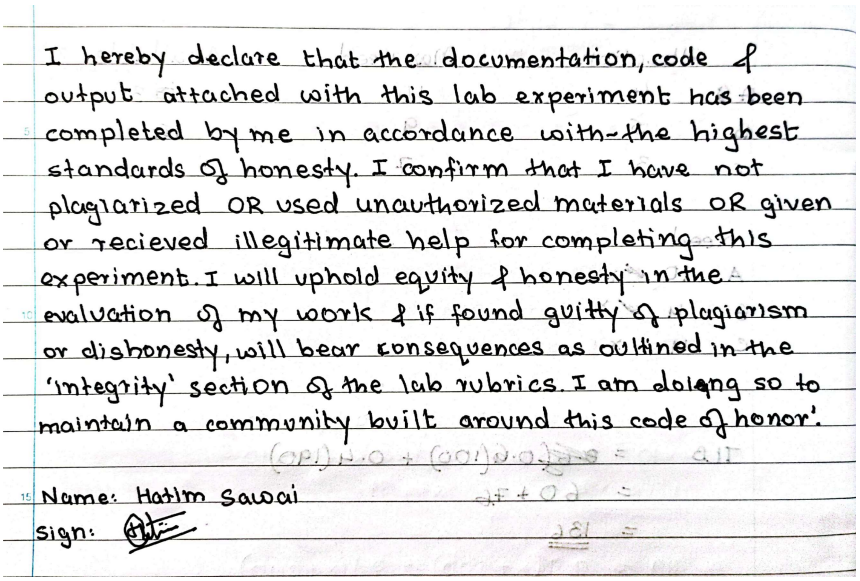
Name	Hatim Sawai
UID No.	2021300108

Experiment 7

HONOR PLEDGE	
PROBLEM STATEMENT	**Title: Big data analysis using Hive/ Use of Graph database** 1. Import the batch-specific data and store it as a Hive Table 2. Perform a Hive query on your uploaded dataset 3. Pull data into a spark dataframe and repeat the query using a spark dataframe 4. Link neo4j to your underlying datastore and run a graph query
THEORY	**1. Hadoop** **Overview:** Hadoop is an open-source framework designed for distributed storage and processing of large data sets across clusters of commodity hardware. It provides a distributed file system (HDFS) for storage and a framework (MapReduce) for processing and analyzing large datasets. **Installation:** Guide Followed: Hadoop-on-Ubuntu 1. Create New User for Hadoop: sudo adduser hdoop & su - hdoop 2. Set Up SSH Keys: ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa 3. Download the latest stable release of Hadoop from the Apache Hadoop Website. 4. Configure Hadoop Environment: Set JAVA_HOME in /usr/local/hadoop/etc/hadoop/hadoop-env.sh

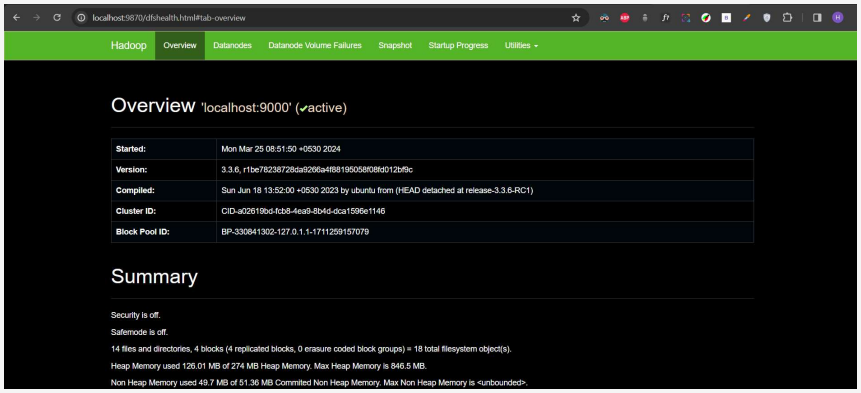
5. Update Hadoop's XML configuration files with default config:
6. Initialize the Hadoop filesystem namespace: /usr/local/hadoop/bin/hdfs namenode -format

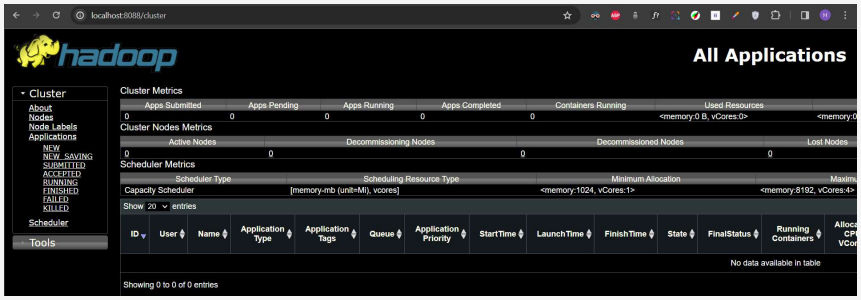
```
hdoop@DESKTOP-5UL8JKF:~$ start-dfs.sh
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [DESKTOP-5UL8JKF]
hdoop@DESKTOP-5UL8JKF:~$ start-yarn.sh
Starting resourcemanager
Starting nodemanagers
hdoop@DESKTOP-5UL8JKF:~$
```

7. Start Hadoop, Launch HDFS and YARN services: start-all.sh, verify using: jps

```
hdoop@DESKTOP-5UL8JKF:~$ jps
64678 Jps
935 NameNode
1720 NodeManager
1242 SecondaryNameNode
1051 DataNode
1598 ResourceManager
hdoop@DESKTOP-5UL8JKF:~$
```

8. Check localhost:9870 for Hadoop UI and localhost:8088 for YARN UI:





2. Hive

Overview:

Hive is a data warehouse infrastructure built on top of

Hadoop for providing data summarization, query, and analysis. It provides a SQL-like interface (HiveQL) to query and analyze data stored in Hadoop's distributed file system (HDFS).

Installation:

Guide Followed: Hive-on-Ubuntu

1. Download the latest stable release of Hive from the Apache Hive website.
2. Extract the downloaded archive to a directory on your WSL Ubuntu system.
3. Set up environment variables in your `.bashrc` file to specify the Hive home directory and add Hive's bin directory to your PATH.
4. Configure Hive's XML files (`hive-site.xml`, `hive-default.xml`, etc.) according to your Hadoop and metastore setup.
5. Create Hive Directories in HDFS, Create two separate directories to store data in the HDFS layer: tmp & warehouse 6. Initiate Derby Database: $HIVE_HOME/bin/schematool -dbType derby -initSchema
7. Start Hive services and the metastore using the provided scripts (`hive --service metastore`, etc.).

```
hdoop@DESKTOP-5UL8JKF:~/apache-hive-3.1.2-bin/bin$ hive
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/home/hdoop/apache-hive-3.1.2-bin/lib/log4j-slf4j-impl-2.10.
/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/local/hadoop/share/hadoop/common/lib/slf4j-reload4j-1.7
4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
SLF4J: Actual binding is of type [org.apache.logging.slf4j.Log4jLoggerFactory]
Hive Session ID = bc63537d-dd02-4292-806a-2bafc4bcee4f

Logging initialized using configuration in jar:file:/home/hdoop/apache-hive-3.1.2-bin/lib/hive
r!/hive-log4j2.properties Async: true
Hive-on-MR is deprecated in Hive 2 and may not be available in the future versions. Consider u
  execution engine (i.e. spark, tez) or using Hive 1.X releases.
Hive Session ID = b7729195-232a-434e-ae7e-293192d9374d
hive> show tables;
OK
enron
temp_employee
Time taken: 1.668 seconds, Fetched: 2 row(s)
hive>
```

```
hdoop@DESKTOP-5UL8JKF:~$ cd $HIVE_HOME/bin
hdoop@DESKTOP-5UL8JKF:~/apache-hive-3.1.2-bin/bin$ hive --service metastore
2024-03-25 08:57:18: Starting Hive Metastore Server
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/home/hdoop/apache-hive-3.1.2-bin/lib/log4j-slf4
/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/local/hadoop/share/hadoop/common/lib/slf4j-
4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
SLF4J: Actual binding is of type [org.apache.logging.slf4j.Log4jLoggerFactory]
```

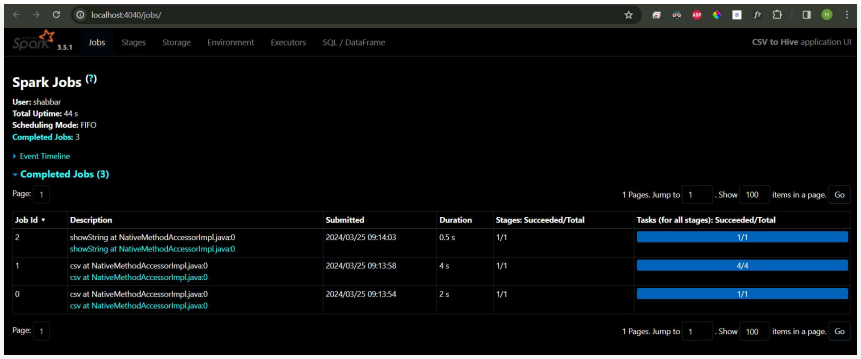
3. Spark

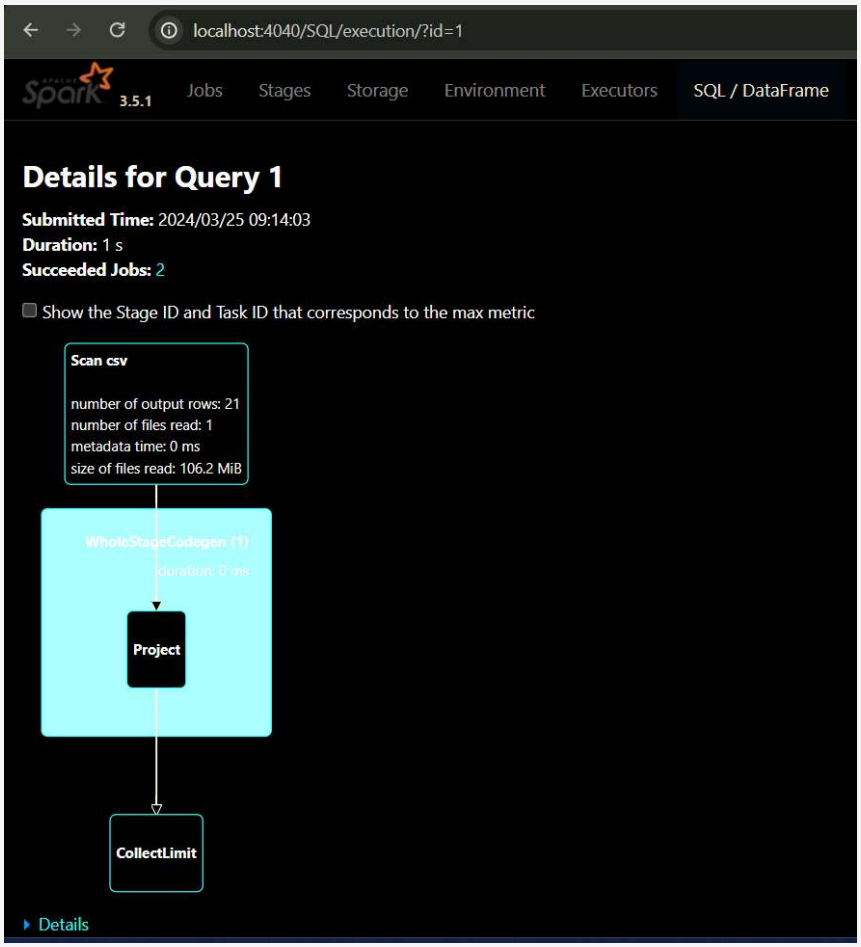
Overview:

Apache Spark is an open-source, distributed computing system that provides an interface for programming entire clusters with implicit data parallelism and fault tolerance. It supports various programming languages such as Scala, Java, Python, and R.

Installation:

pip install spark (in python notebook)





4. Neo4j

Overview:

Neo4j is a graph database management system that provides an efficient and expressive way to store, manage, and query highly connected data. It is optimized for handling graph data and supports powerful querying capabilities using the Cypher query language.

Installation:

Guide Followed: Neo4j-on-Ubuntu

1. Download the latest stable release of Neo4j from the Neo4j Website
2. Follow the installation instructions provided for Linux distributions.
3. After installation, start the Neo4j service using the provided startup scripts: sudo systemctl enable/start/edit/status/stop neo4j.service.

	4. Access the Neo4j browser interface using a web browser and connect to the Neo4j database.

1. Importing Libraries & Dataset

In [ ]:
```
import re
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from pyspark.sql import SparkSession
# read csv file
df = pd.read_csv('../Datasets/enron.csv', index_col=0, low_memory=False)
df.head()
```

Out[ ]:

	Message-ID	Date	Fr
0	<18782981.1075855378110.JavaMail.evans@thyme>	2001-05-14 23:39:00	frozenset({'phillip.allen@enron.cor
1	<15464986.1075855378456.JavaMail.evans@thyme>	2001-05-04 20:51:00	frozenset({'phillip.allen@enron.cor
2	<24216240.1075855687451.JavaMail.evans@thyme>	2000-10-18 10:00:00	frozenset({'phillip.allen@enron.cor
3	<13505866.1075863688222.JavaMail.evans@thyme>	2000-10-23 13:13:00	frozenset({'phillip.allen@enron.cor
4	<30922949.1075863688243.JavaMail.evans@thyme>	2000-08-31 12:07:00	frozenset({'phillip.allen@enron.cor

5 rows × 51 columns

2. Preprocessing Data

In [ ]:
```
def sanitize_column_name(name):
    return re.sub(r'[^A-Za-z0-9_]', '_', name)

new_columns = [sanitize_column_name(col) for col in df.columns]
df.columns = new_columns
df.to_csv("../Datasets/cleaned_enron.csv", index=False)
```

In [ ]:
```
df_new = pd.read_csv('../Datasets/cleaned_enron.csv', index_col=0, low_memory=False
df_new.shape[0]
df_subset = df.iloc[:50000]
df_subset.to_csv("../Datasets/enron_chunk.csv", index=False)
```

In [ ]:
```
df_subset = pd.read_csv('../Datasets/enron_chunk.csv', index_col=0, low_memory=Fals
print(df_subset.shape[0])
df_subset.head()
```

```
50000
```

Out[ ]:

Message_ID	Date	Fr
<18782981.1075855378110.JavaMail.evans@thyme>	2001-05-14 23:39:00	frozenset({'phillip.allen@enron.co
<15464986.1075855378456.JavaMail.evans@thyme>	2001-05-04 20:51:00	frozenset({'phillip.allen@enron.co
<24216240.1075855687451.JavaMail.evans@thyme>	2000-10-18 10:00:00	frozenset({'phillip.allen@enron.co
<13505866.1075863688222.JavaMail.evans@thyme>	2000-10-23 13:13:00	frozenset({'phillip.allen@enron.co
<30922949.1075863688243.JavaMail.evans@thyme>	2000-08-31 12:07:00	frozenset({'phillip.allen@enron.co

5 rows × 50 columns

3. Loading Dataset to a Spark Dataframe

In [ ]:
```
# Create SparkSession
spark = SparkSession.builder \
    .appName("CSV to Hive") \
    .config("hive.metastore.uris", "thrift://localhost:9083") \
    .enableHiveSupport() \
    .getOrCreate()

# Read CSV file into DataFrame
csv_file_path = "./eron2.csv"
df1 = spark.read.csv(csv_file_path, header=True, inferSchema=True)
# Define a function to sanitize column names
# def sanitize_column_name(name):
#     return re.sub(r'[^A-Za-z0-9_]', '_', name)

# new_columns = [sanitize_column_name(col) for col in df1.columns]
# df1 = df1.toDF(*new_columns)
df1.show()
```

```
your 131072x1 screen size is bogus. expect trouble
Warning: Ignoring non-Spark config property: hive.metastore.uris
24/03/24 11:55:07 WARN Utils: Your hostname, DESKTOP-5UL8JKF resolves to a loopback
address: 127.0.1.1; using 172.27.122.177 instead (on interface eth0)
24/03/24 11:55:07 WARN Utils: Set SPARK_LOCAL_IP if you need to bind to another addr
ess
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(ne
wLevel).
24/03/24 11:55:10 WARN NativeCodeLoader: Unable to load native-hadoop library for yo
ur platform... using builtin-java classes where applicable
24/03/24 11:55:30 WARN SparkStringUtils: Truncated the string representation of a pl
an since it was too large. This behavior can be adjusted by setting 'spark.sql.debu
g.maxToStringFields'.
```

```
+--------------------+--------------------+--------------------+--------------------+
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+--------------------+-------------+--------------------+--------------------+------
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-----------+------------+-----------+------------+------------+------------+---
----------+-------------+------------+-------------+-------------+------------
+-------------+-------------+------------+-------+
|          Message_ID|                Date|                From|                  To|
Subject|         X_From|               X_To|               X_cc|X_bcc|
X_Folder|            X_Origin|          X_FileName|             content|
user|       Cat_1_level_1|       Cat_1_level_2|        Cat_1_weight|       Cat_2_lev
el_1|       Cat_2_level_2|        Cat_2_weight|       Cat_3_level_1|       Cat_3_lev
el_2|        Cat_3_weight|       Cat_4_level_1|       Cat_4_level_2|       Cat_4_wei
ght| Cat_5_level_1|       Cat_5_level_2|        Cat_5_weight|       Cat_6_level_1|Ca
t_6_level_2|Cat_6_weight|Cat_7_level_1|Cat_7_level_2|Cat_7_weight|Cat_8_level_1|Cat_
8_level_2|Cat_8_weight|Cat_9_level_1|Cat_9_level_2|Cat_9_weight|Cat_10_level_1|Cat_1
0_level_2|Cat_10_weight|Cat_11_level_1|Cat_11_level_2|Cat_11_weight|Cat_12_level_1|C
at_12_level_2|Cat_12_weight|labeled|
+--------------------+--------------------+--------------------+--------------------+
--------------------+--------------+--------------------+--------------------+-----
+--------------------+--------------------+--------------------+--------------------
+--------------------+--------------------+--------------------+--------------------
+--------------------+--------------------+--------------------+--------------------
+--------------------+--------------------+--------------------+--------------------
+--------------------+-------------+--------------------+--------------------+------
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-----------+------------+-----------+------------+------------+------------+---
----------+-------------+------------+-------------+-------------+------------
+-------------+-------------+------------+-------+
|<18782981.1075855...|2001-05-14 23:39:00|frozenset({'phill...|frozenset({'tim.b...|
NULL|Phillip K Allen|Tim Belden <Tim B...|                NULL| NULL|\Phillip_Allen_
Ja...|             Allen-P|pallen (Non-Privi...|Here is our forecast|             al
len-p|                NULL|                NULL|                NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|               N
ULL|          NULL|               NULL|               NULL|               NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<15464986.1075855...|2001-05-04 20:51:00|frozenset({'phill...|frozenset({'john....|
Re:|Phillip K Allen|John J Lavorato <...|                NULL| NULL|\Phillip_Allen_J
a...|             Allen-P|pallen (Non-Privi...|Traveling to have...|             all
en-p|                NULL|                NULL|                NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|               N
ULL|          NULL|               NULL|               NULL|               NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<24216240.1075855...|2000-10-18 10:00:00|frozenset({'phill...|frozenset({'leah....|
```

```
Re: test|Phillip K Allen|    Leah Van Arsdall|                NULL| NULL|\Phillip_Al
len_De...|             Allen-P|          pallen.nsf|test successful. ...|
allen-p|                NULL|               NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|                N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<13505866.1075863...|2000-10-23 13:13:00|frozenset({'phill...|frozenset({'randa...|
NULL|Phillip K Allen|       Randall L Gay|                NULL| NULL|\Phillip_Allen_
De...|             Allen-P|          pallen.nsf|Randy, Can you se...|             al
len-p|                NULL|               NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|                N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<30922949.1075863...|2000-08-31 12:07:00|frozenset({'phill...|frozenset({'greg....|
Re: Hello|Phillip K Allen|          Greg Piper|                NULL| NULL|\Phillip_A
llen_De...|             Allen-P|          pallen.nsf|Let's shoot for T...|
allen-p|                NULL|               NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|                N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<30965995.1075863...|2000-08-31 11:17:00|frozenset({'phill...|frozenset({'greg....|
Re: Hello|Phillip K Allen|          Greg Piper|                NULL| NULL|\Phillip_A
llen_De...|             Allen-P|          pallen.nsf|Greg, How about e...|
allen-p|                NULL|               NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|                N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<16254169.1075863...|2000-08-22 14:44:00|frozenset({'phill...|frozenset({'david...|
NULL|Phillip K Allen|david.l.johnson@e...|                NULL| NULL|\Phillip_Allen_
De...|             Allen-P|          pallen.nsf|Please cc the fol...|             al
len-p|                NULL|               NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|                N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<17189699.1075863...|2000-07-14 13:59:00|frozenset({'phill...|frozenset({'joyce...|
Re: PRC review - ...|Phillip K Allen|      Joyce Teixeira|                NULL| NULL
```

```
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|any morning betwe...
|             allen-p|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|               NULL|          NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|  False|
|<20641191.1075855...|2000-10-17 09:26:00|frozenset({'phill...|frozenset({'mark....|
Re: High Speed In...|Phillip K Allen|          Mark Scott|                NULL| NULL
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|1. login: pallen ...
|             allen-p|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|               NULL|          NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|  False|
|<30795301.1075855...|2000-10-16 13:44:00|frozenset({'phill...|frozenset({'zimam...|
FW: fixed forward...|Phillip K Allen|     zimam@enron.com|                NULL| NULL
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|"----------------...
| Buck"" <buck.buc...| > As discussed d...| In a Parallon 75...| I am developing ...
| I need your > be...|                   3|                   5| 7 and 10 years f...
| truly you. > > W...| during peak > el...| give me a call. ...| this is real dea...
|               P.E.| MBA > Manager| Business Develop...| Inc. > 8725 Pan ...| NM 87
113 > 505-7...|      allen-p|        NULL|         NULL|         NULL|        NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|          N
ULL|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|   NULL|
|<33076797.1075855...|2000-10-16 13:42:00|frozenset({'phill...|frozenset({'buck....|
Re: FW: fixed for...|Phillip K Allen|          """Buckner| Buck"" <buck.buc...| NULL
|                NULL|\Phillip_Allen_De...|             Allen-P|          pallen.nsf
|Mr. Buckner, For ...|             allen-p|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|               NULL|          NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|   NULL|
|<25459584.1075855...|2000-10-13 13:45:00|frozenset({'phill...|frozenset({'stage...|
NULL|Phillip K Allen|stagecoachmama@ho...|                NULL| NULL|\Phillip_Allen_
De...|             Allen-P|          pallen.nsf|Lucy, Here are th...|             al
len-p|                NULL|                NULL|                NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|               N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<13116875.1075855...|2000-10-09 14:16:00|frozenset({'phill...|frozenset({'keith...|
Consolidated posi...|Phillip K Allen|         Keith Holst|                NULL| NULL
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|-----------------...
```

```
|             allen-p|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|               NULL|           NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|  False|
|<2707340.10758556...|2000-10-09 14:00:00|frozenset({'phill...|frozenset({'keith...|
Consolidated posi...|Phillip K Allen|         Keith Holst|                NULL| NULL
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|-----------------...
|             allen-p|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|               NULL|           NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|  False|
|<2465689.10758556...|2000-10-05 13:26:00|frozenset({'phill...|frozenset({'david...|
NULL|Phillip K Allen|    David W Delainey|                NULL| NULL|\Phillip_Allen_
De...|             Allen-P|          pallen.nsf|Dave, Here are th...|             al
len-p|                NULL|                NULL|                NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|               N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<1115198.10758556...|2000-10-05 12:55:00|frozenset({'phill...|frozenset({'paula...|
Re: 2001 Margin Plan|Phillip K Allen|        Paula Harris|                NULL| NULL
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|Paula, 35 million...
|             allen-p|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|               NULL|           NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|  False|
|<19773657.1075855...|2000-10-04 16:23:00|frozenset({'phill...|frozenset({'ina.r...|
Var, Reporting an...|Phillip K Allen|          Ina Rangel|                NULL| NULL
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|-----------------...
|             allen-p|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|                NULL|                NULL|                NULL|                NULL
|               NULL|           NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|  False|
|<7391389.10758553...|2001-05-04 18:26:00|frozenset({'phill...|frozenset({'tim.h...|
NULL|Phillip K Allen|Tim Heizenrader <...|                NULL| NULL|\Phillip_Allen_
Ja...|             Allen-P|pallen (Non-Privi...|Tim, mike grigsby...|             al
len-p|                NULL|                NULL|                NULL|
```

```
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|                N
ULL|          NULL|                NULL|                NULL|                NULL|
NULL|        NULL|         NULL|         NULL|        NULL|         NULL|         NU
LL|        NULL|         NULL|         NULL|        NULL|          NULL|          NU
LL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|  False|
|<12759088.1075855...|2000-10-03 16:30:00|frozenset({'phill...|frozenset({'palle...|
Westgate|Phillip K Allen|pallen70@hotmail.com|                NULL| NULL|\Phillip_Al
len_De...|             Allen-P|          pallen.nsf|"-----------------...|   let me k
now. Then| let me know your...| which now has a ...| roughly $1.25 pe...| but by ind
ividua...| just as the dupl...| please let me kn...| very short windo...| but it wou
ld be ...|000 to secure the...| George W. Richar...|  Creekside Builders| LLC - winm
ail.dat"|       allen-p|                NULL|                NULL|                NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|         NULL
|         NULL|        NULL|         NULL|         NULL|        NULL|          NULL|
NULL|         NULL|          NULL|          NULL|         NULL|          NULL|
NULL|         NULL|   NULL|
|<29177675.1075855...|2000-10-03 16:15:00|frozenset({'phill...|frozenset({'ina.r...|
Meeting re: Stora...|Phillip K Allen|          Ina Rangel|                NULL| NULL
|\Phillip_Allen_De...|             Allen-P|          pallen.nsf|-----------------...
|              allen-p|                NULL|                NULL|                NULL
|                 NULL|                NULL|                NULL|                NULL
|                 NULL|                NULL|                NULL|                NULL
|                NULL|          NULL|                NULL|                NULL|
NULL|         NULL|        NULL|         NULL|         NULL|        NULL|         NU
LL|         NULL|        NULL|         NULL|         NULL|        NULL|          NUL
L|          NULL|         NULL|          NULL|          NULL|         NULL|
NULL|          NULL|         NULL|  False|
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only showing top 20 rows
```

4. Using Spark to load Data into Hive Table

In [ ]:
```
# Extract schema from DataFrame
schema = df1.schema
print(schema)
```

```
StructType([StructField('Message_ID', StringType(), True), StructField('Date', Strin
gType(), True), StructField('From', StringType(), True), StructField('To', StringTyp
e(), True), StructField('Subject', StringType(), True), StructField('X_From', String
Type(), True), StructField('X_To', StringType(), True), StructField('X_cc', StringTy
pe(), True), StructField('X_bcc', StringType(), True), StructField('X_Folder', Strin
gType(), True), StructField('X_Origin', StringType(), True), StructField('X_FileNam
e', StringType(), True), StructField('content', StringType(), True), StructField('us
er', StringType(), True), StructField('Cat_1_level_1', StringType(), True), StructFi
eld('Cat_1_level_2', StringType(), True), StructField('Cat_1_weight', StringType(),
True), StructField('Cat_2_level_1', StringType(), True), StructField('Cat_2_level_
2', StringType(), True), StructField('Cat_2_weight', StringType(), True), StructFiel
d('Cat_3_level_1', StringType(), True), StructField('Cat_3_level_2', StringType(), T
rue), StructField('Cat_3_weight', StringType(), True), StructField('Cat_4_level_1',
StringType(), True), StructField('Cat_4_level_2', StringType(), True), StructField
('Cat_4_weight', StringType(), True), StructField('Cat_5_level_1', StringType(), Tru
e), StructField('Cat_5_level_2', StringType(), True), StructField('Cat_5_weight', St
ringType(), True), StructField('Cat_6_level_1', StringType(), True), StructField('Ca
t_6_level_2', StringType(), True), StructField('Cat_6_weight', StringType(), True),
StructField('Cat_7_level_1', StringType(), True), StructField('Cat_7_level_2', Strin
gType(), True), StructField('Cat_7_weight', StringType(), True), StructField('Cat_8_
level_1', StringType(), True), StructField('Cat_8_level_2', StringType(), True), Str
uctField('Cat_8_weight', StringType(), True), StructField('Cat_9_level_1', StringTyp
e(), True), StructField('Cat_9_level_2', StringType(), True), StructField('Cat_9_wei
ght', StringType(), True), StructField('Cat_10_level_1', StringType(), True), Struct
Field('Cat_10_level_2', StringType(), True), StructField('Cat_10_weight', StringType
(), True), StructField('Cat_11_level_1', StringType(), True), StructField('Cat_11_le
vel_2', StringType(), True), StructField('Cat_11_weight', StringType(), True), Struc
tField('Cat_12_level_1', StringType(), True), StructField('Cat_12_level_2', StringTy
pe(), True), StructField('Cat_12_weight', StringType(), True), StructField('labele
d', StringType(), True)])
```

In [ ]:
```
# Create Hive table with extracted schema
table_name = "enron"
schema_ddl = ','.join([f'{field.name} {field.dataType.simpleString()}' for field in
create_table_query = f"CREATE TABLE IF NOT EXISTS {table_name} ({schema_ddl}) STORE
spark.sql(create_table_query)
```

```
24/03/24 11:46:32 WARN SessionState: METASTORE_FILTER_HOOK will be ignored, since hi
ve.security.authorization.manager is set to instance of HiveAuthorizerFactory.
```

Out[ ]: DataFrame[]

In [ ]:
```
# Load data into Hive table
df1.write.mode("overwrite").saveAsTable(table_name)
```

In [ ]:
```
spark.stop()
```

5. Performing Hive Queries

In [ ]:
```
# Create SparkSession
spark = SparkSession.builder \
    .appName("Load Hive Table") \
    .config("hive.metastore.uris", "thrift://localhost:9083") \
    .enableHiveSupport() \
    .getOrCreate()

# Load Hive table into DataFrame
df = spark.sql("SELECT * FROM enron")

# Show DataFrame
df.show()
```

```
24/03/24 11:55:41 WARN SparkSession: Using an existing Spark session; only runtime S
QL configurations will take effect.
[Stage 3:>                                                          (0 + 1) / 1]
```

```
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--------------------+--------------------+--------------------+
|          Message_ID|                Date|                From|                  To|
Subject|              X_From|                X_To|               X_cc|
X_bcc|             X_Folder|            X_Origin|          X_FileName|             co
ntent|                 user|       Cat_1_level_1|       Cat_1_level_2|        Cat_1_w
eight|       Cat_2_level_1|       Cat_2_level_2|        Cat_2_weight|       Cat_3_le
vel_1|       Cat_3_level_2|        Cat_3_weight|       Cat_4_level_1|       Cat_4_le
vel_2|        Cat_4_weight|       Cat_5_level_1|       Cat_5_level_2|        Cat_5_w
eight|       Cat_6_level_1|       Cat_6_level_2|        Cat_6_weight|       Cat_7_le
vel_1|       Cat_7_level_2|        Cat_7_weight|       Cat_8_level_1|       Cat_8_le
vel_2|        Cat_8_weight|       Cat_9_level_1|       Cat_9_level_2|        Cat_9_w
eight|      Cat_10_level_1|      Cat_10_level_2|       Cat_10_weight|      Cat_11_le
vel_1|      Cat_11_level_2|       Cat_11_weight|      Cat_12_level_1|      Cat_12_le
vel_2|       Cat_12_weight|             labeled|
+--------------------+--------------------+--------------------+--------------------+
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|<25542984.1075854...|2000-04-20 10:11:00|frozenset({'eric....|frozenset({'lwbth...|
Fwd: Qualify for ...|           Eric Bass|lwbthemarine@bigp...|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|"Thought you mig
h...| 19 Apr 2000 20:5...| queueup Copyrigh...| Inc. 2000)with s...| 19 Apr 2000 >2
0:...|000+ FREE FREE > $25|           000 - $99|999 FREE $14.95 >...|000 $14.95 $14.
95...| 7 >days a week. ...|         November 18| 1999. Barron's i...|  money market
funds|        mutual funds|              stocks| and >bonds >held...|          000 s
hares| >each additional...| Inc. Member NASD...| Inc. and is >not...| just hit the r
ep...| review or >chang...| Free Email at ht...|              bass-e|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|
|<5541885.10758546...|2000-04-20 16:27:00|frozenset({'eric....|frozenset({'timot...|
NULL|           Eric Bass|   Timothy Blanchard|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|----------------
-...|              bass-e|                NULL|                NULL|
```

```
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|               False|
|<28915064.1075854...|2000-04-24 08:31:00|frozenset({'eric....|"frozenset({""o'n...|
'david.baumbach@...| 'jeffrey.gossett...| 'amir.ahanchian@...| 'kenneth.shulkla...|
'timothy.blancha...| 'nick.hiemstra@e...| 'matthew.lenhart...| 'bryan.hull@enro...|
'luis.mena@enron...| 'brian.hoskins@e...|        Game Tonight|           Eric Bass|B
rian Hoskins, Lu...|                NULL|                NULL|\Eric_Bass_Dec200...|
Bass-E|           ebass.nsf|We have a game to...|              bass-e|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|
|<6649833.10758546...|2000-04-26 08:55:00|frozenset({'eric....|frozenset({'georg...|
WH DATA|           Eric Bass|     George Weissman|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|Here is the wh d
a...|              bass-e|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|               False|
|<27501004.1075854...|2000-04-26 11:12:00|frozenset({'eric....|frozenset({'timot...|
I'm Having a Party!|           Eric Bass|Timothy Blanchard...|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|"----------------
-...| ""Michael Galiun...| ""Robert Garcia"...| ""Kara Lynn Holm...|            ""Ho
ward| Patrick"" <Howar...|          ""Robinson| Jesse"" <Jesse.R...| Kevin Swantkows
k...| ""Curtis Willefo...| bwoodwar@central...| ""Lee Zieben"" <...|     jhcl@dyneg
y.com| Chad Starnes/Cor...| Billy Braddock/E...| dwighthelms@aol.com| Michael Stockt
on...| Janel Guerrero/C...| April 29th- All ...| Duck Soup will b...| the more the m
er...| please call. If ...| let me know by F...|              bass-e|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|
|<30641730.1075854...|2000-04-26 16:46:00|frozenset({'eric....|frozenset({'lwbth...|
Fw: Corruption Test|           Eric Bass|"lwbthemarine@big...| mballases@hotmai...|
Jason.Bass2@COMP...|                NULL|                NULL|\Eric_Bass_Dec200...|
Bass-E|           ebass.nsf|------------------...|              bass-e|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
```

```
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|
|<2149245.10758546...|2000-04-26 16:47:00|frozenset({'eric....|frozenset({'shuss...|
Fw: Corruption Test|           Eric Bass|   Shusser@enron.com|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|i bet you score
o...|              bass-e|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|               False|
|<29739912.1075854...|1999-12-14 09:40:00|frozenset({'eric....|frozenset({'danie...|
Fw: FROGAPULT, EL...|           Eric Bass|danielles@jonesgr...|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|"---------------
-...| M.S."" <rparry@b...| M.S."" <rparry@b...|             ELFBOWL| Y2KGAME Virus H
o...|             ELFBOWL| Y2KGAME Virus Ho...|         December 13| 1999 11:37 AM S
u...|             ELFBOWL| Y2KGAME Virus Ho...| Liesha -----Orig...|         Decembe
r 13| 1999 10:50 AM To...|             ELFBOWL| Y2KGAME Virus Ho...|             ELF
BOWL| Y2KGAME Virus Ho...|              bass-e|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|
|<17794525.1075854...|2000-04-26 16:47:00|frozenset({'eric....|"frozenset({""o'n...|
'david.baumbach@...| 'bryan.hull@enro...| 'michael.walters...| Fw: Corruption Test|
Eric Bass|Bryan Hull, O'Nea...|                NULL|                NULL|\Eric_Bass_
Dec200...|              Bass-E|           ebass.nsf|------------------...|
bass-e|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|
|<1944629.10758546...|2000-04-27 07:38:00|frozenset({'eric....|frozenset({'timot...|
Fw: Corruption Test|           Eric Bass|   Timothy Blanchard|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|---------------
-...|              bass-e|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
```

```
NULL|                NULL|               False|
|<1373091.10758546...|2000-04-28 07:38:00|frozenset({'eric....|frozenset({'phill...|
Fw: Corruption Test|           Eric Bass|      Phillip M Love|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|----------------
-...|              bass-e|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|               False|
|<25662208.1075854...|2000-05-01 07:53:00|frozenset({'eric....|"frozenset({""o'n...|
'david.baumbach@...| 'jeffrey.gossett...| 'amir.ahanchian@...| 'kenneth.shulkla...|
'timothy.blancha...| 'nick.hiemstra@e...| 'matthew.lenhart...| 'bryan.hull@enro...|
'luis.mena@enron...| 'brian.hoskins@e...| GAME TONIGHT @ 7:45|           Eric Bass|B
rian Hoskins, Lu...|                NULL|                NULL|\Eric_Bass_Dec200...|
Bass-E|           ebass.nsf|If the weather ho...|              bass-e|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|
|<29617661.1075854...|2000-05-01 09:02:00|frozenset({'eric....|frozenset({'dale....|
New Product|           Eric Bass|         Dale Neuner|Melba Lozano, Tod...|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|Dale, On the new
...|              bass-e|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|                NULL|                NULL|                N
ULL|                NULL|               False|
|<4041756.10758546...|2000-05-01 13:40:00|frozenset({'eric....|"frozenset({""o'n...|
'bryan.hull@enro...|Re: Wellhead Accr...|           Eric Bass|Bryan Hull, O'Nea...|
NULL|                NULL|\Eric_Bass_Dec200...|              Bass-E|           ebas
s.nsf|"Here are the num...|000 of accrual va...|  accrual term deals| actual volumes
g...| half cent bid to...|  incorrect markings| and value withhe...| Greg Sharp will
...| actual volumes g...| and deals incorr...|504 Greg's Value ...|750 Bid to Mid =
...|000 Accrual Value...|000 Accrual Costs...|000 Actual Volume...|            000
$118|000 Incorrect Mar...|000) Total Value ...|750 February- Tot...|305 Greg's Value
...|000 Bid to Mid = ...|000 Accrual Value...|000 Accrual Costs...|000 Actual Volum
e...|            000 $113|000 Incorrect Mar...|000) Total Value ...|000 March - Tota
l...|145 Greg's Value ...|000 Bid to Mid = ...|000 Accrual Value...|000 Accrual Cost
s...|000 Actual Volume...|            000 $119|000 Incorrect Mar...|000) Total Value
...|000 Let me know i...| Here are the acc...|
|<32439370.1075854...|2000-10-24 09:57:00|frozenset({'eric....|frozenset({'shann...|
Re: It could happ...|           Eric Bass|       Shanna Husser|                NULL|
NULL|\Eric_Bass_Jun200...|              Bass-E|           ebass.nsf|"Thought you mig
```

```
h...|              bass-e|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|               False|
|<15626432.1075854...|2000-05-01 17:13:00|frozenset({'eric....|frozenset({'timot...|
Fwd: Fw: Somethin...|           Eric Bass|Brian Hoskins, Ja...|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|"---------------
-...|    John9375@aol.com|    CHMARGAU@aol.com|       srhea@acm.org| Eric Bass/HOU/E
C...| ""MONTY WEEKS"" ...| ""John Steiert""...|           ""Spillar| >Steve"" <mrmax
4...|             ""Short| Michael J"" <bec...| >""Dwayne Shellh...| ""John Schofiel
d...| ""Matthew Rub"" ...| ""RD"" <sabbath@...| ""Cecil Poe"" ><...|           ""Pal
umbo| Donald"" <hardhe...| ""Barry >Mullin""...| ""Gary Monday"" ...| ""Shane >Mille
r""...| ""Mike McBride""...| >""Doug Marshall...| ""Brett Lawler""...|
""LaHue| Robert"" <RLaHue...| ""JettyCat"" ><f...| ""Vernon Hooks""...| ""Aaron >Hom
mel""...| ""Mike Henderson...| ""John >Handley""...| ""Mike Greene"" ...| >""Roy V. Cl
ark""...| ""Allan Carruthe...| >""Saul Carrillo...| ""Jeff Campbell""...| ""BREW"" <BR
EWMA...| ""Johnny Breed""...| ""BeachBum"" <Be...|
|<16080707.1075854...|2000-10-24 10:22:00|frozenset({'eric....|frozenset({'shann...|
Re: It could happ...|           Eric Bass|       Shanna Husser|                NULL|
NULL|\Eric_Bass_Jun200...|              Bass-E|           ebass.nsf|"---------------
-...| Christopher Coff...| William Kelly/HO...| Kyle Etter/HOU/E...| Kam Keiser/HOU/
E...| Jay Reitmeyer/HO...| Jeff Coates/HOU/...| William Keeney/H...| Jeffrey C Gosse
t...| John King/HOU/EC...| Luis Mena/NA/Enr...|             @ ENRON| Lisa Gillette/H
O...| Susan M Scott/HO...| Dawn C Kenne/HOU...| Nick Hiemstra/HO...| Benjamin Thomas
o...| David Marks/HOU/...| Timothy Blanchar...| you still have t...| none of those a
r...| LSU to the Cotto...| the Sharpie Inde...| a sweep would ne...|
RBs|                 WRs| and Defense. Bes...| we have turned t...| the SEC is havi
n...| but which school...| Matthew Lenhart/...| Christopher Coff...| William Kelly/H
O...| Kyle Etter/HOU/E...| Kam Keiser/HOU/E...| Jay Reitmeyer/HO...| Jeff Coates/HO
U/...| William Keeney/H...| Jeffrey C Gosset...|
|<2906108.10758546...|2000-05-04 10:29:00|frozenset({'eric....|frozenset({'dale....|
5X24|           Eric Bass|         Dale Neuner|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|Any news? we wou
l...|              bass-e|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|                NULL|                NULL|
NULL|                NULL|               False|
|<21265183.1075854...|2000-05-08 07:08:00|frozenset({'eric....|"frozenset({""o'n...|
'david.baumbach@...| 'jeffrey.gossett...| 'amir.ahanchian@...| 'kenneth.shulkla...|
'timothy.blancha...| 'nick.hiemstra@e...| 'matthew.lenhart...| 'bryan.hull@enro...|
'luis.mena@enron...| 'brian.hoskins@e...| GAME TONIGHT @ 8:45|           Eric Bass|B
rian Hoskins, Lu...|                NULL|                NULL|\Eric_Bass_Dec200...|
Bass-E|           ebass.nsf|Please let me kno...|              bass-e|
NULL|                NULL|                NULL|                NULL|
```

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NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|
|<15691897.1075854...|2000-05-08 11:46:00|frozenset({'eric....|frozenset({'earl....|
Daily Throughput ...|           Eric Bass|        Earl Tisdale|                NULL|
NULL|\Eric_Bass_Dec200...|              Bass-E|           ebass.nsf|Earl, James McKa
y...|              bass-e|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
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NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|               NULL|               NULL|
NULL|               NULL|              False|
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only showing top 20 rows
```

CONCLUSION	In this experiment we learned how to use Hive to store and query data in a distributed environment. We also learned how to use Spark to load data into Hive tables and perform queries on the data. Finally, we learned how to use Neo4j to run graph queries on our data. This experiment helped us understand the power of big data analysis and how it can be used to derive insights from large datasets.