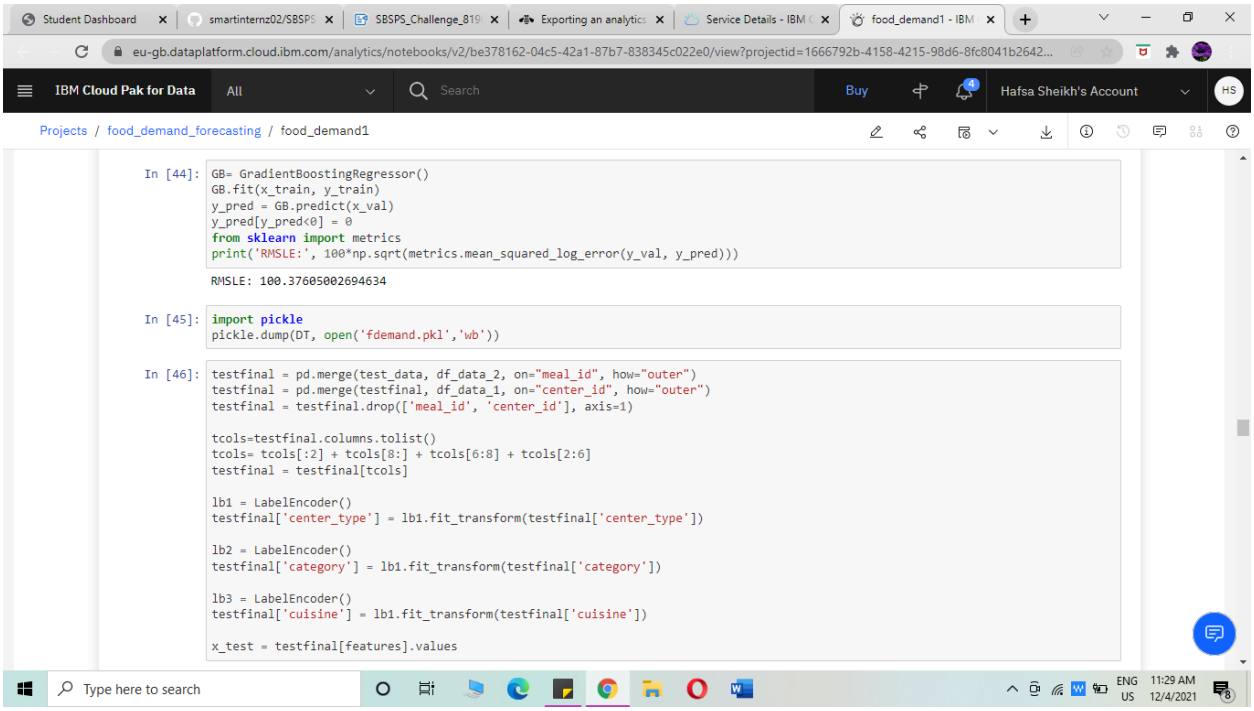
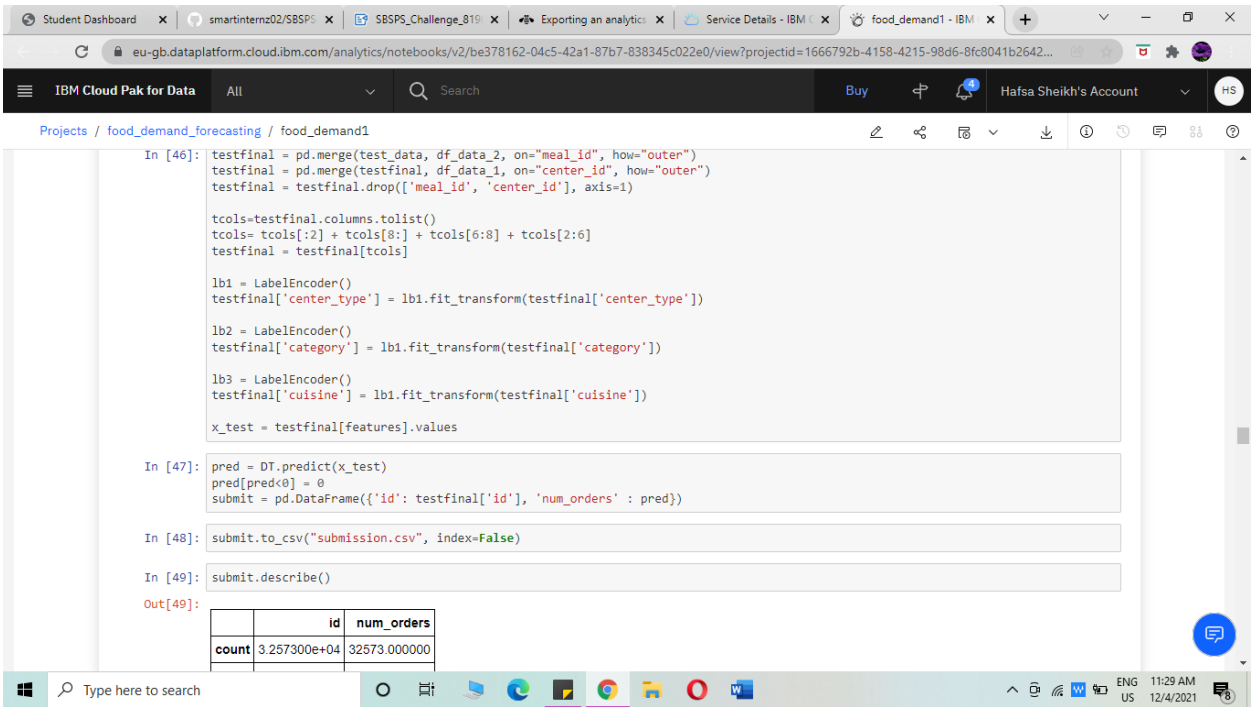
- **Selecting the decision tree regressor as it gave the least RMSLE value. The lesser the RMSLE value, the lesser is the deviation of the predicted value from the actual value.**





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In [46]:
```
testfinal = pd.merge(test_data, df_data_2, on="meal_id", how="outer")
testfinal = pd.merge(testfinal, df_data_1, on="center_id", how="outer")
testfinal = testfinal.drop(['meal_id', 'center_id'], axis=1)

tcols=testfinal.columns.tolist()
tcols= tcols[:2] + tcols[8:] + tcols[6:8] + tcols[2:6]
testfinal = testfinal[tcols]

lb1 = LabelEncoder()
testfinal['center_type'] = lb1.fit_transform(testfinal['center_type'])

lb2 = LabelEncoder()
testfinal['category'] = lb1.fit_transform(testfinal['category'])

lb3 = LabelEncoder()
testfinal['cuisine'] = lb1.fit_transform(testfinal['cuisine'])

x_test = testfinal[features].values
```

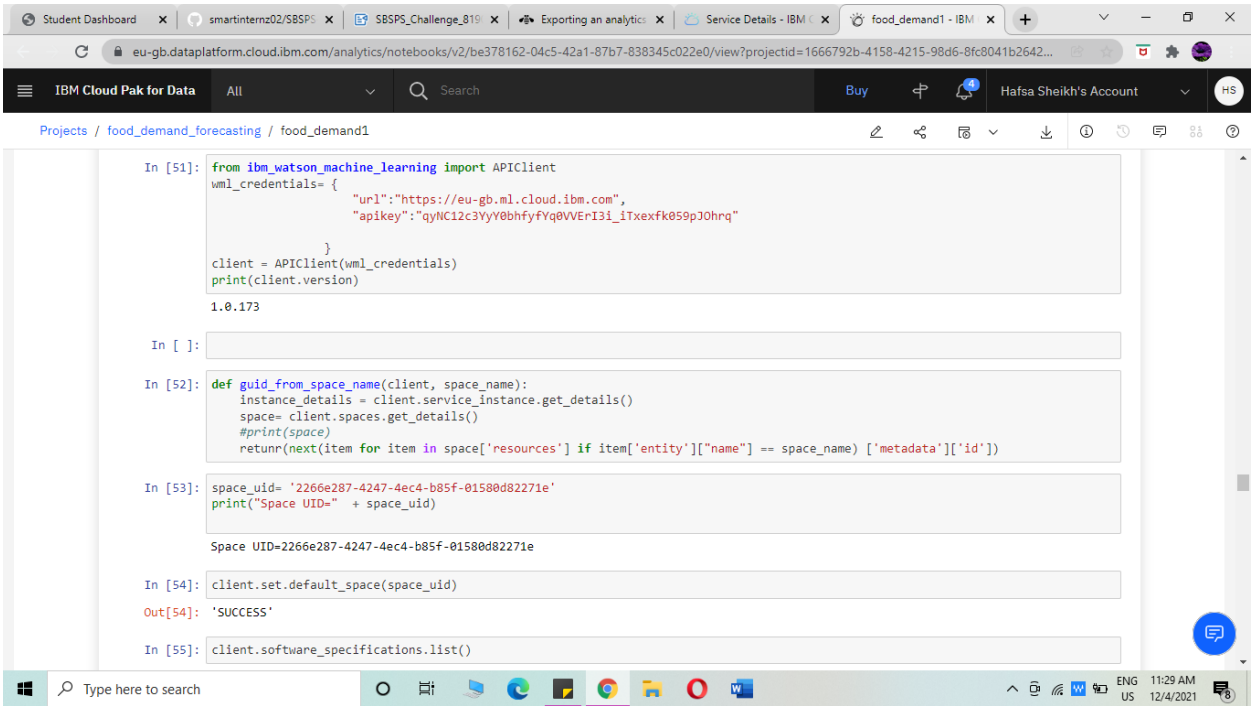
In [47]:
```
pred = DT.predict(x_test)
pred[pred<0] = 0
submit = pd.DataFrame({'id': testfinal['id'], 'num_orders' : pred})
```

In [48]:
```
submit.to_csv("submission.csv", index=False)
```

In [49]:
```
submit.describe()
```

Out[49]:

	id	num_orders
count	3.257300e+04	32573.000000



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In [51]:
```
from ibm_watson_machine_learning import APIClient
wml_credentials= {
                   "url":"https://eu-gb.ml.cloud.ibm.com",
                   "apikey":"qyNC12c3YyY0bhfyfYq0VVErI3i_iTxexfk059pJOhrq"

                 }
client = APIClient(wml_credentials)
print(client.version)
```

```
1.0.173
```

In [ ]:
```
```

In [52]:
```
def guid_from_space_name(client, space_name):
    instance_details = client.service_instance.get_details()
    space= client.spaces.get_details()
    #print(space)
    return(next(item for item in space['resources'] if item['entity']["name"] == space_name) ['metadata']['id'])
```

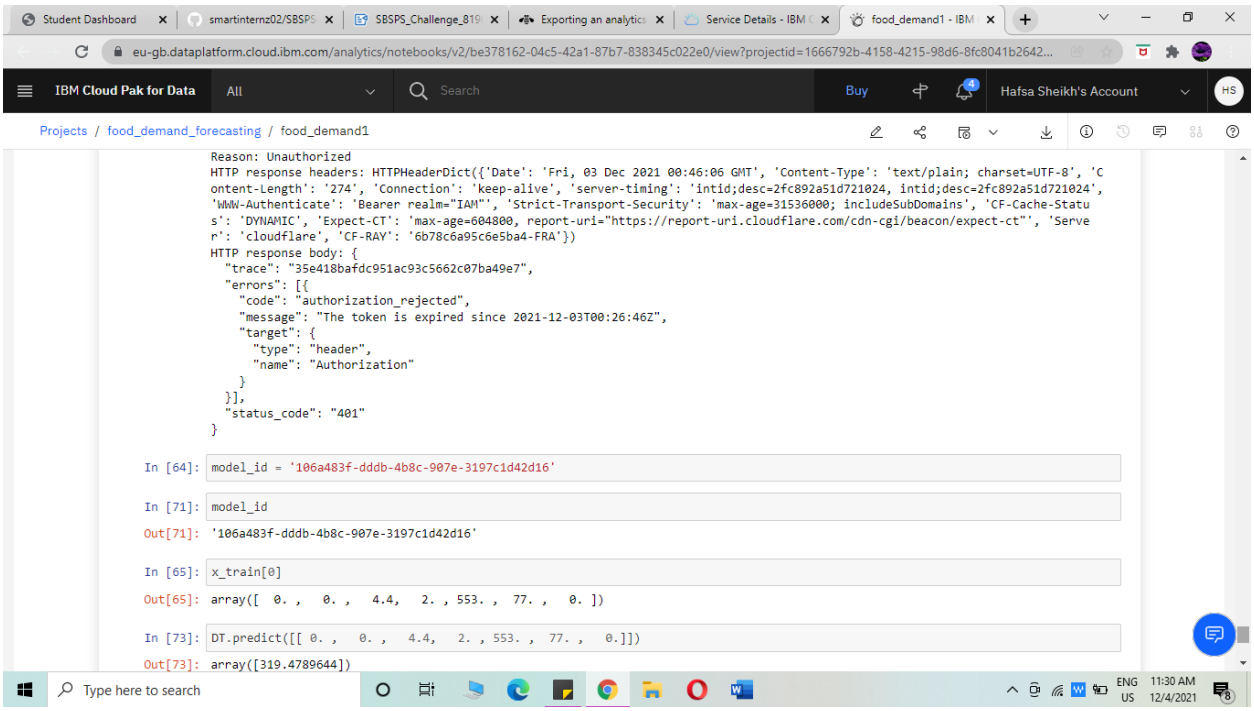
In [53]:
```
space_uid= '2266e287-4247-4ec4-b85f-01580d82271e'
print("Space UID="  + space_uid)
```

```
Space UID=2266e287-4247-4ec4-b85f-01580d82271e
```

In [54]:
```
client.set.default_space(space_uid)
```

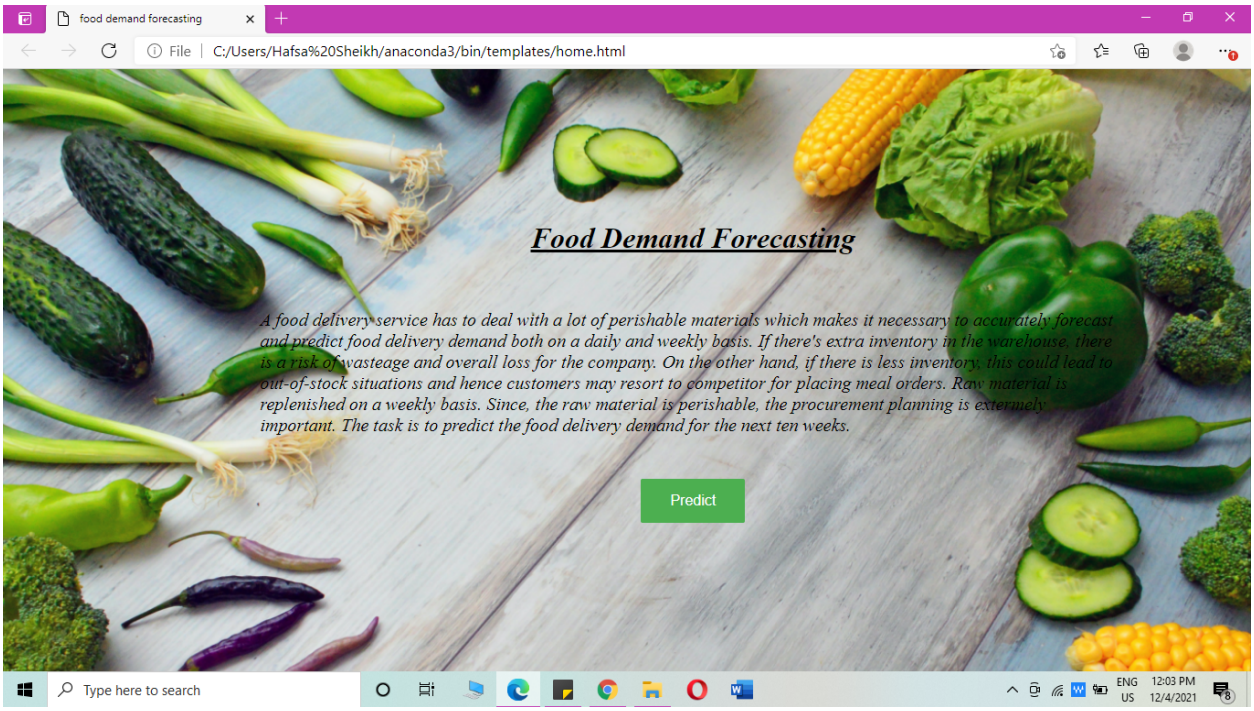
Out[54]:
```
'SUCCESS'
```

In [55]:
```
client.software_specifications.list()
```

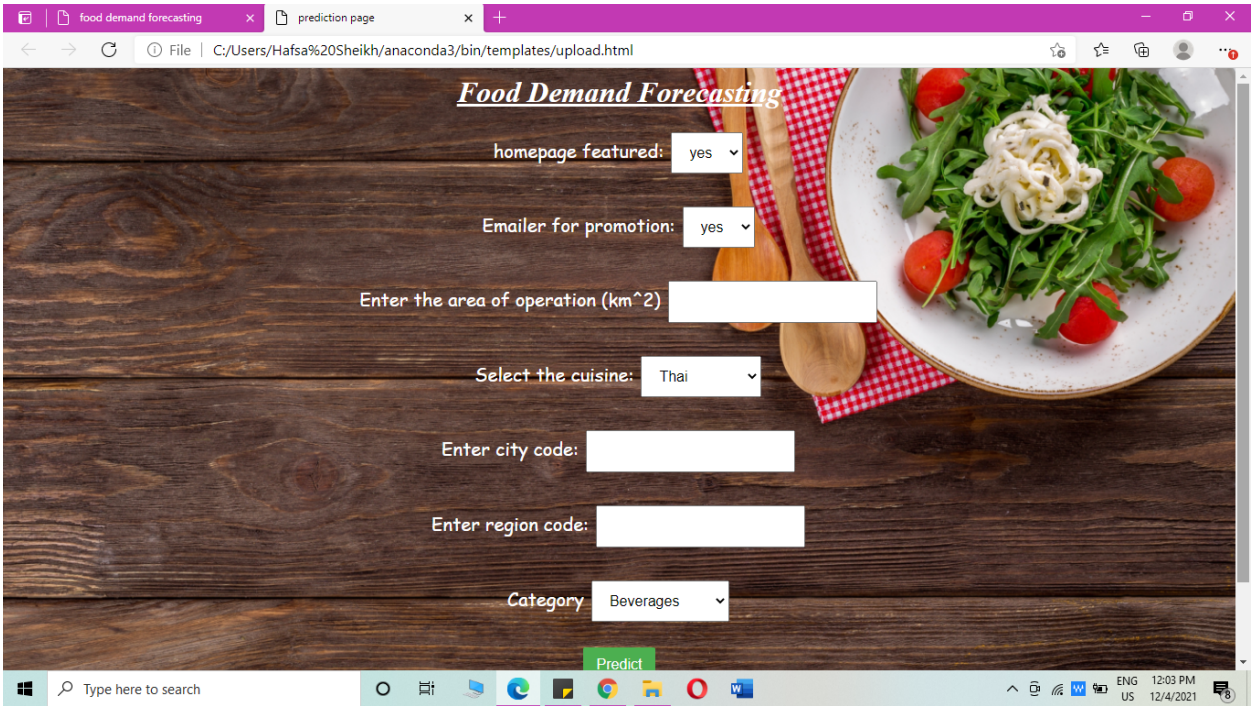

Student Dashboard
smartinternz02/SBSPS
SBSPS_Challenge_819
Exporting an analytics
Service Details - IBM
food_demand1 - IBM
eu-gb.dataplatform.cloud.ibm.com/analytics/notebooks/v2/be378162-04c5-42a1-87b7-838345c022e0/view?projectid=1666792b-4158-4215-98d6-8fc8041b2642...
IBM Cloud Pak for Data
All
Search
Buy
Hafsa Sheikh's Account
HS
Projects / food_demand_forecasting / food_demand1
Reason: Unauthorized
HTTP response headers: HTTPHeaderDict({'Date': 'Fri, 03 Dec 2021 00:46:06 GMT', 'Content-Type': 'text/plain; charset=UTF-8', 'Content-Length': '274', 'Connection': 'keep-alive', 'server-timing': 'intid;desc=2fc892a51d721024, intid;desc=2fc892a51d721024', 'WWW-Authenticate': 'Bearer realm="IAM"', 'Strict-Transport-Security': 'max-age=31536000; includeSubDomains', 'CF-Cache-Status': 'DYNAMIC', 'Expect-CT': 'max-age=604800, report-uri="https://report-uri.cloudflare.com/cdn-cgi/beacon/expect-ct"', 'Server': 'cloudflare', 'CF-RAY': '6b78c6a95c6e5ba4-FRA'})
HTTP response body: {
"trace": "35e418bafdc951ac93c5662c07ba49e7",
"errors": [{
"code": "authorization_rejected",
"message": "The token is expired since 2021-12-03T00:26:46Z",
"target": {
"type": "header",
"name": "Authorization"
}
}],
"status_code": "401"
}
In [64]: model_id = '106a483f-dddb-4b8c-907e-3197c1d42d16'
In [71]: model_id
Out[71]: '106a483f-dddb-4b8c-907e-3197c1d42d16'
In [65]: x_train[0]
Out[65]: array([0. , 0. , 4.4, 2. , 553. , 77. , 0.])
In [73]: DT.predict([[0. , 0. , 4.4, 2. , 553. , 77. , 0.]])
Out[73]: array([319.4789644])
Type here to search
ENG
US
11:30 AM
12/4/2021

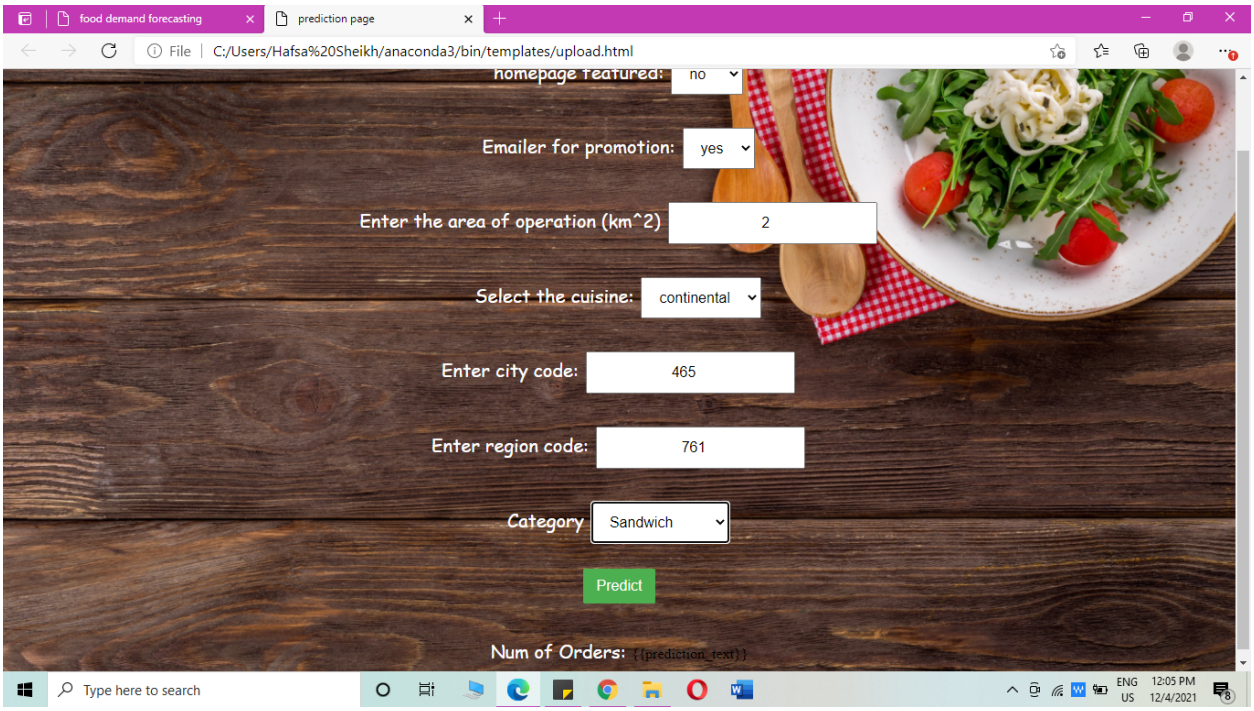
Front End created using HTML and internal CSS:

- **home.html**



- **upload.html**





Source Code:
https://github.com/smartinternz02/SBSPS-Challenge-8190-Food-Demand-Forecasting-for-Food-Delivery-Company-using-IBM-Cloud