Important Note:

- This assigement requires at least PostgreSQL 9.5 or higher release since this assignments uses **ROLLUP** and **CUBE** grouping operations
- Curently the DSCC has a PostgreSQL 10.5 that we will use for this assignment

Deliverables:

- Submit a single zip-compressed file that has the name: YourLastName_Assignment_5 that has the following files:

    1. Your **PDF document** that has your Source code and output
    2. Your **ipynb script** that has your Source code and output

Objectives:

- Experiment with SQL grouping operations like CUBE and ROLLUP to retrieve, group and cluster data from Walmart dataset
- Use Ecnomic data to analyze and visualize the weekly total sales per Walmart-store

Submission Formats :

Create a folder or directory with all supplementary files with your last name at the beginning of the folder name, compress that folder with zip compression, and post the zip-archived folder under the assignment link in Canvas. The following files should be included in an archive folder/directory that is uploaded as a single zip-compressed file. (Use zip, not StuffIt or any 7z or any other compression method.)

1. Complete IPYNB script that has the source code in Python used to access and analyze the data. The code should be submitted as an IPYNB script that can be be loaded and run in Jupyter Notebook for Python
2. Output from the program, such as console listing/logs, text files, and graphics output for visualizations. If you use the Data Science Computing Cluster or School of Professional Studies database servers or systems, include Linux logs of your sessions as plain text files. Linux logs may be generated by using the script process at the beginning of your session, as demonstrated in tutorial handouts for the DSCC servers.
3. List file names and descriptions of files in the zip-compressed folder/directory.

Formatting Python Code When programming in Python, refer to Kenneth Reitz' PEP 8: The Style Guide for Python Code: http://pep8.org/ (http://pep8.org/) (Links to an external site.)Links to an external site. There is the Google style guide for Python at https://google.github.io/styleguide/pyguide.html (https://google.github.io/styleguide/pyguide.html) (Links to an external site.)Links to an external site. Comment often and in detail.

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1. Last Edit 10-28-2018

Descriptions and Requirement Specifications

Walmart Weekly Sales

Walmart is the world's largest company by revenue, it has over US$500 billion; Walmart has 11,718 stores and clubs in 28 countries.

You can read more about Walmart by visitin the following page **More Info (https://en.wikipedia.org/wiki/Walmart)**

Walmart total weekly sales

Walmart tracks the total weekly sales per store and there is a sample dataset that is published on **Kaggle**, you can read more about this dataset [here (https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting)](https://www.kaggle.com/c/walmart-recruiting-store-sales-forecasting)

In this assignment we will not discuss the store sales **prediction**, rather we will focus on store sales **description**

Note: Unlike the employment weekly numbers, the CPI is published monthly by LBS even though it is listed on a weekly basis teh given dataset.

The walmart database is composed of 3 tables that are populated on PosgeSQL10.5 on DSCC. The tables are listed below:

Stores:

- Store: The store number. Range from 1-45.
- Type: Three types of stores 'A', 'B' or 'C'.
- Size: Sets the size of a Store would be calculated by the no. of products available in the particular store ranging from 34,000 to 210,000.

Weekly_Sales:

- Store: The store which observation in recorded 1-45.
- Dept: One of 1-99 that shows the department.
- IsHoliday: Boolean value representing a holiday week or not.

Features:

- Temperature:Temperature of the region during that week.
- Fuel_Price: Fuel Price in that region during that week.
- MarkDown1:5 : Represents the Type of markdown and what quantity was available during that week.
- CPI: Consumer Price Index during that week.
- Unemployment: The unemployment rate during that week in the region of the store.

Bureau of Labor Statistics

The Bureau of Labor Statistics [(BLS) (https://www.bls.gov/home.htm)](https://www.bls.gov/home.htm) of the U.S. Department of Labor publishes many of the monthly and weekly MAJOR ECONOMIC INDICATORS that are used to measure the labor market, inflation and price changes in the economy. You can read more about these indicators [here (https://www.bls.gov/bls/newsrels.htm#major)](https://www.bls.gov/bls/newsrels.htm#major)

Examples of these indicators that you will see in the database for this assignment are unemployement and CPI


Walmart
Coke
DASANI
$18
pepsi
Bell

PostgreSQL 10.5

Postgres provides few programming language constructs for complex grouping operations like ROLLUP and CUBE. You can read more about these grouping operations [here (https://www.postgresql.org/docs/10/static/queries-table-expressions.html#QUERIES-GROUPING-SETS)](https://www.postgresql.org/docs/10/static/queries-table-expressions.html#QUERIES-GROUPING-SETS)

Import the packages needed

In [1]:
```
import psycopg2
import csv
import pandas as pd
import numpy as np
from datetime import datetime,date
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

%matplotlib inline
```

In [2]:
```
#setup the format for the pretty print of Total
pd.options.display.float_format = '{:20,.2f}'.format
```

First, we need to connect to the postgresql10 database server

- make sure you are already connected to VPN before you execute the following command

In [3]:
```
db_connection = psycopg2.connect(host='postgresql10.sps.northwestern.edu',dbname="walmart", user="
 " , password=" ")


cursor = db_connection.cursor()
```

Query #1:

- Get the total weekly sales by store

In [4]:
```
cursor.execute("SELECT Store, sum(Weekly_Sales) from weekly_sales GROUP BY Store")
rows=cursor.fetchall()
```

In [5]:
```
total_weekly_sales_by_store = pd.DataFrame(rows, columns=['Store','Total'])


total_weekly_sales_by_store.tail()
```

Out[5]:

	Store	Total
40	41	181,341,934.89
41	42	79,565,752.43
42	43	90,565,435.41
43	44	43,293,087.84
44	45	112,395,341.42

Query #2:

- Get the total weekly sales by store and department

In [6]:
```
cursor.execute("SELECT Store, Dept, sum(Weekly_Sales) from weekly_sales GROUP BY Store, Dept")
rows=cursor.fetchall()
```

In [7]:
```
total_weekly_sales_by_store_dept = pd.DataFrame(rows, columns=['Store','Department','Total'])

total_weekly_sales_by_store_dept = total_weekly_sales_by_store_dept.sort_values(by=['Store', 'Depar
tment'])

total_weekly_sales_by_store_dept
```

Out[7]:

	Store	Department	Total
11	1	1	3,219,405.18
2015	1	2	6,592,598.93
672	1	3	1,880,518.36
303	1	4	5,285,874.09
35	1	5	3,468,885.58
940	1	6	686,654.56
1408	1	7	3,513,007.70
2084	1	8	5,107,710.84
2107	1	9	4,012,873.47
328	1	10	4,437,774.25
25	1	11	3,563,455.70
2214	1	12	1,511,015.98
2974	1	13	5,533,081.91
1020	1	14	2,183,402.78
2025	1	16	3,453,601.77
1596	1	17	1,315,107.78
1439	1	18	877,479.40
1793	1	19	180,039.65
1436	1	20	585,094.73
255	1	21	1,116,608.43
2046	1	22	1,151,446.89
850	1	23	3,092,115.41
1912	1	24	884,796.73
252	1	25	1,451,784.16
2976	1	26	967,823.61
516	1	27	196,574.90
20	1	28	84,815.30
859	1	29	665,098.75
967	1	30	488,387.19
1425	1	31	344,420.26
...	...	...	...
2779	45	51	104.52
2605	45	52	209,675.92
2750	45	54	5,784.62
2573	45	55	870,254.51
1714	45	56	519,397.43
3075	45	58	241,179.85
1841	45	59	85,912.45
3121	45	60	25,313.20
898	45	67	972,546.81
1413	45	71	628,686.82
2810	45	72	5,357,682.10
207	45	74	1,531,547.32

	Store	Department	Total
2150	45	77	1,525.96
3183	45	78	88.00
2851	45	79	2,180,038.31
541	45	80	72,622.47
1023	45	81	2,095,392.73
3220	45	82	1,920,560.27
2904	45	83	117,915.34
802	45	85	286,197.78
429	45	87	901,911.85
3046	45	90	3,385,387.04
628	45	91	2,379,795.61
924	45	92	6,882,003.38
2606	45	93	390,193.68
1032	45	94	494,496.46
1447	45	95	7,564,151.83
748	45	96	5.94
55	45	97	924,775.55
2460	45	98	75,767.27

3331 rows × 3 columns

Query #3:

- Get the total weekly sales by store and week

In [8]:
```
cursor.execute("SELECT Store, Date, sum(Weekly_Sales) from weekly_sales GROUP BY Store, Date")
rows=cursor.fetchall()
```

In [9]:
```
total_weekly_sales_by_store_dept = pd.DataFrame(rows, columns=['Store','Date','Total'])

total_weekly_sales_by_store_dept = total_weekly_sales_by_store_dept.sort_values(by=['Store', 'Date'
])


total_weekly_sales_by_store_dept
```

Out[9]:

	Store	Date	Total
3874	1	2010-02-05	1,643,690.90
2271	1	2010-02-12	1,641,957.44
4071	1	2010-02-19	1,611,968.17
855	1	2010-02-26	1,409,727.59
2331	1	2010-03-05	1,554,806.68
4027	1	2010-03-12	1,439,541.59
4302	1	2010-03-19	1,472,515.79
2925	1	2010-03-26	1,404,429.92
5899	1	2010-04-02	1,594,968.28
2009	1	2010-04-09	1,545,418.53
3162	1	2010-04-16	1,466,058.28
442	1	2010-04-23	1,391,256.12
2556	1	2010-04-30	1,425,100.71
1608	1	2010-05-07	1,603,955.12
2849	1	2010-05-14	1,494,251.50
1874	1	2010-05-21	1,399,662.07
1035	1	2010-05-28	1,432,069.95
6002	1	2010-06-04	1,615,524.71
2163	1	2010-06-11	1,542,561.09
4310	1	2010-06-18	1,503,284.06
1135	1	2010-06-25	1,422,711.60
602	1	2010-07-02	1,492,418.14
3056	1	2010-07-09	1,546,074.18
4960	1	2010-07-16	1,448,938.92
2038	1	2010-07-23	1,385,065.20
4054	1	2010-07-30	1,371,986.60
4969	1	2010-08-06	1,605,491.78
2525	1	2010-08-13	1,508,237.76
6075	1	2010-08-20	1,513,080.49
5004	1	2010-08-27	1,449,142.92
...	...	...	...
3311	45	2012-04-06	899,479.43
5738	45	2012-04-13	781,970.60
4527	45	2012-04-20	776,661.74
4959	45	2012-04-27	711,571.88
694	45	2012-05-04	782,300.68
5339	45	2012-05-11	770,487.37
2476	45	2012-05-18	800,842.28
1284	45	2012-05-25	817,741.17
3271	45	2012-06-01	837,144.63
1718	45	2012-06-08	795,133.00
207	45	2012-06-15	821,498.18
1809	45	2012-06-22	822,569.16

	Store	Date	Total
4304	45	2012-06-29	773,367.71
5519	45	2012-07-06	843,361.10
6151	45	2012-07-13	749,817.08
1453	45	2012-07-20	737,613.65
4402	45	2012-07-27	711,671.58
5305	45	2012-08-03	725,729.51
3814	45	2012-08-10	733,037.32
3416	45	2012-08-17	722,496.93
3840	45	2012-08-24	718,232.26
5159	45	2012-08-31	734,297.87
6110	45	2012-09-07	766,512.66
3772	45	2012-09-14	702,238.27
1716	45	2012-09-21	723,086.20
2566	45	2012-09-28	713,173.95
3426	45	2012-10-05	733,455.07
5940	45	2012-10-12	734,464.36
5852	45	2012-10-19	718,125.53
3440	45	2012-10-26	760,281.43

6435 rows × 3 columns

Query #4:

- Get the total weekly sales by department and week

In [10]:
```
cursor.execute("SELECT Dept, Date, sum(Weekly_Sales) from weekly_sales GROUP BY Dept, Date")
rows=cursor.fetchall()
```

In [11]:

```
total_weekly_sales_by_dept_date = pd.DataFrame(rows, columns=['Dept','Date','Total'])

total_weekly_sales_by_dept_date = total_weekly_sales_by_dept_date.sort_values(by=['Dept', 'Date'])


total_weekly_sales_by_dept_date
```

Out[11]:

	Dept	Date	Total
8953	1	2010-02-05	881,833.41
7577	1	2010-02-12	1,457,182.40
9110	1	2010-02-19	1,118,257.36
6345	1	2010-02-26	681,391.58
2019	1	2010-03-05	762,652.57
9088	1	2010-03-12	803,886.93
9337	1	2010-03-19	846,686.47
8139	1	2010-03-26	1,045,724.42
5118	1	2010-04-02	2,451,952.54
7341	1	2010-04-09	1,518,946.82
2731	1	2010-04-16	609,719.72
391	1	2010-04-23	588,496.89
2227	1	2010-04-30	600,156.00
7004	1	2010-05-07	669,362.80
2472	1	2010-05-14	666,912.20
7224	1	2010-05-21	633,105.07
869	1	2010-05-28	643,528.83
10761	1	2010-06-04	648,393.81
1870	1	2010-06-11	648,890.42
9344	1	2010-06-18	665,184.13
6583	1	2010-06-25	648,196.08
6108	1	2010-07-02	678,962.23
2654	1	2010-07-09	637,733.18
4323	1	2010-07-16	648,002.69
1782	1	2010-07-23	631,305.04
3493	1	2010-07-30	634,299.47
4334	1	2010-08-06	642,139.20
7809	1	2010-08-13	624,871.72
10813	1	2010-08-20	608,719.73
9917	1	2010-08-27	609,494.16
...	...	...	...
7847	99	2012-03-23	1.01
6960	99	2012-04-06	1,553.18
286	99	2012-04-13	386.06
911	99	2012-04-20	1.90
1898	99	2012-05-04	7,400.01
8334	99	2012-05-11	1,105.00
1010	99	2012-05-18	-11.99
791	99	2012-05-25	32.44
5931	99	2012-06-01	29.90
7461	99	2012-06-08	2,404.76
38	99	2012-06-15	4,134.76
2471	99	2012-06-22	800.00

	Dept	Date	Total
1037	99	2012-06-29	0.00
7283	99	2012-07-06	210.29
2265	99	2012-07-13	61.43
10903	99	2012-07-20	150.97
3663	99	2012-07-27	120.54
11010	99	2012-08-03	1,820.76
1165	99	2012-08-10	510.32
9585	99	2012-08-17	411.25
8638	99	2012-08-24	3,091.09
8631	99	2012-08-31	611.11
7084	99	2012-09-07	234.04
5069	99	2012-09-14	31.16
9086	99	2012-09-21	119.81
4854	99	2012-09-28	0.01
8752	99	2012-10-05	11,587.17
2196	99	2012-10-12	2,024.93
9054	99	2012-10-19	0.03
7563	99	2012-10-26	41.89

11090 rows × 3 columns

Query #5:

- Get the total weekly sales using **ROLLUP** clause for the hierarchical data: store, department and week

In [12]:
```
cursor.execute("SELECT Store, Dept, Date, sum(Weekly_Sales) from weekly_sales GROUP BY ROLLUP(Stor
e, Dept, Date)")
rows=cursor.fetchall()
```

In [13]:

```
rollup_by_store_dept_date = pd.DataFrame(rows, columns=['Store','Dept','Date','Total'])

#For the pretty print : Replace NaN by -1

rollup_by_store_dept_date['Store'] = rollup_by_store_dept_date['Store'].replace(np.nan,-1)
rollup_by_store_dept_date['Dept'] = rollup_by_store_dept_date['Dept'].replace(np.nan,-1)

#type conversion of values returned by ROLLUP

rollup_by_store_dept_date['Store'] = rollup_by_store_dept_date['Store'].astype(int)
rollup_by_store_dept_date['Dept'] = rollup_by_store_dept_date['Dept'].astype(int)
rollup_by_store_dept_date['Total'] = rollup_by_store_dept_date['Total'].astype(np.float64)


#For the pretty print: Replace -1  by BLANK for Store and department
rollup_by_store_dept_date['Store'].replace(-1,'',inplace=True)
rollup_by_store_dept_date['Dept'].replace(-1,'',inplace=True)

#For the pretty print: Replace NaN  by BLANK for date
rollup_by_store_dept_date['Date'] = rollup_by_store_dept_date['Date'].dt.date
rollup_by_store_dept_date['Date'].replace(np.nan,'',inplace=True)


rollup_by_store_dept_date = rollup_by_store_dept_date.sort_values(by=['Store', 'Dept', 'Date'])


rollup_by_store_dept_date
```

Out[13]:

	Store	Dept	Date	Total
56093	1	1	2010-02-05	24,924.50
267400	1	1	2010-02-12	46,039.49
10751	1	1	2010-02-19	41,595.55
295442	1	1	2010-02-26	19,403.54
162717	1	1	2010-03-05	21,827.90
287383	1	1	2010-03-12	21,043.39
248692	1	1	2010-03-19	22,136.64
317889	1	1	2010-03-26	26,229.21
157684	1	1	2010-04-02	57,258.43
219234	1	1	2010-04-09	42,960.91
409083	1	1	2010-04-16	17,596.96
344205	1	1	2010-04-23	16,145.35
50692	1	1	2010-04-30	16,555.11
38051	1	1	2010-05-07	17,413.94
377780	1	1	2010-05-14	18,926.74
356067	1	1	2010-05-21	14,773.04
318343	1	1	2010-05-28	15,580.43
258991	1	1	2010-06-04	17,558.09
304988	1	1	2010-06-11	16,637.62
298146	1	1	2010-06-18	16,216.27
66777	1	1	2010-06-25	16,328.72
49534	1	1	2010-07-02	16,333.14
169403	1	1	2010-07-09	17,688.76
190943	1	1	2010-07-16	17,150.84
366965	1	1	2010-07-23	15,360.45
211566	1	1	2010-07-30	15,381.82
399671	1	1	2010-08-06	17,508.41
251978	1	1	2010-08-13	15,536.40
325142	1	1	2010-08-20	15,740.13
321811	1	1	2010-08-27	15,793.87
...	...	...	...	...
13095	45	98	2012-04-27	619.41
36605	45	98	2012-05-04	694.25
206934	45	98	2012-05-11	893.60
3776	45	98	2012-05-18	745.44
135480	45	98	2012-05-25	795.94
31131	45	98	2012-06-01	874.64
211184	45	98	2012-06-08	713.50
237333	45	98	2012-06-15	856.35
198669	45	98	2012-06-22	622.62
223119	45	98	2012-06-29	690.52
291750	45	98	2012-07-06	659.65
31624	45	98	2012-07-13	695.21

	Store	Dept	Date	Total
134526	45	98	2012-07-20	845.30
227689	45	98	2012-07-27	657.63
253329	45	98	2012-08-03	516.46
313596	45	98	2012-08-10	727.49
168367	45	98	2012-08-17	500.16
71731	45	98	2012-08-24	415.40
6841	45	98	2012-08-31	346.04
35985	45	98	2012-09-07	352.44
124491	45	98	2012-09-14	605.96
243787	45	98	2012-09-21	467.30
349445	45	98	2012-09-28	508.37
29738	45	98	2012-10-05	628.10
358054	45	98	2012-10-12	1,061.02
41037	45	98	2012-10-19	760.01
380735	45	98	2012-10-26	1,076.80
424031	45	98		75,767.27
424914	45			112,395,341.42
0				6,737,218,987.11

424947 rows × 4 columns

Query #6:

- Get the total weekly sales using **ROLLUP** clause for the hierarchical data: store, department and week

In [14]:
```
cursor.execute("SELECT Store, Dept, sum(Weekly_Sales) from weekly_sales GROUP BY ROLLUP(Store, Dep
t)")
rows=cursor.fetchall()
```

In [15]:

```
rollup_by_store_dept = pd.DataFrame(rows, columns=['Store','Dept','Total'])

#For the pretty print : Replace NaN by -1

rollup_by_store_dept['Store'] = rollup_by_store_dept['Store'].replace(np.nan,-1)
rollup_by_store_dept['Dept'] = rollup_by_store_dept['Dept'].replace(np.nan,-1)

#type conversion of values returned by ROLLUP

rollup_by_store_dept['Store'] = rollup_by_store_dept['Store'].astype(int)
rollup_by_store_dept['Dept'] = rollup_by_store_dept['Dept'].astype(int)
rollup_by_store_dept['Total'] = rollup_by_store_dept['Total'].astype(np.float64)


#For the pretty print: Replace -1  by BLANK for Store and department
rollup_by_store_dept['Store'].replace(-1,'',inplace=True)
rollup_by_store_dept['Dept'].replace(-1,'',inplace=True)


rollup_by_store_dept = rollup_by_store_dept.sort_values(by=['Store', 'Dept'])


rollup_by_store_dept
```

Out[15]:

	Store	Dept	Total
13	1	1	3,219,405.18
2017	1	2	6,592,598.93
674	1	3	1,880,518.36
305	1	4	5,285,874.09
37	1	5	3,468,885.58
941	1	6	686,654.56
1412	1	7	3,513,007.70
2086	1	8	5,107,710.84
2108	1	9	4,012,873.47
329	1	10	4,437,774.25
26	1	11	3,563,455.70
2216	1	12	1,511,015.98
2976	1	13	5,533,081.91
1023	1	14	2,183,402.78
2026	1	16	3,453,601.77
1598	1	17	1,315,107.78
1441	1	18	877,479.40
1795	1	19	180,039.65
1438	1	20	585,094.73
257	1	21	1,116,608.43
2047	1	22	1,151,446.89
851	1	23	3,092,115.41
1913	1	24	884,796.73
255	1	25	1,451,784.16
2979	1	26	967,823.61
518	1	27	196,574.90
21	1	28	84,815.30
861	1	29	665,098.75
968	1	30	488,387.19
1426	1	31	344,420.26
...	...	...	...
2751	45	54	5,784.62
2573	45	55	870,254.51
1715	45	56	519,397.43
3076	45	58	241,179.85
1842	45	59	85,912.45
3122	45	60	25,313.20
899	45	67	972,546.81
1414	45	71	628,686.82
2809	45	72	5,357,682.10
208	45	74	1,531,547.32
2151	45	77	1,525.96
3184	45	78	88.00

	Store	Dept	Total
2852	45	79	2,180,038.31
541	45	80	72,622.47
1024	45	81	2,095,392.73
3220	45	82	1,920,560.27
2904	45	83	117,915.34
803	45	85	286,197.78
430	45	87	901,911.85
3047	45	90	3,385,387.04
629	45	91	2,379,795.61
925	45	92	6,882,003.38
2607	45	93	390,193.68
1032	45	94	494,496.46
1448	45	95	7,564,151.83
749	45	96	5.94
56	45	97	924,775.55
2461	45	98	75,767.27
3344	45		112,395,341.42
0			6,737,218,987.11

3377 rows × 3 columns

Query #7:

- Get the total weekly sales using **CUBE** clause for the hierarchical data: store, department and week

In [16]:
```
cursor.execute("SELECT Store, Dept, Date, sum(Weekly_Sales) from weekly_sales GROUP BY CUBE(Store,
 Dept, Date)")
rows=cursor.fetchall()
```

In [17]:

```
cube_by_store_dept_date = pd.DataFrame(rows, columns=['Store','Dept','Date','Total'])

#For the pretty print : Replace NaN by -1

cube_by_store_dept_date['Store'] = cube_by_store_dept_date['Store'].replace(np.nan,-1)
cube_by_store_dept_date['Dept'] = cube_by_store_dept_date['Dept'].replace(np.nan,-1)

#type conversion of values returned by ROLLUP

cube_by_store_dept_date['Store'] = cube_by_store_dept_date['Store'].astype(int)
cube_by_store_dept_date['Dept'] = cube_by_store_dept_date['Dept'].astype(int)
cube_by_store_dept_date['Total'] = cube_by_store_dept_date['Total'].astype(np.float64)


#For the pretty print: Replace -1  by BLANK for Store and department
cube_by_store_dept_date['Store'].replace(-1,'',inplace=True)
cube_by_store_dept_date['Dept'].replace(-1,'',inplace=True)

#For the pretty print: Replace NaN  by BLANK for date
cube_by_store_dept_date['Date'] = cube_by_store_dept_date['Date'].dt.date
cube_by_store_dept_date['Date'].replace(np.nan,'',inplace=True)


cube_by_store_dept_date = cube_by_store_dept_date.sort_values(by=['Store', 'Dept', 'Date'])


cube_by_store_dept_date
```

Out[17]:

	Store	Dept	Date	Total
0	1	1	2010-02-05	24,924.50
1	1	1	2010-02-12	46,039.49
2	1	1	2010-02-19	41,595.55
3	1	1	2010-02-26	19,403.54
4	1	1	2010-03-05	21,827.90
5	1	1	2010-03-12	21,043.39
6	1	1	2010-03-19	22,136.64
7	1	1	2010-03-26	26,229.21
8	1	1	2010-04-02	57,258.43
9	1	1	2010-04-09	42,960.91
10	1	1	2010-04-16	17,596.96
11	1	1	2010-04-23	16,145.35
12	1	1	2010-04-30	16,555.11
13	1	1	2010-05-07	17,413.94
14	1	1	2010-05-14	18,926.74
15	1	1	2010-05-21	14,773.04
16	1	1	2010-05-28	15,580.43
17	1	1	2010-06-04	17,558.09
18	1	1	2010-06-11	16,637.62
19	1	1	2010-06-18	16,216.27
20	1	1	2010-06-25	16,328.72
21	1	1	2010-07-02	16,333.14
22	1	1	2010-07-09	17,688.76
23	1	1	2010-07-16	17,150.84
24	1	1	2010-07-23	15,360.45
25	1	1	2010-07-30	15,381.82
26	1	1	2010-08-06	17,508.41
27	1	1	2010-08-13	15,536.40
28	1	1	2010-08-20	15,740.13
29	1	1	2010-08-27	15,793.87
...	...	...	...	...
424959			2012-04-13	46,629,261.41
424997			2012-04-20	45,072,529.78
424981			2012-04-27	43,716,798.89
424952			2012-05-04	47,124,197.93
425008			2012-05-11	46,925,878.99
425078			2012-05-18	46,823,939.22
425010			2012-05-25	47,892,463.31
424990			2012-06-01	48,281,649.72
425066			2012-06-08	49,651,171.78
425025			2012-06-15	48,412,110.70
425083			2012-06-22	47,668,284.97
424973			2012-06-29	46,597,112.12

	Store	Dept	Date	Total
425005			2012-07-06	51,253,021.88
425079			2012-07-13	46,099,732.10
424967			2012-07-20	46,059,543.45
424965			2012-07-27	44,097,154.97
425071			2012-08-03	47,485,899.56
424995			2012-08-10	47,403,451.04
424977			2012-08-17	47,354,452.05
425052			2012-08-24	47,447,323.60
424999			2012-08-31	47,159,639.43
424985			2012-09-07	48,330,059.31
424963			2012-09-14	44,226,038.65
425050			2012-09-21	44,354,547.11
425040			2012-09-28	43,734,899.40
424964			2012-10-05	47,566,639.31
425074			2012-10-12	46,128,514.25
425043			2012-10-19	45,122,410.57
425063			2012-10-26	45,544,116.29
424946				6,737,218,987.11

442696 rows × 4 columns

Query #8:

- Get the **descriptive statisitics** per store

In [18]:
```
cursor.execute("SELECT * from weekly_sales")
rows=cursor.fetchall()
```

In [19]:
```
weekly_sales = pd.DataFrame(rows, columns=['Store','Dept', 'Date','Weekly_Sales','IsHoliday'])

#For the pretty print: format date with no time-field
weekly_sales['Date'] = weekly_sales['Date'].dt.date
```

DataFrame has few good methods for descriptive statistics, grouping, and heirarchical clusterning:

- Count only non-null values, use **count**
- Count total values including null values, use **size** attribute
- Count distinct values, use **nunique**
- **stack()** on the **groupby** result will produce the pretty print

In [20]:
```
weekly_sales.groupby('Store').agg(['count', 'size', 'nunique', 'max']).stack()
```

Out[20]:

Store		Dept	Date	Weekly_Sales	IsHoliday
1	count	10244	10244	10,244.00	10244
	size	10244	10244	10,244.00	10244
	nunique	77	143	10,042.00	2
	max	99	2012-10-26	203,670.47	True
2	count	10238	10238	10,238.00	10238
	size	10238	10238	10,238.00	10238
	nunique	78	143	10,088.00	2
	max	99	2012-10-26	285,353.53	True
3	count	9036	9036	9,036.00	9036
	size	9036	9036	9,036.00	9036
	nunique	72	143	8,688.00	2
	max	98	2012-10-26	155,897.94	True
4	count	10272	10272	10,272.00	10272
	size	10272	10272	10,272.00	10272
	nunique	78	143	10,098.00	2
	max	99	2012-10-26	385,051.04	True
5	count	8999	8999	8,999.00	8999
	size	8999	8999	8,999.00	8999
	nunique	72	143	8,594.00	2
	max	98	2012-10-26	93,517.72	True
6	count	10211	10211	10,211.00	10211
	size	10211	10211	10,211.00	10211
	nunique	77	143	10,076.00	2
	max	99	2012-10-26	342,578.65	True
7	count	9762	9762	9,762.00	9762
	size	9762	9762	9,762.00	9762
	nunique	76	143	9,391.00	2
	max	99	2012-10-26	222,921.09	True
8	count	9895	9895	9,895.00	9895
	size	9895	9895	9,895.00	9895
...	...	...	...	...	...
38	nunique	63	143	6,715.00	2
	max	99	2012-10-26	100,618.04	True
39	count	9878	9878	9,878.00	9878
	size	9878	9878	9,878.00	9878
	nunique	75	143	9,713.00	2
	max	99	2012-10-26	351,553.98	True
40	count	10017	10017	10,017.00	10017
	size	10017	10017	10,017.00	10017
	nunique	77	143	9,724.00	2
	max	99	2012-10-26	145,504.24	True
41	count	10088	10088	10,088.00	10088

Store		Dept	Date	Weekly_Sales	IsHoliday
	size	10088	10088	10,088.00	10088
	nunique	77	143	9,864.00	2
	max	99	2012-10-26	290,809.17	True
42	**count**	6953	6953	6,953.00	6953
	size	6953	6953	6,953.00	6953
	nunique	62	143	6,452.00	2
	max	98	2012-10-26	112,152.35	True
43	**count**	6751	6751	6,751.00	6751
	size	6751	6751	6,751.00	6751
	nunique	61	143	6,292.00	2
	max	99	2012-10-26	108,517.42	True
44	**count**	7169	7169	7,169.00	7169
	size	7169	7169	7,169.00	7169
	nunique	62	143	6,548.00	2
	max	99	2012-10-26	66,629.98	True
45	**count**	9637	9637	9,637.00	9637
	size	9637	9637	9,637.00	9637
	nunique	74	143	9,381.00	2
	max	98	2012-10-26	240,758.86	True

180 rows × 4 columns

Query #9:

- Get the top 500 weekly sales and plot them (Red color for Holiday and Blue color for Not Holiday) against the weekly Unemployment and Temperature

In [21]:
```
cursor.execute("SELECT * from weekly_sales")
rows=cursor.fetchall()
```

In [22]:
```
weekly_sales = pd.DataFrame(rows, columns=['Store','Dept', 'Date','Weekly_Sales','IsHoliday'])

weekly_sales = weekly_sales.sort_values(by=['Weekly_Sales'], ascending=False)
```

In [23]:
```
top_ten_weekly_sales = weekly_sales[:500]

top_ten_weekly_sales.head()
```

Out[23]:

	Store	Dept	Date	Weekly_Sales	IsHoliday
95373	10	72	2010-11-26	693,099.36	True
338013	35	72	2011-11-25	649,770.18	True
95425	10	72	2011-11-25	630,999.19	True
337961	35	72	2010-11-26	627,962.93	True
135665	14	72	2010-11-26	474,330.10	True

In [24]:
```
cursor.execute("SELECT * from features")
rows=cursor.fetchall()
```

In [25]:
```
weekly_sales_temp_unemp = pd.DataFrame(rows, columns=['Store', 'Date', 'Temperature', 'Fuel_Price',
'MarkDown1', 'MarkDown2', 'MarkDown3', 'MarkDown4', 'MarkDown5', 'CPI', 'Unemployment', 'IsHoliday'
])
```

In [26]:
```
# Sanity test that we got good data from db server

weekly_sales_temp_unemp.head()
```

Out[26]:

	Store	Date	Temperature	Fuel_Price	MarkDown1	MarkDown2	MarkDown3	MarkDown4	MarkDown5	CPI	Unemploy
0	1	2010-02-05	42.31	2.57	0.00	0.00	0.00	0.00	0.00	211.10	
1	1	2010-02-12	38.51	2.55	0.00	0.00	0.00	0.00	0.00	211.24	
2	1	2010-02-19	39.93	2.51	0.00	0.00	0.00	0.00	0.00	211.29	
3	1	2010-02-26	46.63	2.56	0.00	0.00	0.00	0.00	0.00	211.32	
4	1	2010-03-05	46.50	2.62	0.00	0.00	0.00	0.00	0.00	211.35	

In [27]:
```
weekly_sales_temp_unemp.groupby('Store').agg(['count', 'size', 'nunique', 'max']).stack()
```

Out[27]:

Store		Date	Temperature	Fuel_Price	MarkDown1	MarkDown2	MarkDown3	MarkDown4	MarkDown5	CPI
1	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	181.00	169.00	91.00	73.00	89.00	91.00	91.00	168.00
	max	2013-07-26 00:00:00	91.65	3.91	72,937.29	46,011.38	74,910.32	32,403.87	20,475.32	225.17
2	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	179.00	169.00	91.00	76.00	87.00	91.00	91.00	168.00
	max	2013-07-26 00:00:00	93.34	3.91	75,149.79	92,523.94	105,146.30	48,159.86	36,430.33	224.80
3	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	180.00	169.00	91.00	70.00	77.00	88.00	91.00	168.00
	max	2013-07-26 00:00:00	89.12	3.91	29,091.04	14,356.07	54,466.91	8,368.15	7,297.10	228.73
4	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	177.00	168.00	91.00	75.00	89.00	89.00	91.00	168.00
	max	2013-07-26 00:00:00	86.29	3.88	56,705.09	72,413.71	93,310.30	48,086.64	28,604.20	132.72
5	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	182.00	169.00	91.00	66.00	74.00	85.00	91.00	168.00
	max	2013-07-26 00:00:00	91.07	3.91	23,811.41	17,079.76	43,319.43	14,928.42	24,751.93	225.77
6	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	182.00	169.00	91.00	76.00	88.00	91.00	91.00	168.00
	max	2013-07-26 00:00:00	91.46	3.91	64,733.80	82,881.16	112,255.67	34,049.73	27,272.53	226.80
7	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	177.00	165.00	91.00	66.00	87.00	91.00	91.00	168.00
	max	2013-07-26 00:00:00	68.84	3.94	56,917.70	17,021.30	44,081.25	16,519.53	57,029.78	201.24
8	count	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
...	...	...	...	...	...	...	...	...	...	...
38	nunique	182	180.00	166.00	91.00	31.00	70.00	29.00	91.00	168.00
	max	2013-07-26 00:00:00	101.95	4.47	5,631.57	2,765.45	265.53	334.12	3,186.15	132.72

Store		Date	Temperature	Fuel_Price	MarkDown1	MarkDown2	MarkDown3	MarkDown4	MarkDown5	CPI
39	**count**	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	180.00	169.00	91.00	75.00	87.00	91.00	91.00	168.00
	max	2013-07-26 00:00:00	88.65	3.91	66,099.34	53,918.62	109,976.14	32,731.31	108,519.28	223.84
40	**count**	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	178.00	165.00	91.00	71.00	85.00	89.00	91.00	168.00
	max	2013-07-26 00:00:00	76.67	4.10	39,257.29	31,425.65	60,367.16	25,676.37	15,828.62	139.12
41	**count**	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	175.00	165.00	91.00	76.00	90.00	91.00	91.00	168.00
	max	2013-07-26 00:00:00	76.54	3.94	65,739.82	56,106.20	97,533.40	63,830.91	21,739.26	201.24
42	**count**	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	176.00	174.00	86.00	32.00	66.00	17.00	91.00	168.00
	max	2013-07-26 00:00:00	95.36	4.47	8,063.80	2,655.21	220.60	313.04	4,143.90	132.72
43	**count**	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	179.00	169.00	90.00	30.00	72.00	16.00	91.00	168.00
	max	2013-07-26 00:00:00	91.36	3.91	1,952.91	3,350.20	163.92	615.93	7,035.07	216.44
44	**count**	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	177.00	165.00	89.00	28.00	65.00	21.00	91.00	168.00
	max	2013-07-26 00:00:00	85.58	3.85	3,297.48	1,821.61	106.31	89.76	2,583.41	132.72
45	**count**	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	size	182	182.00	182.00	182.00	182.00	182.00	182.00	182.00	182.00
	nunique	182	179.00	161.00	91.00	71.00	89.00	91.00	91.00	168.00
	max	2013-07-26 00:00:00	82.99	4.07	53,311.88	43,941.56	72,542.01	38,157.91	17,861.50	193.59

180 rows × 11 columns

In [28]:
```
unemployment = []
temperature = []

for row in top_ten_weekly_sales.itertuples():
    temperature.append(weekly_sales_temp_unemp[(weekly_sales_temp_unemp.Store == row.Store) & (week
ly_sales_temp_unemp.Date == row.Date)]['Temperature'].values[0])
    unemployment.append(weekly_sales_temp_unemp[(weekly_sales_temp_unemp.Store == row.Store) & (wee
kly_sales_temp_unemp.Date == row.Date)]['Unemployment'].values[0])
```

In [29]:
```
se_unemployment = pd.Series(unemployment)
se_temperature = pd.Series(temperature)
```

In [30]:
```
top_ten_weekly_sales.insert(loc=5, column='Unemployment', value=se_unemployment.values)
top_ten_weekly_sales.insert(loc=6, column='Temperature', value=se_temperature.values)
```

In [31]:
```
top_ten_weekly_sales.head()
```

Out[31]:

	Store	Dept	Date	Weekly_Sales	IsHoliday	Unemployment	Temperature
95373	10	72	2010-11-26	693,099.36	True	9.00	55.33
338013	35	72	2011-11-25	649,770.18	True	8.74	47.88
95425	10	72	2011-11-25	630,999.19	True	7.87	60.68
337961	35	72	2010-11-26	627,962.93	True	8.76	46.67
135665	14	72	2010-11-26	474,330.10	True	8.72	46.15

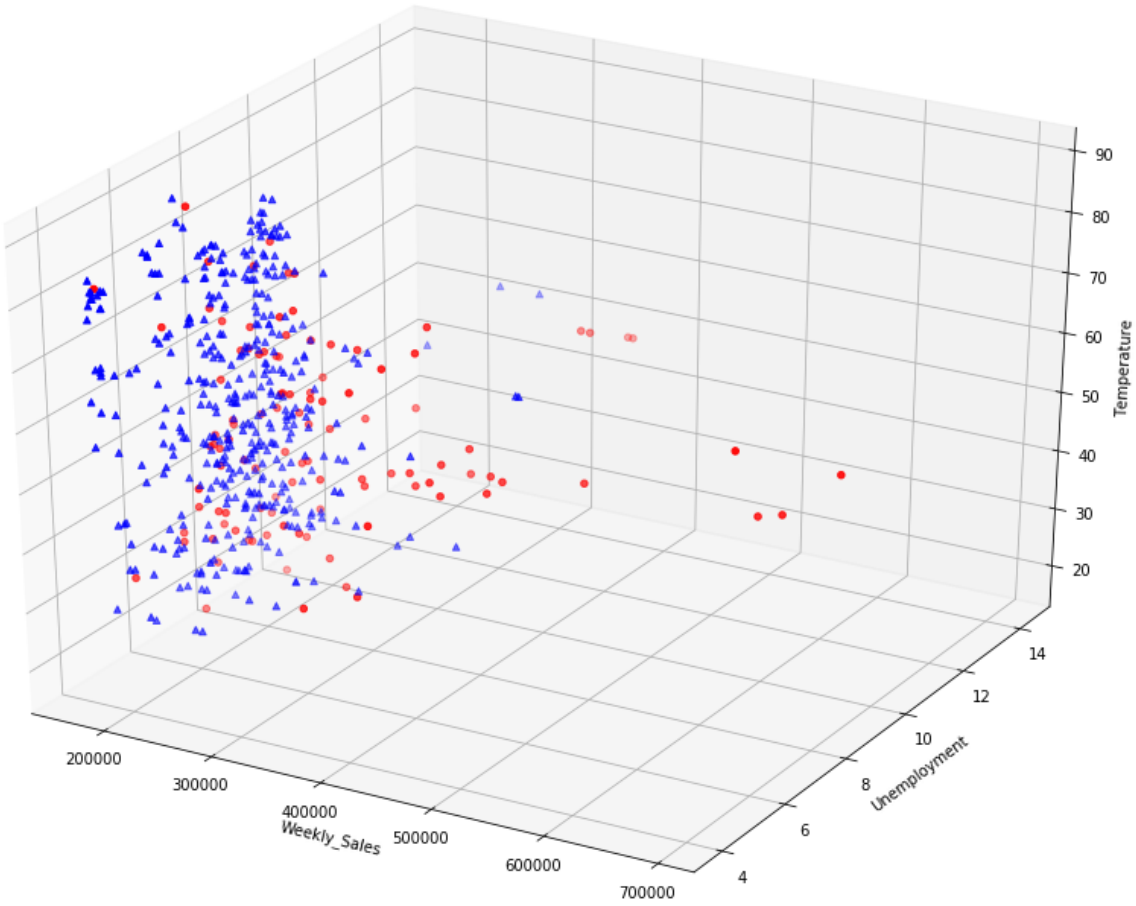
In [32]:
```
top_ten_weekly_sales.describe()
```

Out[32]:

	Store	Dept	Weekly_Sales	Unemployment	Temperature
count	500.00	500.00	500.00	500.00	500.00
mean	14.10	77.46	208,667.25	7.59	51.54
std	8.61	27.57	62,695.45	1.52	16.37
min	1.00	1.00	170,170.92	3.88	17.95
25%	10.00	72.00	177,431.23	6.96	39.37
50%	14.00	92.00	186,580.04	7.82	49.91
75%	20.00	92.00	207,864.04	8.57	64.24
max	45.00	95.00	693,099.36	14.31	88.55

In [33]:
```
feature0_holiday = top_ten_weekly_sales[top_ten_weekly_sales.IsHoliday == True]['Weekly_Sales'].val
ues
feature0_not_holiday = top_ten_weekly_sales[top_ten_weekly_sales.IsHoliday == False]['Weekly_Sales'
].values

feature1_holiday = top_ten_weekly_sales[top_ten_weekly_sales.IsHoliday == True]['Unemployment'].val
ues
feature1_not_holiday = top_ten_weekly_sales[top_ten_weekly_sales.IsHoliday == False]['Unemployment'
].values

feature2_holiday = top_ten_weekly_sales[top_ten_weekly_sales.IsHoliday == True]['Temperature'].valu
es
feature2_not_holiday = top_ten_weekly_sales[top_ten_weekly_sales.IsHoliday == False]['Temperature']
.values
```

In [34]:
```
# Plot the raw data

fig = plt.figure(figsize=(16, 12))
ax = fig.add_subplot(111, projection='3d')



x_ax_holiday = np.array(feature0_holiday)
y_ax_holiday = np.array(feature1_holiday)
z_ax_holiday = np.array(feature2_holiday)

x_ax_not_holiday = np.array(feature0_not_holiday)
y_ax_not_holiday = np.array(feature1_not_holiday)
z_ax_not_holiday = np.array(feature2_not_holiday)


ax.scatter(x_ax_holiday, y_ax_holiday, z_ax_holiday, marker='o', c = 'red')
ax.scatter(x_ax_not_holiday, y_ax_not_holiday, z_ax_not_holiday, marker='^', c = 'blue')



ax.set_xlabel('Weekly_Sales')
ax.set_ylabel('Unemployment')
ax.set_zlabel('Temperature')



plt.show()
```



Requirements

The PDF document and you rIPYNB script that you are submitting on Canvas must have the source code and the output for the following requirements

Requirement #1:

- Discuss the difference between **ROLLUP** and the **CUBE** that can be used in the **Group By** clause of the **SQL-SELECT** statement in PostgreSQL 10.5.

In [ ]:
```
# ROLLUP generates aggregated results based on hierarchy.
# CUBE generates aggregated results accross all of the combinatons of values in the selected column
s.
```

Requirement #2:

- Get the descriptive statisitics per department

In [35]:
```
# Option 1 --- Using the describe() method
weekly_sales.groupby('Dept').describe().head(10)

# Option 2 --- Using agg method with stack()
# weekly_sales.groupby('Dept').agg(['count', 'size', 'nunique', 'max']).stack()
```

Out[35]:

	Store								Weekly_Sales					
	count	mean	std	min	25%	50%	75%	max	count	mean	std	min	25%	50%
Dept														
1	6,435.00	23.00	12.99	1.00	12.00	23.00	34.00	45.00	6,435.00	19,213.49	15,102.37	711.11	10,423.47	15,314.91
2	6,435.00	23.00	12.99	1.00	12.00	23.00	34.00	45.00	6,435.00	43,607.02	25,176.76	5,453.18	22,647.90	41,412.61
3	6,435.00	23.00	12.99	1.00	12.00	23.00	34.00	45.00	6,435.00	11,793.70	12,790.99	2.00	5,338.32	9,260.87
4	6,435.00	23.00	12.99	1.00	12.00	23.00	34.00	45.00	6,435.00	25,974.63	13,261.14	4,695.19	15,722.03	24,259.42
5	6,347.00	22.76	12.91	1.00	12.00	23.00	34.00	45.00	6,347.00	21,365.58	19,988.45	-0.04	10,328.75	18,006.92
6	5,986.00	21.91	12.77	1.00	11.00	21.00	32.00	45.00	5,986.00	4,747.86	4,446.43	-4,988.94	2,417.45	4,067.80
7	6,435.00	23.00	12.99	1.00	12.00	23.00	34.00	45.00	6,435.00	24,161.24	27,985.08	76.81	9,542.85	18,885.93
8	6,435.00	23.00	12.99	1.00	12.00	23.00	34.00	45.00	6,435.00	30,191.26	18,189.72	2,483.26	16,592.91	28,472.64
9	6,354.00	22.85	13.00	1.00	12.00	23.00	34.00	45.00	6,354.00	20,206.68	16,695.73	-132.46	9,339.82	16,890.55
10	6,435.00	23.00	12.99	1.00	12.00	23.00	34.00	45.00	6,435.00	18,321.27	12,992.49	2.46	10,394.96	16,961.42

Requirement #3:

- Use the **CUBE** and dataframe to produce a listing of total sales per department across the entire list of stores

In [36]:
```
cursor.execute("SELECT Store, Dept, sum(Weekly_Sales) from weekly_sales GROUP BY CUBE(Store, Dept)"
)
rows=cursor.fetchall()
```

In [37]:
```
cube_by_store_dept = pd.DataFrame(rows, columns=['Store','Dept','Total'])

#For the pretty print : Replace NaN by -1

cube_by_store_dept['Store'] = cube_by_store_dept['Store'].replace(np.nan,-1)
cube_by_store_dept['Dept'] = cube_by_store_dept['Dept'].replace(np.nan,-1)

#type conversion of values returned by ROLLUP

cube_by_store_dept['Store'] = cube_by_store_dept['Store'].astype(int)
cube_by_store_dept['Dept'] = cube_by_store_dept['Dept'].astype(int)
cube_by_store_dept['Total'] = cube_by_store_dept['Total'].astype(np.float64)


#For the pretty print: Replace -1  by BLANK for Store and department
cube_by_store_dept['Store'].replace(-1,'',inplace=True)
cube_by_store_dept['Dept'].replace(-1,'',inplace=True)


cube_by_store_dept = cube_by_store_dept.sort_values(by=['Store', 'Dept'])
```

In [38]:
```
df1 = cube_by_store_dept

df1.head()
```

Out[38]:

	Store	Dept	Total
13	1	1	3,219,405.18
2017	1	2	6,592,598.93
674	1	3	1,880,518.36
305	1	4	5,285,874.09
37	1	5	3,468,885.58

Requirement #4:

- Use the **CUBE** and dataframe to produce a listing of total sales per store across the entire list of departments for the week of 2010-02-19

In [49]:
```
cursor.execute("SELECT Date, Dept, Store, sum(Weekly_Sales) from weekly_sales GROUP BY CUBE(Date, D
ept, Store)")
rows=cursor.fetchall()
```

In [50]:
```
cube_by_dept_store = pd.DataFrame(rows, columns=['Date','Dept','Store','Total'])

#For the pretty print : Replace NaN by -1

cube_by_dept_store['Dept'] = cube_by_dept_store['Dept'].replace(np.nan,-1)
cube_by_dept_store['Store'] = cube_by_dept_store['Store'].replace(np.nan,-1)

#type conversion of values returned by ROLLUP

cube_by_dept_store['Dept'] = cube_by_dept_store['Dept'].astype(int)
cube_by_dept_store['Store'] = cube_by_dept_store['Store'].astype(int)
cube_by_dept_store['Total'] = cube_by_dept_store['Total'].astype(np.float64)


#For the pretty print: Replace -1  by BLANK for Store and department
cube_by_dept_store['Dept'].replace(-1,'',inplace=True)
cube_by_dept_store['Store'].replace(-1,'',inplace=True)

#For the pretty print: Replace NaN  by BLANK for date
cube_by_dept_store['Date'] = cube_by_dept_store['Date'].dt.date
cube_by_dept_store['Date'].replace(np.nan,'',inplace=True)

cube_by_dept_store = cube_by_dept_store.sort_values(by=['Date','Dept', 'Store'])


df2 = cube_by_dept_store

df2.dtypes
```

Out[50]:
```
Date      object
Dept      object
Store     object
Total    float64
dtype: object
```

In [51]:
```
df2['Date'] = pd.to_datetime(df2['Date'])

df2.head()
```

Out[51]:

	Date	Dept	Store	Total
0	2010-02-05	1	1	24,924.50
1	2010-02-05	1	2	35,034.06
2	2010-02-05	1	3	6,453.58
3	2010-02-05	1	4	38,724.42
4	2010-02-05	1	5	9,323.89

In [52]:
```
df2.dtypes
```

Out[52]:
```
Date     datetime64[ns]
Dept             object
Store            object
Total           float64
dtype: object
```

In [53]:
```
ts = pd.to_datetime('2010-02-19')

df2.loc[df2.Date == ts].head()
```

Out[53]:

	Date	Dept	Store	Total
6070	2010-02-19	1	1	41,595.55
6071	2010-02-19	1	2	58,221.52
6072	2010-02-19	1	3	8,918.31
6073	2010-02-19	1	4	49,937.09
6074	2010-02-19	1	5	11,417.67

Requirement #5:

- Use the **CUBE** and dataframe to produce a listing of total sales per department across the entire list of stores for the week of 2010-02-19

In [54]:
```
cursor.execute("SELECT Date, Store, Dept, sum(Weekly_Sales) from weekly_sales GROUP BY CUBE(Date, S
tore, Dept)")
rows=cursor.fetchall()
```

In [55]:
```
cube_by_dept_store_dates = pd.DataFrame(rows, columns=['Date','Store','Dept','Total'])

#For the pretty print : Replace NaN by -1

cube_by_dept_store_dates['Dept'] = cube_by_dept_store_dates['Dept'].replace(np.nan,-1)
cube_by_dept_store_dates['Store'] = cube_by_dept_store_dates['Store'].replace(np.nan,-1)

#type conversion of values returned by ROLLUP

cube_by_dept_store_dates['Dept'] = cube_by_dept_store_dates['Dept'].astype(int)
cube_by_dept_store_dates['Store'] = cube_by_dept_store_dates['Store'].astype(int)
cube_by_dept_store_dates['Total'] = cube_by_dept_store_dates['Total'].astype(np.float64)


#For the pretty print: Replace -1  by BLANK for Store and department
cube_by_dept_store_dates['Dept'].replace(-1,'',inplace=True)
cube_by_dept_store_dates['Store'].replace(-1,'',inplace=True)

#For the pretty print: Replace NaN  by BLANK for date
cube_by_dept_store_dates['Date'] = cube_by_dept_store_dates['Date'].dt.date
cube_by_dept_store_dates['Date'].replace(np.nan,'',inplace=True)

cube_by_dept_store_dates = cube_by_dept_store_dates.sort_values(by=['Date', 'Store','Dept'])


df3 = cube_by_dept_store_dates

df3.dtypes
```

Out[55]:
```
Date      object
Store     object
Dept      object
Total    float64
dtype: object
```

In [56]:
```
df3['Date'] = pd.to_datetime(df3['Date'])
```

In [57]:
```
df3.dtypes
```

Out[57]:
```
Date     datetime64[ns]
Store            object
Dept             object
Total           float64
dtype: object
```

In [59]:
```
pd.reset_option('display.max_rows')

ts = pd.to_datetime('2010-02-19')

df3.loc[df3.Date == ts].head()
```

Out[59]:

	Date	Store	Dept	Total
6003	2010-02-19	1	1	41,595.55
6004	2010-02-19	1	2	47,928.89
6005	2010-02-19	1	3	11,523.47
6006	2010-02-19	1	4	36,826.95
6007	2010-02-19	1	5	26,468.27

Requirement #6:

- Get the top 500 weekly sales and plot them (Red color for Unemployment greater than or equal to 5 and Green color if it is less than 5) against the weekly Unemployment and Temperature

In [60]:
```
top_500_weekly_sales = weekly_sales[:500]

top_500_weekly_sales.head()
```

Out[60]:

	Store	Dept	Date	Weekly_Sales	IsHoliday
95373	10	72	2010-11-26	693,099.36	True
338013	35	72	2011-11-25	649,770.18	True
95425	10	72	2011-11-25	630,999.19	True
337961	35	72	2010-11-26	627,962.93	True
135665	14	72	2010-11-26	474,330.10	True

In [61]:
```
unemployment = []
temperature = []

for row in top_500_weekly_sales.itertuples():
    temperature.append(weekly_sales_temp_unemp[(weekly_sales_temp_unemp.Store == row.Store) & (week
ly_sales_temp_unemp.Date == row.Date)]['Temperature'].values[0])
    unemployment.append(weekly_sales_temp_unemp[(weekly_sales_temp_unemp.Store == row.Store) & (wee
kly_sales_temp_unemp.Date == row.Date)]['Unemployment'].values[0])
```

In [62]:
```
se_unemployment = pd.Series(unemployment)
se_temperature = pd.Series(temperature)
```

In [64]:
```
top_500_weekly_sales.insert(loc=5, column='Unemployment', value=se_unemployment.values)
top_500_weekly_sales.insert(loc=6, column='Temperature', value=se_temperature.values)
```

In [65]:
```
top_500_weekly_sales.head()
```

Out[65]:

	Store	Dept	Date	Weekly_Sales	IsHoliday	Unemployment	Temperature
95373	10	72	2010-11-26	693,099.36	True	9.00	55.33
338013	35	72	2011-11-25	649,770.18	True	8.74	47.88
95425	10	72	2011-11-25	630,999.19	True	7.87	60.68
337961	35	72	2010-11-26	627,962.93	True	8.76	46.67
135665	14	72	2010-11-26	474,330.10	True	8.72	46.15

In [83]:
```
feature0_red = top_500_weekly_sales[top_500_weekly_sales.Unemployment >= 5.00]['Weekly_Sales'].valu
es
feature0_green = top_500_weekly_sales[top_500_weekly_sales.Unemployment < 5.00]['Weekly_Sales'].val
ues

feature1_red = top_500_weekly_sales[top_500_weekly_sales.Unemployment >= 5.00]['Unemployment'].valu
es
feature1_green = top_500_weekly_sales[top_500_weekly_sales.Unemployment < 5.00]['Unemployment'].val
ues

feature2_red = top_500_weekly_sales[top_500_weekly_sales.Unemployment >= 5.00]['Temperature'].value
s
feature2_green = top_500_weekly_sales[top_500_weekly_sales.Unemployment < 5.00]['Temperature'].valu
es
```

In [84]:
```
# Plot the raw data

fig = plt.figure(figsize=(16, 12))
ax = fig.add_subplot(111, projection='3d')



x_ax_red = np.array(feature0_red)
y_ax_red = np.array(feature1_red)
z_ax_red = np.array(feature2_red)

x_ax_green = np.array(feature0_green)
y_ax_green = np.array(feature1_green)
z_ax_green = np.array(feature2_green)


ax.scatter(x_ax_red, y_ax_red, z_ax_red, marker='o', c = 'red')
ax.scatter(x_ax_green, y_ax_green, z_ax_green, marker='^', c = 'green')



ax.set_xlabel('Weekly_Sales')
ax.set_ylabel('Unemployment')
ax.set_zlabel('Temperature')



plt.show()
```