

BIG DATA MANAGEMENT

Assignment IV

Submitted To:

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Introduction

Google Cloud Bigtable is a highly scalable, fully managed NoSQL database designed for large analytical and operational workloads. It supports high-throughput applications and is optimized for low latency, making it ideal for time-series data, sensor data, and real-time analytics. In this assignment, we use Bigtable to store and analyse weather sensor data from three stations: SeaTac (SEA), Vancouver (YVR), and Portland (PDX). The primary objectives are to create a Bigtable instance, connect to it using the Java client library within Eclipse, load data from CSV files, and execute various queries to extract specific insights.

Connection Establishment Process via Eclipse

To connect and interact with Google Bigtable in Eclipse using Java, the following steps are followed:

1. Install Google Cloud SDK and Authenticate

- Install the Google Cloud CLI from the official documentation.

<https://cloud.google.com/sdk/docs/install> using this link

Authenticate using: “**gcloud auth application-default login**” This command

2. Setup Java Project in Eclipse

- Create a Java project and add required dependencies (via Maven or manually) for Google Cloud Bigtable:

We included the following dependencies on the Pom class.

```
<project                                     xmlns="http://maven.apache.org/POM/4.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
  https://maven.apache.org/xsd/maven-4.0.0.xsd">

  <modelVersion>4.0.0</modelVersion>

  <groupId>com.bigtable</groupId>

  <artifactId>assign4</artifactId>

  <version>0.0.1-SNAPSHOT</version>

  <dependencies>

    <dependency>

      <groupId>com.google.cloud</groupId>
```

```
<artifactId>google-cloud-bigtable</artifactId>
<version>2.21.0</version> <!-- Use latest -->
</dependency>

<dependency>
<groupId>com.google.cloud</groupId>
<artifactId>google-cloud-core</artifactId>
<version>2.23.0</version>
</dependency>
</dependencies>
```

Enable the Bigtable API

Before using Bigtable, we must enable the Cloud Bigtable API:

<https://console.cloud.google.com/flows/enableapi?apiid=bigtableadmin.googleapis.com>

Select your Google Cloud project (e.g., iitjdb)

Click "**Enable**"

Create a Bigtable Instance

You can create a Bigtable instance either via the **Google Cloud Console** or **gcloud CLI**.

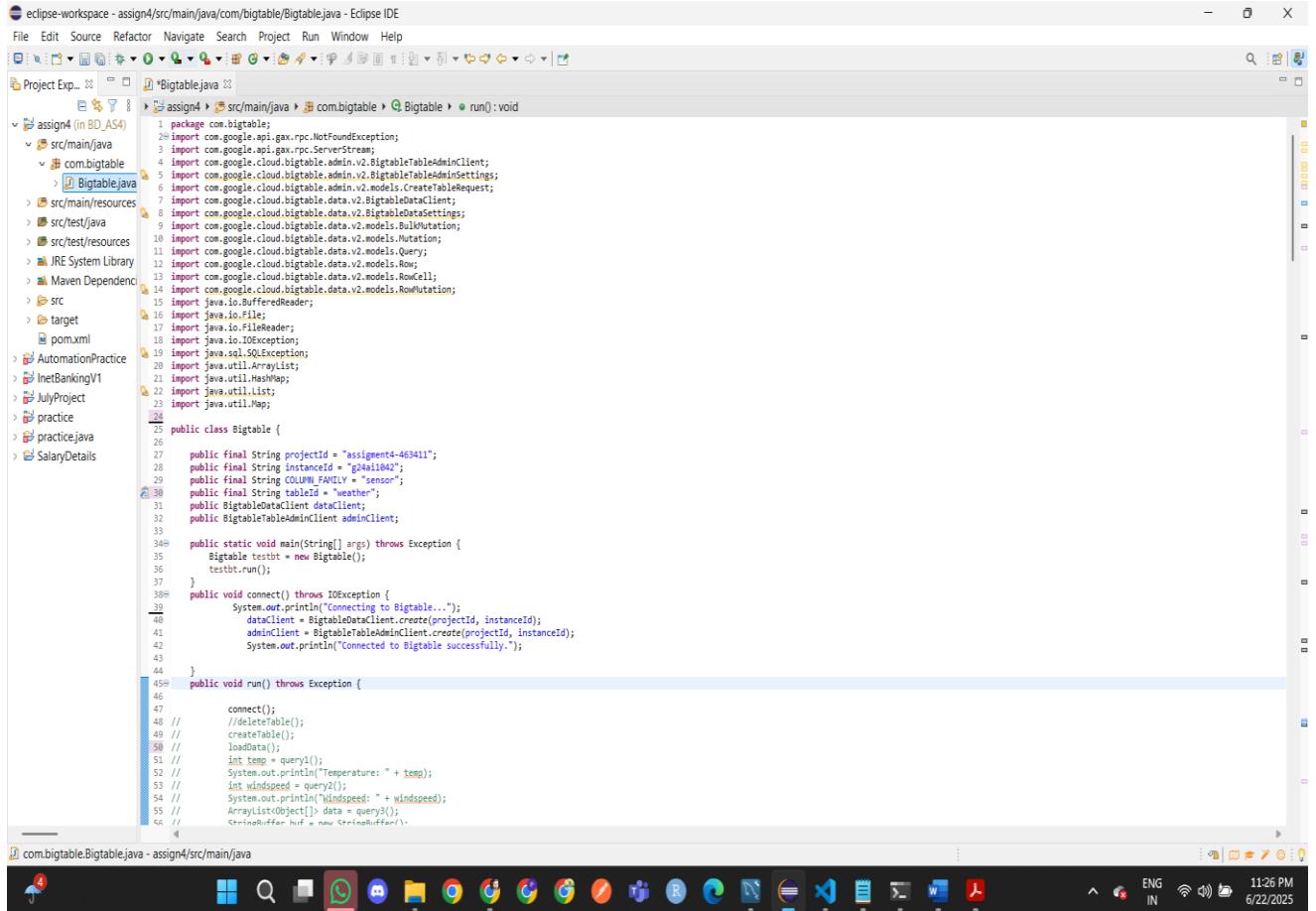
Using Google Cloud Console

1. Go to: <https://console.cloud.google.com/bigtable/instances>
2. Click on "**Create Instance**"
3. Fill in the details:
 - o **Instance ID:** ail7560
 - o **Instance name:** WeatherSensorInstance (or any name)
 - o **Storage type:** SSD
 - o **Nodes:** Select 1 node (sufficient for development/testing)
 - o **Cluster ID:** e.g., ail7560-cluster
 - o **Region:** Select a region (e.g., us-central1) and Click "**Create**"

3. Initialize Clients in the connect() Method

The Script

```
public final String projectId = "assigment4-463411";  
  
public final String instanceId = "g24ai1042";  
  
public final String COLUMN_FAMILY = "sensor";  
  
public final String tableId = "weather";  
  
public BigtableDataClient dataClient;  
  
public BigtableTableAdminClient adminClient  
  
public void connect() throws IOException {  
  
    System.out.println("Connecting to Bigtable...");  
  
    dataClient = BigtableDataClient.create(projectId, instanceId);  
  
    adminClient = BigtableTableAdminClient.create(projectId, instanceId);  
  
    System.out.println("Connected to Bigtable successfully.");  
  
}
```



```
package com.bigtable;  
import com.google.api.gax.rpc.NotFoundException;  
import com.google.api.gax.rpc.ServerStream;  
import com.google.cloud.bigtable.admin.v2.BigtableTableAdminClient;  
import com.google.cloud.bigtable.admin.v2.BigtableTableAdminSettings;  
import com.google.cloud.bigtable.admin.v2.models.CreateTableRequest;  
import com.google.cloud.bigtable.data.v2.BigtableDataClient;  
import com.google.cloud.bigtable.data.v2.BigtableDataSettings;  
import com.google.cloud.bigtable.data.v2.models.Mutation;  
import com.google.cloud.bigtable.data.v2.models.Query;  
import com.google.cloud.bigtable.data.v2.models.Row;  
import com.google.cloud.bigtable.data.v2.models.RowCell;  
import com.google.cloud.bigtable.data.v2.models.RowMutation;  
import java.io.BufferedReader;  
import java.io.FileReader;  
import java.io.IOException;  
import java.sql.SQLException;  
import java.util.ArrayList;  
import java.util.HashMap;  
import java.util.List;  
import java.util.Map;  
  
public class Bigtable {  
  
    public final String projectId = "assigment4-463411";  
    public final String instanceId = "g24ai1042";  
    public final String COLUMN_FAMILY = "sensor";  
    public final String tableId = "weather";  
    public BigtableDataClient dataClient;  
    public BigtableTableAdminClient adminClient;  
  
    public static void main(String[] args) throws Exception {  
        Bigtable testbt = new Bigtable();  
        testbt.run();  
    }  
    public void connect() throws IOException {  
        System.out.println("Connecting to Bigtable...");  
        dataClient = BigtableDataClient.create(projectId, instanceId);  
        adminClient = BigtableTableAdminClient.create(projectId, instanceId);  
        System.out.println("Connected to Bigtable successfully.");  
    }  
    public void run() throws Exception {  
        connect();  
        //deleteTable();  
        //createTable();  
        loadData();  
        int temp = query1();  
        System.out.println("Temperature: " + temp);  
        int windspeed = query2();  
        System.out.println("Windspeed: " + windspeed);  
        ArrayList<Object[]> data = query3();  
        CsvInMemoryBuffer hif = new CsvInMemoryBuffer();  
    }  
}
```

The screenshot shows the Eclipse IDE interface with the following details:

- Title Bar:** eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE
- Menu Bar:** File, Edit, Source, Refactor, Navigate, Search, Project, Run, Window, Help
- Toolbar:** Standard Eclipse toolbar icons.
- Project Explorer:** Shows the project structure:
 - assign4 (in BD, A54)
 - src/main/java
 - com.bigtable
 - Bigtable.java
 - Bigtable
 - com
 - sensor
 - weather
 - src/main/resources
 - src/test/java
 - src/test/resources
 - IRE System Library
 - Maven Dependencies
 - src
 - target
 - pom.xml
- Code Editor:** Displays the `Bigtable.java` file content. The code implements a `Bigtable` class with methods for connecting to a Bigtable instance, running a test, and performing various operations like querying and appending data to a buffer. It also includes comments for closing data and admin clients.
- Bottom Status Bar:** Writable, Smart Insert, 42:75 : 1801.
- System Tray:** Shows icons for battery, signal strength, and system status.
- Taskbar:** Shows icons for various applications including a browser, file explorer, and development tools.
- System Icons:** Shows the date and time (11:28 PM IN 6/22/2025) and connectivity status.

After Execution

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Project Explorer Bigtable.java

```
assign4 (in BD_AS4)
src/main/java com.bigtable Bigtable
Bigtable.java
src/main/resources
src/test/java
src/test/resources
JRE System Library
Maven Dependencies
src
target
pom.xml
AutomationPractice
InetBankingV1
JulyProject
practice
practice.java
SalaryDetails
```

```
27 public final String projectId = "assignment4-463411";
28 public final String instanceId = "g24ai1042";
29 public final String COLUMN_FAMILY = "sensor";
30 public final String tableId = "weather";
31 public BigtableDataClient dataClient;
32 public BigtableTableAdminClient adminClient;
33
34 public static void main(String[] args) throws Exception {
35     Bigtable testbt = new Bigtable();
36     testbt.run();
37 }
38 public void connect() throws IOException {
39     System.out.println("Connecting to Bigtable...");
40     dataClient = BigtableDataClient.create(projectId, instanceId);
41     adminClient = BigtableTableAdminClient.create(projectId, instanceId);
42     System.out.println("Connected to Bigtable successfully.");
43 }
44 public void run() throws Exception {
45     connect();
46     //deleteTable();
47     //createTable();
48     //loadData();
49     //int temp = query1();
50     //System.out.println("Temperature: " + temp);
51     //int windspeed = query2();
52     //System.out.println("Windspeed: " + windspeed);
53     //ArrayList<Object[]> data = query3();
54     //StringBuffer buf = new StringBuffer();
55     //for (int i = 0; i < data.size(); i++) {
56 }
```

Console

```
<terminated>: Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 22, 2025, 11:28:56 PM - 11:29:37 PM)
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assignment4-463411/instances/g24ai1042
Jun 22, 2025 11:29:35 PM com.google.cloud.bigtable.data.v2.stub.BigtableChannelPrimer sendPrimeRequests
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assignment4-463411/instances/g24ai1042
Jun 22, 2025 11:29:37 PM com.google.cloud.bigtable.data.v2.stub.BigtableChannelPrimer sendPrimeRequests
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assignment4-463411/instances/g24ai1042
Connected to Bigtable successfully.
```

Create the Table

```
public void createTable(){

    System.out.println("Creating table: " + tableId);

    try{

        CreateTableRequest request = CreateTableRequest.of(tableId).addFamily(COLUMN_FAMILY);

        adminClient.createTable(request);

        System.out.println("Table created successfully.");

    }

    catch (Exception e){

        System.err.println("Table creation failed: " + e.getMessage());

    }

}
```

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure for "assign4 (in BD_AS4)". The file "Bigtable.java" is open, displaying Java code for creating a table in Bigtable.
- Code Editor:** The code for the `createTable` method is highlighted. The line `System.out.println("Creating table: " + tableId);` is currently selected.
- Console:** A terminal window titled "Console" is at the bottom, showing log output from a Java application named "Bigtable". The log includes several "WARNING" messages about failed prime channel attempts and a successful connection message.
- Taskbar:** The taskbar at the bottom of the screen shows various application icons, including a file with a red dot, a search icon, a messaging icon, a file folder, a browser, and others.

```
<terminated> Bigtable Java Application] C:\Program files\Java\jdk-16.0.2\bin\javaw.exe (Jun 22, 2025, 11:28:56 PM - 11:29:37 PM)
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assigment4-463411/instances/g24ai1042
Jun 22, 2025 11:29:35 PM com.google.cloud.bigtable.data.v2.stub.BigtableChannelPrimer sendPrimeRequests
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assigment4-463411/instances/g24ai1042
Jun 22, 2025 11:29:37 PM com.google.cloud.bigtable.data.v2.stub.BigtableChannelPrimer sendPrimeRequests
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assigment4-463411/instances/g24ai1042
Connected to Bigtable successfully.
```

After the Execution

The screenshot shows the Eclipse IDE interface. The Project Explorer view displays the file `Bigtable.java`. The code implements a `run()` method that loads data from CSV files for three cities: SeaTac, Vancouver, and Portland. The `loadData()` method uses `loadFromCSV` to read data from `seatac.csv`, `vancouver.csv`, and `portland.csv` respectively. The `Console` view shows the execution output:

```
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 22, 2025, 11:37:20 PM - 11:37:58 PM)
Jun 22, 2025 11:37:51 PM com.google.cloud.bigtable.data.v2.stub.BigtableChannelPrimer sendPrimeRequests
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assigment4-463411/instances/g24ai1042
Jun 22, 2025 11:37:53 PM com.google.cloud.bigtable.data.v2.stub.BigtableChannelPrimer sendPrimeRequests
WARNING: Failed to prime channel: com.google.api.gax.rpc.NotFoundException: io.grpc.StatusRuntimeException: NOT_FOUND: No tables found for instance projects/assigment4-463411/instances/g24ai1042
Connected to Bigtable successfully.
Creating table: weather
Table created successfully.
```

On the Big Table

The screenshot shows the Google Cloud Bigtable interface. The left sidebar navigation bar includes links for Overview, Tables, Bigtable Studio, Backups, Application profiles, Observability, System insights, and Key Visualizer. The main content area is titled "INSTANCE g24ai1042:Tables". It displays a table of existing tables, with one entry visible:

Table ID	Cluster	Status	Storage utilization	Automated backup	Latest backup	Change stream	
weather	g24ai1042-c1	Ready	2.8 MB	Not enabled	Enable	No backups	Disabled

A message in the right panel states: "No tables selected" and "Please select at least one resource." The bottom of the screen shows the Windows taskbar with various application icons.

Load The Data from the CSV file into the Table on the Big Table

Here the Java Script

```
public void loadData() throws Exception {  
  
    String path = "C://Users//Purushothaman S//Downloads//Assig-4 (1)//Assig-4//data//";  
  
    try {  
  
        System.out.println("Load data for SeaTac");  
  
        loadFromCSV(path + "seatac.csv", "SEA");  
  
        System.out.println("SEA Data has been loaded Successfully");  
  
  
        System.out.println("Loading data for Vancouver");  
  
        loadFromCSV(path+"vancouver.csv", "YVR");  
  
        System.out.println("YVR Data has been loaded Successfully");  
  
  
        System.out.println("Loading data for Portland");  
  
        loadFromCSV(path+"portland.csv", "PDX");  
  
        System.out.println("PDX Data has been loaded Successfully");  
  
    }  
  
    catch (Exception e) {  
  
        throw new Exception(e)  
  
    }  
  
}  
  
  
private void loadFromCSV(String filepath, String stationId) throws Exception {  
  
    BufferedReader reader = new BufferedReader(new FileReader(filepath));  
  
    String line;  
  
    boolean isHeader = true;  
  
    Map<String, Boolean> hourAlreadyLoaded = new HashMap<>();  
  
    BulkMutation bulkMutation = BulkMutation.create(tableId);  
  
    while ((line = reader.readLine()) != null) {  
  
        // Skip the header row  
  
        if (isHeader) {  

```

```

isHeader = false;

continue;

}

String[] parts = line.split(",");

if (parts.length < 9) continue;

String date = parts[1].trim();

String time = parts[2].trim();

String[] timeParts = time.split ":";

if (timeParts.length < 1) continue;

int hourInt;

try {

hourInt = Integer.parseInt(timeParts[0]);

} catch (NumberFormatException e) {

continue;

}

String hour = String.format("%02d", hourInt);

String hourKey = date + "#" + hour;

if (hourAlreadyLoaded.containsKey(hourKey)) continue;

hourAlreadyLoaded.put(hourKey, true);

String rowKey = stationId + "#" + hourKey;

String temperature = parts[3].trim();

String dewPoint = parts[4].trim();

String humidity = parts[5].trim();

String windSpeed = parts[6].trim();

String gust = parts[7].trim();

String pressure = parts[8].trim();

Mutation mutation = Mutation.create()

.setCell(COLUMN_FAMILY, "temperature", temperature)

.setCell(COLUMN_FAMILY, "dewPoint", dewPoint)

.setCell(COLUMN_FAMILY, "humidity", humidity)

.setCell(COLUMN_FAMILY, "windSpeed", windSpeed)

```

```

.setCell(COLUMN_FAMILY, "gust", gust)
.setCell(COLUMN_FAMILY, "pressure", pressure)
.setCell(COLUMN_FAMILY, "time", time);
bulkMutation.add(rowKey, mutation);
}
reader.close();
dataClient.bulkMutateRows(bulkMutation);
System.out.println("Loaded data for station: " + stationId);
}

```

On Execution

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure for "assign4" (in BD_A54). The "Bigtable.java" file is selected.
- Code Editor:** Displays the Java code for "Bigtable.java". The code implements a "Bigtable" class with methods for creating a table and loading data from CSV files for SeaTac, Vancouver, and Portland airports.
- Console:** Shows the terminal output of the application's execution. It includes the connection message "Connected to Bigtable successfully.", the creation of the "weather" table, and the confirmation "Table created successfully.".
- Taskbar:** At the bottom, it shows the Windows taskbar with various pinned icons and the system tray indicating the date and time as 6/22/2025 at 11:45 PM.

```

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Project Exp... Bigtable.java
assign4 (in BD_A54) src/main/java com.bigtable Bigtable query10:int
81 }
82     catch (Exception e){
83         System.out.println("Table creation failed: " + e.getMessage());
84     }
85 }
86
87 public void loadData() throws Exception {
88
89     String path = "C://Users//Purushothaman S//Downloads//Assig-4 (1)//Assig-4//data//";
90     try {
91
92         System.out.println("Load data for SeaTac");
93         loadFromCSV(path + "seatac.csv", "SEA");
94         System.out.println("SEA Data has been loaded Successfully");
95
96         System.out.println("Loading data for Vancouver");
97         loadFromCSV(path + "vancouver.csv", "VNR");
98         System.out.println("VNR Data has been loaded Successfully");
99
100
101        System.out.println("Loading data for Portland");
102        loadFromCSV(path + "portland.csv", "PDX");
103        System.out.println("PDX Data has been loaded Successfully");
104
105    }
106    catch (Exception e) {
107
108        throw new Exception(e);
109    }
110
111 }
112 }
113
114

```

```

<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 22, 2025, 11:37:20 PM - 11:37:58 PM)
Connected to Bigtable successfully.
Creating table: weather
Table created successfully.

```

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure for "assign4" with files like Bigtable.java, testbt.java, and various configuration files.
- Code Editor:** Displays the Java code for Bigtable.java, which includes methods for connecting to Bigtable, running queries, and closing connections.
- Console:** Shows the terminal output of the application's execution. It includes messages such as "Connected to Bigtable successfully.", "Creating table: weather", and "Table created successfully.".
- Taskbar:** At the bottom, it shows the Windows taskbar with various pinned icons and the system clock indicating 11:45 PM on 6/22/2025.

```

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Project Exp... Bigtable.java
assign4 (in BD_AS4) src/main/java com.bigtable Bigtable run():void
36     testbt.run();
37 }
38     public void connect() throws IOException {
39         System.out.println("Connecting to Bigtable...");
40         dataClient = BigtableDataClient.create(projectId, instanceId);
41         adminClient = BigtableTableAdminClient.create(projectId, instanceId);
42         System.out.println("Connected to Bigtable successfully.");
43     }
44     public void run() throws Exception {
45         connect();
46         //deleteTable();
47         //createTable();
48         //loadData();
49         int temp = query1();
50         System.out.println("Temperature: " + temp);
51         int windspeed = query2();
52         System.out.println("Windspeed: " + windspeed);
53         ArrayList<Object[]> data = query3();
54         StringBuffer buf = new StringBuffer();
55         for (int i = 0; i < data.size(); i++) {
56             Object[] vals = data.get(i);
57             for (int j = 0; j < vals.length; j++) {
58                 buf.append(vals[j].toString() + " ");
59             }
60             buf.append("\n");
61         }
62         System.out.println(buf.toString());
63         temp = query4();
64         System.out.println("Temperature: " + temp);
65     }
66 /**
67 * Close data and admin clients
68 */
69 public void close() {
70
    
```

<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 22, 2025, 11:37:20 PM – 11:37:58 PM)

Connected to Bigtable successfully.
Creating table: weather
Table created successfully.

After the Execution

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure for "assign4" with files like Bigtable.java, testbt.java, and various configuration files.
- Code Editor:** Displays the Java code for Bigtable.java, which includes a try-catch block for loading data from CSV files.
- Console:** Shows the terminal output of the application's execution. It includes messages such as "Connecting to Bigtable...", "Connected to Bigtable successfully.", and "Load Data for SeaTac", "SeaTac Data has been loaded Successfully", etc., for each city.
- Taskbar:** At the bottom, it shows the Windows taskbar with various pinned icons and the system clock indicating 11:47 PM on 6/22/2025.

```

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Project Exp... Bigtable.java
assign4 (in BD_AS4) src/main/java com.bigtable Bigtable run():void
81     }
82     catch (Exception e){
83         System.err.println("Table creation failed: " + e.getMessage());
84     }
85 }
86     public void loadData() throws Exception {
87
88         String path = "C://Users//Purushothaman S//Downloads//Assig-4 (1)//Assig-4//data//";
89         try {
90
91             System.out.println("Loading data for SeaTac");
92             loadFromCSV(path + "seatac.csv", "SEAT");
93             System.out.println("SEA Data has been loaded Successfully");
94
95             System.out.println("Loading data for Vancouver");
96             loadFromCSV(path+"vancouver.csv", "VAN");
97             System.out.println("VAN Data has been loaded Successfully");
98
99             System.out.println("Loading data for Portland");
100            loadFromCSV(path+"portland.csv", "PDX");
101            System.out.println("PDX Data has been loaded Successfully");
102
103        }
104        catch (Exception e) {
105
    
```

<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 22, 2025, 11:46:38 PM – 11:47:27 PM)

Connecting to Bigtable...
Connected to Bigtable successfully.
Load Data for SeaTac
SeaTac Data has been loaded Successfully
Load Data for Vancouver
Vancouver Data has been loaded Successfully
Load Data for Portland
Portland Data has been loaded Successfully
Load Data for station: PDX
PDX Data has been loaded Successfully

On Big Table

The screenshot shows the Google Cloud Bigtable Studio interface. On the left, a sidebar menu includes 'Overview', 'Tables' (selected), 'Bigtable Studio' (selected), 'Backups', 'Application profiles', 'Observability', 'System insights', and 'Key Visualizer'. The main area has tabs for 'Explorer' (selected) and 'Builder'. The 'Explorer' tab contains sections for 'Tables' (with 'weather' listed), 'Materialized Views', and 'Views'. A query editor window displays the following SQL-like code:

```
1 SELECT *
2 FROM weather (WITH_HISTORY => FALSE)
3 WHERE _key LIKE '%'
4 LIMIT 3
5
6
7 -- SELECT *
8 -- FROM weather (WITH_HISTORY => FALSE)
9 -- WHERE _key LIKE '$'
10 -- LIMIT 3
11
12 -- SELECT *
13 -- FROM weather (WITH_HISTORY => FALSE)
14 -- WHERE _key LIKE 'Y'
15 -- LIMIT 3;
```

The 'RESULTS' section shows three rows of data:

_key	sensor
'POV=2021-10-04#20'	{'dewPoint': 53, 'gust': 'M', 'humidity': 67.4, 'pressure': 1012.3, 'temperature': 64, 'time': '20:53', 'windSpeed': 4}
'POV=2021-10-04#21'	{'dewPoint': 53, 'gust': 'M', 'humidity': 60.7, 'pressure': 1011.1, 'temperature': 67, 'time': '21:53', 'windSpeed': 3}
'POV=2021-10-04#22'	{'dewPoint': 52, 'gust': 'M', 'humidity': 56.5, 'pressure': 1010.4, 'temperature': 68, 'time': '22:53', 'windSpeed': 2}

At the bottom, there are navigation links for 'Release Notes' and a toolbar with various icons. The status bar at the bottom right shows '12:01 AM 6/23/2025'.

The screenshot shows the Google Cloud Bigtable Studio interface. The top navigation bar includes links to various Google services like Google, Finance, YouTube, Maps, News, Translate, Ecom, Trello, Programming in Py..., Google Cloud, DeepSeek, Sumit Kalra - YouTu..., Perplexity, and Amazon Web Services. The main title is "console.cloud.google.com/bigtable/instances/g24ai1042/studio/query?sampleQueryTableId=weather&inv=1&inv=Ab00bQ&project=assignment4-463411".

The left sidebar shows the instance structure: All instances > INSTANCE g24ai1042: Bigtable Studio. The "Bigtable Studio" tab is selected. Other tabs include Overview, Tables, Backups, Application profiles, Observability, System insights, and Key Visualizer.

The central area has tabs for Explorer and Editor. The Editor tab is active, showing a query editor with the following SQL-like code:

```
1 -- SELECT *
2 -- FROM weather (WITH_HISTORY => FALSE)
3 -- WHERE _key LIKE '%'
4 -- LIMIT 3
5
6
7 SELECT *
8 FROM weather (WITH_HISTORY => FALSE)
9 WHERE _key LIKE '$'
10 LIMIT 3;
11
12 -- SELECT *
13 -- FROM weather (WITH_HISTORY => FALSE)
14 -- WHERE _key LIKE '%'
15 -- LIMIT 3;
```

The Editor tab also includes buttons for RUN SELECTED, SAVE, FORMAT, CLEAR, and DOCUMENTATION. A status message "Valid" with a checkmark is displayed.

The RESULTS section displays three rows of data:

Key	sensor
SE4#2021-10-14#20	{'dewPoint': 49, 'gust': 'M', 'humidity': 66.9, 'pressure': 1013.6, 'temperature': 60, 'time': '20:53', 'windSpeed': 6}
SE4#2021-10-14#21	{'dewPoint': 48, 'gust': 'M', 'humidity': 62.2, 'pressure': 1012.5, 'temperature': 61, 'time': '21:53', 'windSpeed': 4}
SE4#2021-10-14#22	{'dewPoint': 48, 'gust': 'M', 'humidity': 66.8, 'pressure': 1011.9, 'temperature': 59, 'time': '22:53', 'windSpeed': 5}

At the bottom, there are buttons for EXPORT, ROWS PER PAGE (set to 100), and PAGES (1-3 of 3). The bottom taskbar shows various system icons and the date/time: 12:03 AM, 6/23/2025.

Screenshot of a web browser showing the Google Cloud Bigtable Editor interface.

The URL in the address bar is: `console.cloud.google.com/bigtable/instances/g24ai1042/studio/query?sampleQueryTableId=weather&inv=1&invt=Ab00bQ&project=assignment4-463411`

The search bar contains: `Search () for resources, docs, products, and more`

The main area shows the Bigtable instance `g24ai1042:Bigtable Studio`. The left sidebar includes sections for Overview, Tables, Bigtable Studio (selected), Backups, Application profiles, Observability, System insights, and Key Visualizer. A Release Notes section is also present.

The Bigtable Studio panel has tabs for Explorer (selected) and Editor. The Editor tab shows a query editor with the following SQL-like code:

```
1 -- SELECT *
2 -- FROM weather (WITH_HISTORY => FALSE)
3 -- WHERE _key LIKE '%'
4 -- LIMIT 3
5
6
7 -- SELECT *
8 -- FROM weather (WITH_HISTORY => FALSE)
9 -- WHERE _key LIKE '$'
10 -- LIMIT 3
11
12 SELECT *
13 FROM weather (WITH_HISTORY => FALSE)
14 WHERE _key LIKE '%'
15 LIMIT 3
```

The results table displays three rows of data:

_key	sensor
YVR#2021-10-04#21	{"dewPoint": "50", "gust": "M", "humidity": "77.4", "pressure": "1013.7", "temperature": "57", "time": "21:00", "windSpeed": "6"}
YVR#2021-10-04#22	{"dewPoint": "50", "gust": "M", "humidity": "77.4", "pressure": "1012.6", "temperature": "57", "time": "22:00", "windSpeed": "9"}
YVR#2021-10-04#23	{"dewPoint": "50", "gust": "M", "humidity": "77.4", "pressure": "1011.9", "temperature": "57", "time": "23:00", "windSpeed": "9"}

At the bottom, there are navigation links for Release Notes, a toolbar with various icons, and a system tray showing battery level, signal strength, language (ENG IN), and date/time (6/23/2025, 12:05 AM).

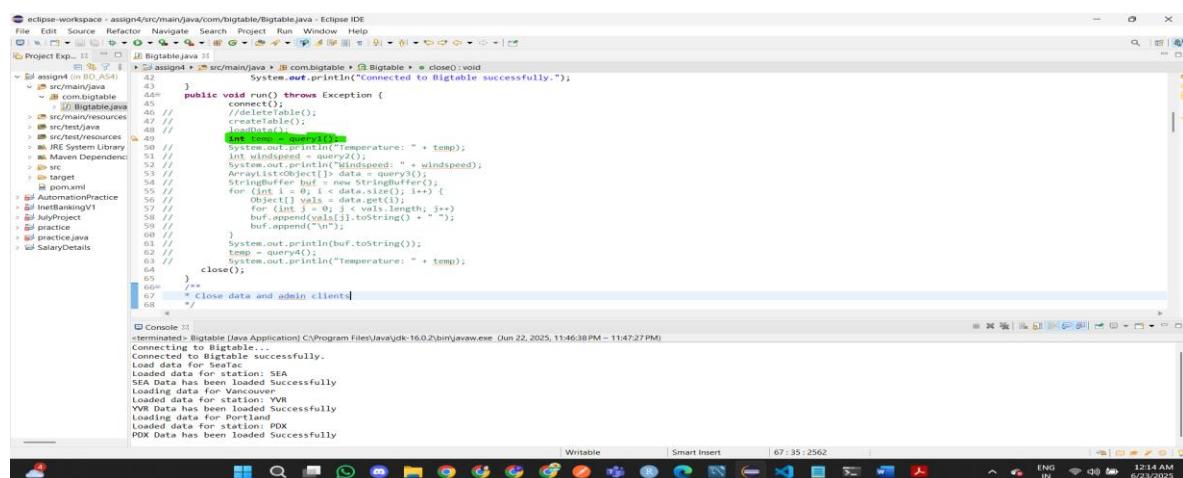
Questions and Solutions

Write the method `query1()` that returns the temperature at Vancouver on 2022-10-01 at 10 a.m.

Solution on the Script

```
public void run() throws Exception {  
  
    connect();  
  
    int temp = query1();  
  
    System.out.println("Temperature: " + temp);  
  
    close();  
  
}  
  
public int query1() throws Exception {  
  
    System.out.println("Executing query #1.");  
  
    String rowKey = "YVR#2022-10-01#10";  
  
    Row row = dataClient.readRow(tableId, rowKey);  
  
    if (row != null) {  
  
        for (RowCell cell : row.getCells()) {  
  
            if (cell.getQualifier().toStringUtf8().equals("temperature")) {  
  
                return Integer.parseInt(cell.getValue().toStringUtf8());  
  
            }  
  
        }  
  
    }  
  
    return -999;  
}
```

On Script



The screenshot shows the Eclipse IDE interface with the Bigtable.java file open in the editor. The code implements the run() method to connect to a Bigtable instance and execute a query to retrieve the temperature for station YVR on 2022-10-01 at 10 a.m. The output window shows the connection message and the retrieved temperature value.

```
eclipse-workspace - assign4 (in BD_A54)  
File Edit Source Refactor Navigate Search Project Run Window Help  
Project Explorer | Search | Problems | Java | Resources | Editors | Perspectives | Help  
Bigtable.java 21  
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↳ src/main/java  
↳   ↳ com/bigtable  
↳     ↳ Bigtable.java  
↳ src/main/resources  
↳ src/test/java  
↳ src/test/resources  
↳ IRE System Library  
↳ Maven Dependencies  
↳ pom.xml  
↳ AutomationPractice  
↳ BigtableV1  
↳ JUnitProject  
↳ practice  
↳ SalaryDetails  
↳ assig4 (in BD_A54)  
↳ src/main/java  
↳   ↳ com/bigtable  
↳     ↳ Bigtable.java  
↳       public void run() throws Exception {  
        connect();  
        //deleteTable();  
        //createTable();  
        //loadData();  
        //loadData();  
        System.out.println("Connected to Bigtable successfully.");  
        int temp = query1();  
        System.out.println("Temperature: " + temp);  
        int windspeed = query2();  
        System.out.println("Wind Speed: " + windspeed);  
        ArrayList<Object> data = query3();  
        StringBuffer buf = new StringBuffer();  
        for (Object[] vals : data) {  
            Object[] vals2 = vals[1];  
            for (int i = 0; i < vals2.length; i++) {  
                buf.append(vals2[i].toString() + " ");  
            }  
            buf.append("\n");  
        }  
        System.out.print(buf.toString());  
        temp = query4();  
        System.out.println("Temperature: " + temp);  
    }  
    close();  
    /* Close data and admin clients */  
}  
*/  
* Close data and admin clients  
*/  
* Connected to Bigtable successfully.  
Connected to Bigtable successfully.  
Load data for SEA.  
Load data for station: SEA  
SEA Data has been loaded Successfully  
Loading data for station: VVR  
VVR Data has been loaded Successfully  
Load data for station: PDX  
PDX Data has been loaded Successfully  
Console: Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\java.exe (Jun 22, 2025, 11:46:38 PM – 11:47:27 PM)  
Connected to Bigtable successfully.  
Load data for SEA.  
Load data for station: SEA  
SEA Data has been loaded Successfully  
Loading data for station: VVR  
VVR Data has been loaded Successfully  
Load data for station: PDX  
PDX Data has been loaded Successfully
```

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE

```

File Edit Source Refactor Navigate Search Project Run Window Help
Project Explorer [assign4]
src/main/java com.bigtable Bigtable query1():int
src/main/resources
src/test/java
src/test/resources
JRE System Library
Maven Dependencies
src
target
pom.xml
AutomationPractice
inetBankingV1
JulyProject
practice
practice.java
SalaryDetails

153     .setCell(COLUMN_FAMILY, "humidity", humidity)
154     .setCell(COLUMN_FAMILY, "windspeed", windspeed)
155     .setCell(COLUMN_FAMILY, "gusts", gust)
156     .setCell(COLUMN_FAMILY, "pressure", pressure)
157     .setCell(COLUMN_FAMILY, "time", time);
158     bulkMutation.add(rowKey, mutation);
159   }
160   reader.close();
161   dataClient.bulkMutateRows(bulkMutation);
162   System.out.println("Loaded data for station: " + stationId);
163 }

164 /**
165 * @param queryId
166 * @return
167 */
168 String rowKey = "YVR#2023-10-01#10";
169 Row row = dataClient.readRow(tableId, rowKey);
170 if (row != null) {
171   for (RowCell cell : row.getCells()) {
172     if (cell.getQualifier().toStringUtf8().equals("temperature")) {
173       return Integer.parseInt(cell.getValue().toStringUtf8());
174     }
175   }
176 }
177
178
179 public int query2() throws Exception {
  }

Console [assign4]
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 22, 2025, 11:46:38 PM - 11:47:27 PM)
Connecting to Bigtable...
Connected to Bigtable...
Connected to Bigtable successfully.
Load data for SeaTac.
Loaded data for station: SEA
SEA Data has been loaded Successfully
Loading data for Vancouver.
Loaded data for station: YVR
YVR Data has been loaded Successfully
Loading data for Portland.
Loaded data for station: PDX
PDX Data has been loaded Successfully

```

Writable Smart Insert 176:6: 6101 ENG IN 1219 AM 6/23/2025

After the Execution

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE

```

File Edit Source Refactor Navigate Search Project Run Window Help
Project Explorer [assign4]
src/main/java com.bigtable Bigtable run():void
src/main/resources
src/test/java
src/test/resources
JRE System Library
Maven Dependencies
src
target
pom.xml
AutomationPractice
inetBankingV1
JulyProject
practice
practice.java
SalaryDetails

36   testbt.run();
37 }
38 public void connect() throws IOException {
39   System.out.println("Connecting to Bigtable...");
40   dataclient = BigtableDataClient.create(projectId, instanceId);
41   adminClient = BigtableTableAdminClient.create(projectId, instanceId);
42   System.out.println("Connected to Bigtable successfully.");
43 }
44 public void run() throws Exception {
45   connect();
46   //deleteTable();
47   //createTable();
48   loadData();
49   int temp = query1();
50   System.out.println("Temperature: " + temp);
51   int windspeed = query2();
52   System.out.println("Windspeed: " + windspeed);
53   ArrayList<Object[]> data = query3();
54   StringBuffer buf = new StringBuffer();
55   for (int i = 0; i < data.size(); i++) {
56     Object[] vals = data.get(i);
57     for (int j = 0; j < vals.length; j++)
58       buf.append(vals[j].toString() + " ");
59     buf.append("\n");
60   }
61   System.out.println(buf.toString());
62   temp = query4();
  }

Console [assign4]
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 23, 2025, 12:23:18AM - 122352AM)
Connecting to Bigtable...
Connected to Bigtable...
Connected to Bigtable successfully.
Executing query #1
Temperature: 52

```

Writable Smart Insert 61:48:2430 ENG IN 12:24 AM 6/23/2025

Write the method query2() that returns the highest wind speed in the month of September 2022 in Portland

Solution On Script

```
public void run() throws Exception {  
    connect();  
    int windspeed = query2();  
    System.out.println("Windspeed: " + windspeed);  
    close();  
}  
  
public int query2() throws Exception {  
    System.out.println("Executing query #2.");  
    int maxSpeed = 0;  
    Query query = Query.create(tableId).prefix("PDX#2022-09");  
    ServerStream<Row> rows = dataClient.readRows(query);  
    for (Row row : rows) {  
        for (RowCell cell : row.getCells()) {  
            if (cell.getQualifier().toStringUtf8().equals("windspeed")) {  
                int speed = Integer.parseInt(cell.getValue().toStringUtf8());  
                maxSpeed = Math.max(maxSpeed, speed);  
            }  
        }  
    }  
    return maxSpeed;  
}
```

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE

```

File Edit Source Refactor Navigate Search Project Run Window Help
Project Exp... Bigtable.java
assign4 (in BD_AS4) src/main/java com.bigtable Bigtable run():void
42     System.out.println("Connected to Bigtable successfully.");
43 }
44 public void run() throws Exception {
45     connect();
46     //deleteTable();
47     createTable();
48     loadData();
49     int temp = query1();
50     System.out.println("Temperature: " + temp);
51     int windspeed = query2();
52     System.out.println("Windspeed: " + windspeed);
53     ArrayList<Object>[] data = query3();
54     StringBuffer buf = new StringBuffer();
55     for (int i = 0; i < data.size(); i++) {
56         Object[] vals = data.get(i);
57         for (int j = 0; j < vals.length; j++) {
58             buf.append(vals[j].toString() + " ");
59         }
60     }
61     System.out.println(buf.toString());
62     temp = query4();
63     System.out.println("Temperature: " + temp);
64     close();
65 }
66 /**
67 * Close data and admin clients
68 */

```

Console

```

<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 23, 2025, 12:23:18 AM - 12:23:52 AM)
Connecting to Bigtable...
Connected to Bigtable successfully.
Executing query #1.
Temperature: 52

```

Writable Smart Insert 58:54:2355

12:27 AM 6/23/2025

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE

```

File Edit Source Refactor Navigate Search Project Run Window Help
Project Exp... Bigtable.java
assign4 (in BD_AS4) src/main/java com.bigtable Bigtable query20:int
177
178 public int query2() throws Exception {
179     System.out.println("Executing query #2.");
180     System.out.println("The highest wind speed during September 2022 in Portland is.");
181     String prefix = "PODX#2022-09-";
182     int maxWindSpeed = Integer.MIN_VALUE;
183     Query query = Query.create(tableId).prefix(prefix);
184     ServerStreamRow<Row> rows = dataClient.readRows(query);
185     for (Row row : rows) {
186         for (RowCell cell : row.getCells(COLUMN_FAMILY, "windSpeed")) {
187             String value = cell.getValue().toStringUtf8().trim();
188             try {
189                 int windSpeed = Integer.parseInt(value);
190                 if (windSpeed > maxWindSpeed) {
191                     maxWindSpeed = windSpeed;
192                 }
193             } catch (NumberFormatException e) {
194             }
195         }
196     }
197     return (maxWindSpeed == Integer.MIN_VALUE) ? 0 : maxWindSpeed;
198 }
199
200
201
202
203 public ArrayList<Object[]> query3() throws Exception {
204     System.out.println("Executing query #3.");
205     ArrayList<Object[]> data = new ArrayList<Object[]>();
206     Query query = Query.create(tableId).prefix("SEA#2022-10-02");
207     ServerStreamRow<Row> rows = dataClient.readRows(query);
208     for (Row row : rows) {
209         String[] keyParts = row.getKey().toStringUtf8().split("#");
210         String date = keyParts[1];
211         String hour = keyParts[2];
212         String temp = "", dew = "", hum = "", wind = "", press = "";
213         for (RowCell cell : row.getCells()) {
214             switch (cell.getQualifier().toStringUtf8()) {
215                 case "temperature": temp = cell.getValue().toStringUtf8(); break;
216                 case "dewpoint": dew = cell.getValue().toStringUtf8(); break;
217                 case "humidity": hum = cell.getValue().toStringUtf8(); break;
218                 case "windSpeed": wind = cell.getValue().toStringUtf8(); break;
219                 case "pressure": press = cell.getValue().toStringUtf8(); break;
220             }
221         }
222         data.add(new Object[]{date, hour, temp, dew, hum, wind, press});
223     }
224 }
225
226
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```

After the Execution

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer View:** Shows the project structure with the file `Bigtable.java` selected.
- Code Editor View:** Displays the Java code for `Bigtable.java`. The code implements a method `query3()` which queries a Bigtable for the highest wind speed in September 2022 for Portland. The output of the code execution is visible in the code editor.
- Console View:** Shows the terminal output of the Java application. It includes the connection logs and the result of the query: "The Highest wind speed during September 2022 in Portland is. windspeed: 21".
- Taskbar:** At the bottom, it shows the Windows taskbar with various pinned icons and system status indicators.

```
180 System.out.println("Executing query #2.");
181 System.out.println("The Highest wind speed during September 2022 in Portland is.");
182 String prefix = "PDX#2022-09-";
183 int maxWindSpeed = Integer.MIN_VALUE;
184 Query query = Query.create(tableId).prefix(prefix);
185 ServerStream<Row> rows = dataClient.readRows(query);
186 for (Row row : rows) {
187     for (RowCell cell : row.getCells(COLUMN_FAMILY, "windSpeed")) {
188         String value = cell.getValue().toStringUtf8().trim();
189         try {
190             int windSpeed = Integer.parseInt(value);
191             if (windSpeed > maxWindSpeed) {
192                 maxWindSpeed = windSpeed;
193             }
194         } catch (NumberFormatException e) {
195             }
196     }
197 }
198 }
199 }
200 }
201 return (maxWindSpeed == Integer.MIN_VALUE) ? 0 : maxWindSpeed;
202 }
203
204 public ArrayList<Object[]> query3() throws Exception {
205     System.out.println("Executing query #3.");
206 }
```

```
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 23, 2025, 12:38:58 AM - 12:39:36 AM)
Connecting to Bigtable...
Connected to Bigtable successfully.
Executing query #2.
The Highest wind speed during September 2022 in Portland is.
windspeed: 21
```

Write the method `query3()` that returns all the readings for SeaTac for October 2, 2022.

Solution On Script

```
public void run() throws Exception {  
    connect();  
  
    ArrayList<Object[]> data = query3();  
  
    StringBuffer buf = new StringBuffer();  
  
    for (int i = 0; i < data.size(); i++) {  
  
        Object[] vals = data.get(i);  
  
        for (int j = 0; j < vals.length; j++) {  
  
            buf.append(vals[j].toString() + " ");  
  
            buf.append("\n");  
        }  
  
        System.out.println(buf.toString());  
    }  
  
    public ArrayList<Object[]> query3() throws Exception {  
        System.out.println("Executing query #3.");  
  
        System.out.println("Writing the method Query3 which returns all the readings for SeaTac  
for October 2, 2022.");  
  
        ArrayList<Object[]> data = new ArrayList<Object[]>();  
  
        String prefix = "SEA#2022-10-02#";  
  
        Query query = Query.create(tableId).prefix(prefix);  
  
        ServerStream<Row> rows = dataClient.readRows(query);  
  
        for (Row row : rows) {  
            String rowKey = row.getKey().toStringUtf8(); // SEA#2022-10-02#10  
            String[] parts = rowKey.split("#");  
            String date = parts[1];  
            String hour = parts[2];  
            String temperature = "", dewPoint = "", humidity = "", windSpeed = "", pressure = "";  
            for (RowCell cell : row.getCells()) {  
                if (cell.getColumnIndex() == 0) {  
                    date = cell.getValue();  
                } else if (cell.getColumnIndex() == 1) {  
                    hour = cell.getValue();  
                } else if (cell.getColumnIndex() == 2) {  
                    temperature = cell.getValue();  
                } else if (cell.getColumnIndex() == 3) {  
                    dewPoint = cell.getValue();  
                } else if (cell.getColumnIndex() == 4) {  
                    humidity = cell.getValue();  
                } else if (cell.getColumnIndex() == 5) {  
                    windSpeed = cell.getValue();  
                } else if (cell.getColumnIndex() == 6) {  
                    pressure = cell.getValue();  
                }  
            }  
            data.add(new Object[]{date, hour, temperature, dewPoint, humidity, windSpeed, pressure});  
        }  
        return data;  
    }  
}
```

```

String col = cell.getQualifier().toStringUtf8();
String val = cell.getValue().toStringUtf8();

switch (col) {
    case "temperature": temperature = val; break;
    case "dewPoint": dewPoint = val; break;
    case "humidity": humidity = val; break;
    case "windSpeed": windSpeed = val; break;
    case "pressure": pressure = val; break;
}

```

```

Object[] record = new Object[] {
    date,
    hour,
    Integer.parseInt(temperature),
    Integer.parseInt(dewPoint),
    humidity,
    windSpeed,
    pressure
};

data.add(record);
}

return data;
}

```

On Script

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE

```

File Edit Source Refactor Navigate Search Project Run Window Help
Project Exp. Bigtable.java
assign4 (in BD_AS4)
src/main/java
  com.bigtable
    Bigtable.java
src/main/resources
src/test/java
src/test/resources
JRE System Library
Maven Dependencies
src/target
pom.xml
AutomationPractice
InetBankingV1
JulyProject
practice
practice.java
SalaryDetails

Bigtable.java
1 assign4 > src/main/java > com.bigtable > Bigtable > main(String[])
2 public class Bigtable {
3     public static void main(String[] args) {
4         System.out.println("Connected to Bigtable successfully.");
5         public void run() throws Exception {
6             connect();
7             //deleteTable();
8             createTable();
9             loadData();
10            int temp = query1();
11            System.out.println("Temperature: " + temp);
12            int windspeed = query2();
13            System.out.println("Windspeed: " + windspeed);
14            ArrayList<Object[]> data = query3();
15            StringBuffer buf = new StringBuffer();
16            for (int i = 0; i < data.size(); i++) {
17                Object[] vals = data.get(i);
18                for (int j = 0; j < vals.length; j++) {
19                    buf.append(vals[j].toString() + " ");
20                }
21            }
22            System.out.println(buf.toString());
23            temp = query4();
24            System.out.println("Temperature: " + temp);
25        }
26        close();
27    }
28 }

Console
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 23, 2025, 12:38:58 AM - 12:39:36 AM)
Connecting to Bigtable...
Connected to Bigtable successfully.

```

eclipse-workspace - assign4/src/main/java/com/bigtable/Bigtable.java - Eclipse IDE

```

File Edit Source Refactor Navigate Search Project Run Window Help
Project Exp. Bigtable.java
assign4 (in BD_AS4)
src/main/java
  com.bigtable
    Bigtable.java
src/main/resources
src/test/java
src/test/resources
JRE System Library
Maven Dependencies
src/target
pom.xml
AutomationPractice
InetBankingV1
JulyProject
practice
practice.java
SalaryDetails

Bigtable.java
16 public class Bigtable {
17     public ArrayList<Object[]> query3() throws Exception {
18         System.out.println("Executing query #3.");
19         System.out.println("Question: 5.");
20         System.out.println("Write the method query3() that returns all the readings for SeaTac for October 2, 2022.");
21         ArrayList<Object[]> data = new ArrayList<Object[]>();
22         String prefix = "SEA#2022-10-02#";
23         Query query = Query.create(tableId).prefix(prefix);
24         ServerStreamRow rows = dataClient.readRows(query);
25         for (Row row : rows) {
26             String rowKey = row.getKey().toStringUtf8(); // SEA#2022-10-02#10
27             String[] parts = rowKey.split("#");
28             String date = parts[1];
29             String hour = parts[2];
30             String temperature = "", dewPoint = "", humidity = "", windSpeed = "", pressure = "";
31             for (RowCell cell : row.getCells()) {
32                 String col = cell.getQualifier().toStringUtf8();
33                 String val = cell.getValue().toStringUtf8();
34                 switch (col) {
35                     case "temperature": temperature = val; break;
36                     case "dewPoint": dewPoint = val; break;
37                     case "humidity": humidity = val; break;
38                     case "windSpeed": windSpeed = val; break;
39                     case "pressure": pressure = val; break;
40                 }
41             }
42             Object[] record = new Object[] {
43                 date,
44                 hour,
45                 Integer.parseInt(temperature),
46                 Integer.parseInt(dewPoint),
47                 humidity,
48             };
49         }
50     }
51 }

Console
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 23, 2025, 12:38:58 AM - 12:39:36 AM)
Connecting to Bigtable...
Connected to Bigtable successfully.

```

After the Execution

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure with files like Bigtable.java, assign4.java, and various test and resource files.
- Code Editor:** Displays the Java code for the `query3()` method. The code connects to a Bigtable database, reads rows for a specific date, and prints the temperature, dew point, humidity, and pressure for each row.
- Console:** Shows the terminal output of the application running. It starts by connecting to the Bigtable database and then executes the `query3()` method, which returns all the readings for SeaTac for October 2, 2022. The output lists several rows of data, each containing timestamp, station ID, temperature, dew point, humidity, and pressure.
- System Bar:** At the bottom, it shows system information like battery level, network status, and the date/time (104 AM, 6/23/2025).

Write the method `query4()` that returns the highest temperature at any station in the summer months of 2022 (July (7), August (8)).

Solution On Script

```
public void run() throws Exception {
    connect();
    int temp = query4();
    System.out.println("Temperature: " + temp);
    close();
}

public int query4() throws Exception {
    System.out.println("Executing query #4.");
    System.out.println("Writing the method Query4 Which returns the highest temperature at");
    System.out.println("Any station in the summer months of 2022 July (7), August (8).");
}
```

```

int maxTemp = -100;

// Prefixes for July and August 2022

String[] prefixes = {

    "SEA#2022-07-", "SEA#2022-08-",

    "PDX#2022-07-", "PDX#2022-08-",

    "YVR#2022-07-", "YVR#2022-08-"

};

for (String prefix : prefixes) {

    Query query = Query.create(tableId).prefix(prefix);

    ServerStream<Row> rows = dataClient.readRows(query);

    for (Row row : rows) {

        for (RowCell cell : row.getCells(COLUMN_FAMILY, "Temperature")) {

            String tempStr = cell.getValue().toStringUtf8();

            try {

                int temp = Integer.parseInt(tempStr);

                if (temp > maxTemp) {

                    maxTemp = temp;

                }

            }

            catch (NumberFormatException e) {

                }

            }

        }

    }

}

return maxTemp;
}

```

On

Script

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure with files like assign4, Bigtable.java, and practice.java.
- Code Editor:** Displays the Bigtable.java code. The code connects to a Bigtable instance, queries temperature and windspeed data, and prints the results to the console.
- Console:** Shows the execution output:

```
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 23, 2025, 1:03:18 AM - 1:03:52 AM)
Connecting to Bigtable...
Connected to Bigtable successfully.
Executing query #3.
Writing the Query3 Which returns all the readings for SeaTac for October 2, 2022.
2022-10-02 00 74 53 47.8 9 1014.1
2022-10-02 01 69 53 56.7 7 1014.1
2022-10-02 02 67 53 60.7 7 1014.3
2022-10-02 03 66 53 62.9 7 1014.4
2022-10-02 04 64 53 67.3 7 1014.2
2022-10-02 05 62 52 72.3 8 1014.1
2022-10-02 06 61 52 72.2 8 1014.3
2022-10-02 07 63 51 64.8 9 1014.2
2022-10-02 08 61 53 74.9 4 1014.
```
- Taskbar:** Shows various application icons and system status.

After the Execution

The screenshot shows the Eclipse IDE interface with the following details:

- Project Explorer:** Shows the project structure with files like assign4, Bigtable.java, and practice.java.
- Code Editor:** Displays the Bigtable.java code. The code has been modified to implement a method query4() that finds the highest temperature at any station in the summer months of 2022 (July 7, August 8).
- Console:** Shows the execution output:

```
<terminated> Bigtable [Java Application] C:\Program Files\Java\jdk-16.0.2\bin\javaw.exe (Jun 23, 2025, 1:19:46 AM - 1:20:33 AM)
Connecting to Bigtable...
Connected to Bigtable successfully.
Executing query #4.
Writing the method Query4 Which returns the highest temperature at
Any station in the summer months of 2022 July (7), August (8).
Temperature: -100.
```
- Taskbar:** Shows various application icons and system status.

Conclusion

This assignment provided practical experience in connecting to and interacting with Google Cloud Bigtable using Java in Eclipse. By building clients, designing the data schema, and writing queries, we gained hands-on understanding of NoSQL data storage principles. The ability to store and retrieve large-scale time-series data such as weather measurements demonstrates Bigtable's suitability for scalable, cloud-native applications. These skills are crucial for developing modern data-driven applications that require real-time analytics and high throughput.

Git Link: <https://github.com/PurushothamanShanmugam/Big-Data>