Create the Vitual Machine on GCP and SSH into it.
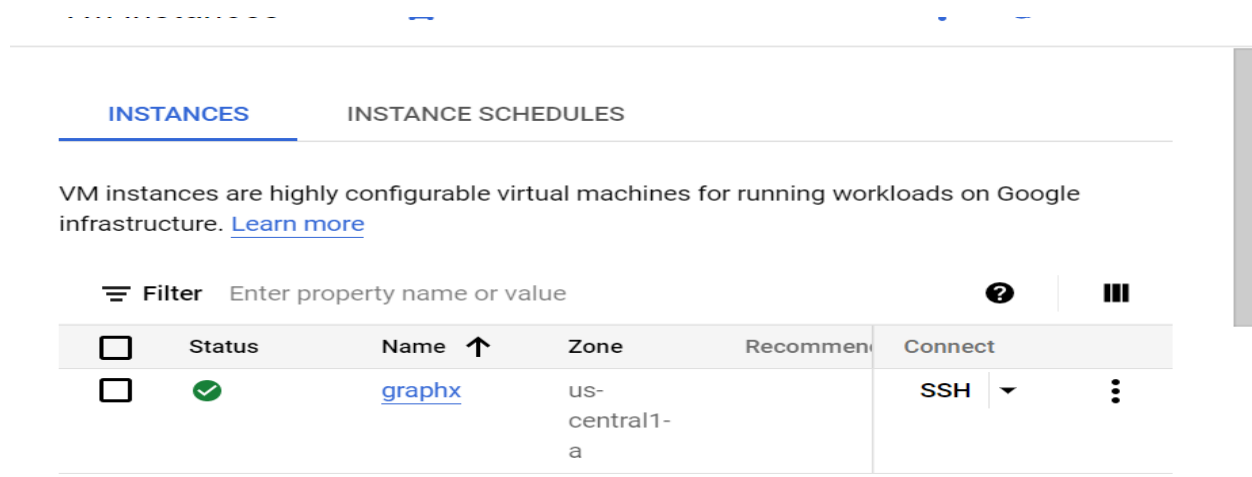

Install Java:

★ sudo apt-get update

★ sudo apt-get install openjdk-11-jdk

Install Spark and Unpack it:

$ wget https://dlcdn.apache.org/spark/spark-3.3.1/spark-3.3.1-bin-hadoop3.tgz

$ tar -xvf spark-3.3.1-bin-hadoop3.tgz

$ mv spark-3.3.1-bin-hadoop3 spark

```
dpandey@graphx:~$ wget https://dlcdn.apache.org/spark/spark-3.3.1/spark-3.3.1-bi
n-hadoop3.tgz
--2022-12-18 17:19:36--  https://dlcdn.apache.org/spark/spark-3.3.1/spark-3.3.1-b
in-hadoop3.tgz
Resolving dlcdn.apache.org (dlcdn.apache.org)... 151.101.2.132, 2a04:4e42::644
Connecting to dlcdn.apache.org (dlcdn.apache.org)|151.101.2.132|:443... connected
.
HTTP request sent, awaiting response... 200 OK
Length: 299350810 (285M) [application/x-gzip]
Saving to: 'spark-3.3.1-bin-hadoop3.tgz'

spark-3.3.1-bin-hadoop3.tgz 100%[========================================>] 28
5.48M   237MB/s    in 1.2s

2022-12-18 17:19:37 (237 MB/s) - 'spark-3.3.1-bin-hadoop3.tgz' saved [299350810/2
99350810]

dpandey@graphx:~$ tar -xvf spark-3.3.1-bin-hadoop3.tgz
spark-3.3.1-bin-hadoop3/
spark-3.3.1-bin-hadoop3/LICENSE
spark-3.3.1-bin-hadoop3/NOTICE
spark-3.3.1-bin-hadoop3/R/
spark-3.3.1-bin-hadoop3/R/lib/
```

Create graphX directory and then prepare person.csv and relationship.csv file into graphX directory

$ mkdir graphX

```
dpandey@graphx:~$ cat person.csv
id,Name,Age
1,Andrew,45
2,Sierra,43
3,Bob,12
4,Emily,10
5,William,35
6,Rachel,32
dpandey@graphx:~$ cat relationship.csv
src,dst,relation
1,2,Husband
1,3,Father
1,4,Father
1,5,Friend
1,6,Friend
2,1,Wife
2,3,Mother
2,4,Mother
2,6,Friend
3,1,Son
3,2,Son
4,1,Daughter
4,2,Daughter
5,1,Friend
6,1,Friend
6,2,Friend
dpandey@graphx:~$
```

$ sudo apt install python3-pip

$ pip3 install numpy

★ **graphX.py**
Download Link:
https://github.com/divyapandey03/Cloud-Computing/blob/main/Apache%20Spark%20%2B%20GraphFramse%20%2B%20GraphX/graphX.py

https://repos.spark-packages.org/graphframes/graphframes/0.8.2-spark3.1-s_2.12/graphframes-0.8.2-spark3.1-s_2.12.jar

$ spark-submit --packages graphframes:graphframes:0.8.2-spark3.1-s_2.12 pyspark_graphX.py

GraphFrame:

```
22/12/18 21:26:30 INFO CodeGenerator: Code generated in 34.000571 ms
+---+-------+---+
| id|   Name|Age|
+---+-------+---+
|  1| Andrew| 45|
|  2| Sierra| 43|
|  3|    Bob| 12|
|  4|  Emily| 10|
|  5|William| 35|
|  6| Rachel| 32|
+---+-------+---+
```

```
0 s
+---+---+--------+
|src|dst|relation|
+---+---+--------+
|  1|  2| Husband|
|  1|  3|  Father|
|  1|  4|  Father|
|  1|  5|  Friend|
|  1|  6|  Friend|
|  2|  1|    Wife|
|  2|  3|  Mother|
|  2|  4|  Mother|
|  2|  6|  Friend|
|  3|  1|     Son|
|  3|  2|     Son|
|  4|  1|Daughter|
|  4|  2|Daughter|
|  5|  1|  Friend|
|  6|  1|  Friend|
|  6|  2|  Friend|
+---+---+--------+
```

Triangle Count:

```
4 s
22/12/18 21:26:34 INFO CodeGenerator: Code generated in 42.742765 ms
+---+------+
| id|degree|
+---+------+
|  1|    10|
+---+------+

22/12/18 21:26:34 INFO FileSourceStrategy: Pushed Filters: IsNotNull(dst).
```

```
22/12/18 21:26:34 INFO DAGScheduler: Job 9 fin
5 s
+---+--------+
| id|inDegree|
+---+--------+
|  1|       5|
+---+--------+
```

```
22/12/18 21:26:35 INFO DAGScheduler: Job 11 finished: showString a
24 s
+---+---------+
| id|outDegree|
+---+---------+
|  1|        5|
+---+---------+

22/12/18 21:26:37 INFO FileSourceStrategy: Pushed Filters:
```

```
22/12/18 21:26:40 INFO CodeGenerator: Code
+-----+---+-------+---+
|count| id|   Name|Age|
+-----+---+-------+---+
|    3|  1| Andrew| 45|
|    1|  6| Rachel| 32|
|    1|  3|    Bob| 12|
|    0|  5|William| 35|
|    1|  4|  Emily| 10|
|    3|  2| Sierra| 43|
+-----+---+-------+---+
```

```
22/12/18 21:26:44 INFO CodeGenerator: Code generated in 13.037785 ms
+-----+---+------+---+---------+
|count| id|  Name|Age|max_count|
+-----+---+------+---+---------+
|    3|  1|Andrew| 45|        3|
|    3|  2|Sierra| 43|        3|
+-----+---+------+---+---------+

22/12/18 21:26:44 INFO FileSourceStrategy: Pushed Filters:
```

PageRank:

```
22/12/18 21:26:50 INFO CodeGenerator: Code generated in 21.243891 ms
+---+-------+---+------------------+
| id|   Name|Age|          pagerank|
+---+-------+---+------------------+
|  1| Andrew| 45| 1.787923121897472|
|  2| Sierra| 43| 1.406016795082752|
|  6| Rachel| 32|0.7723665979473922|
|  4|  Emily| 10|0.7723665979473922|
|  3|    Bob| 12|0.7723665979473922|
|  5|William| 35|0.4889602891776001|
+---+-------+---+------------------+
```

```
22/12/18 21:26:51 INFO CodeGenerator: Code generated in 12.548207 ms
+---+---+--------+------+
|src|dst|relation|weight|
+---+---+--------+------+
|  5|  1|  Friend|   1.0|
|  3|  1|     Son|   0.5|
|  4|  1|Daughter|   0.5|
|  4|  2|Daughter|   0.5|
|  6|  1|  Friend|   0.5|
|  3|  2|     Son|   0.5|
|  6|  2|  Friend|   0.5|
|  2|  3|  Mother|  0.25|
|  2|  4|  Mother|  0.25|
|  2|  1|    Wife|  0.25|
|  2|  6|  Friend|  0.25|
|  1|  2| Husband|   0.2|
|  1|  6|  Friend|   0.2|
|  1|  3|  Father|   0.2|
|  1|  4|  Father|   0.2|
|  1|  5|  Friend|   0.2|
```

BFS:

```
89 s
22/12/18 21:26:54 INFO CodeGenerator: Code generated in 17.623646 ms
+-----------+-----------+-------------+--------------+---------------+
|       from|         e0|           v1|            e1|             to|
+-----------+-----------+-------------+--------------+---------------+
|{3, Bob, 12}|{3, 1, Son}|{1, Andrew, 45}|{1, 5, Friend}|{5, William, 35}|
+-----------+-----------+-------------+--------------+---------------+
```

```
t-cs570.internal:35549 in memory (size: 7.6 KiB, free: 434.1 MiB)
+-------------+---------------+--------------+--------------+---------------+
|         from|             e0|            v1|            e1|             to|
+-------------+---------------+--------------+--------------+---------------+
|{4, Emily, 10}|{4, 1, Daughter}|{1, Andrew, 45}|{1, 6, Friend}|{6, Rachel, 32}|
|{4, Emily, 10}|{4, 2, Daughter}|{2, Sierra, 43}|{2, 6, Friend}|{6, Rachel, 32}|
+-------------+---------------+--------------+--------------+---------------+
```

```
22/12/18 21:26:57 INFO DAGScheduler: Job 82 finished: showString at NativeMethodAccessorI
19 s
+--------------+---------------+--------------+--------------+---------------+
|          from|             e0|            v1|            e1|             to|
+--------------+---------------+--------------+--------------+---------------+
|{4, Emily, 10}|{4, 1, Daughter}|{1, Andrew, 45}|{1, 6, Friend}|{6, Rachel, 32}|
|  {3, Bob, 12}|     {3, 1, Son}|{1, Andrew, 45}|{1, 6, Friend}|{6, Rachel, 32}|
|{4, Emily, 10}|{4, 2, Daughter}|{2, Sierra, 43}|{2, 6, Friend}|{6, Rachel, 32}|
|  {3, Bob, 12}|     {3, 2, Son}|{2, Sierra, 43}|{2, 6, Friend}|{6, Rachel, 32}|
+--------------+---------------+--------------+--------------+---------------+
```