D211 Advanced Data Acquisition

Western Governs University

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Part 1: Data Dashboard

A. Interactive Data Dashboard

File is titled: D211_Dashboard_IG_Final.twbx

A1. Data Sets

Internal:
"churn.csv"

External:
"Telcom_prepared_churn.csv"

A2. Installation Instructions
- The dashboard can also be viewed by downloading Tableau Public. The following steps can be followed to download and install Tableau Public:
    1. Go to Tableau Public at: https://www.tableau.com/products/desktop
    2. Click on the "Download Tableau Desktop button.
    3. Fill out the form that pops up with name, email address, and organization (if applicable). Then click "Download the App" button.
    4. Select the version of Tableau Desktop that is compatible with your operating system (Windows or Mac)
    5. Once the download is complete, double-click on the Tableau Desktop installer file to start the installation process.
    6. Follow the instructions provided by the installer to complete the installation.
    7. Once the installation is complete, launch Tableau Desktop
    8. On the start page, click on the "open workbook" button.
    9. A dialog box will appear prompting you to select the workbook file you want to open. Navigate to the folder where the file is saved.
    10. Select the file D211_Dashboard_IG_Final.twbx and click on the "open" button.
    11. Tableau will now open the workbook, and you should see the dashboard displayed on the screen.

- If using virtual machine:
    1. Open Tableau Desktop
    2. Click file
    3. Open file D211_Dashboard_IG_Final.twbx

A3. Navigation Instructions

Churn Findings

The first sheet is the internal KPIs, then external KPIs, Total Charges/Monthly Charges, Tenure vs Bandwidth, Age & TechSupport, and Techie & Yearly Equip Failure. Last is the dashboard Churn Findings. This dashboard includes churn findings from the internal and external churn data sets. When navigating the dashboard, the internal and external KPIs are listed at the top. For each of these churn data sets there are numbers for variables based on if the customer churned (yes) or if they stayed with the telecom service (no). In the middle of the dashboard there are two bar charts. The first bar chart on the left is 'Age & TechSupport'. There is a navigation bar where the data can be adjusted based on monthly charges. The next bar chart is 'Techie & Yearly Equip Failure'. This bar chart can be flited based on gender. Under gender you can select one of the boxes to filter the data based on female or male. The bottom of the dashboard includes scatter plots for the churn data. The first scatter plot is the 'Total Charges/Monthly Charges'. The last scatterplot is 'Tenure vs Bandwidth'. Both of these scatterplots have sliders that can filter data by age.

A4. SQL Code

SQL code for each sheet to make the dashboard is listed below:

- SQL Code for Internal dataset already in pgadmin:

```
CREATE TABLE public.customer
(
    customer_id text COLLATE pg_catalog."default" NOT NULL,
    lat numeric,
    lng numeric,
    population integer,
    children integer,
    age integer,
    income numeric,
    marital text COLLATE pg_catalog."default",
    churn text COLLATE pg_catalog."default",
    gender text COLLATE pg_catalog."default",
    tenure numeric,
    monthly_charge numeric,
    bandwidth_gp_year numeric,
    outage_sec_week numeric,
    email integer,
    contacts integer,
    yearly_equip_faiure integer,
    techie text COLLATE pg_catalog."default",
    port_modem text COLLATE pg_catalog."default",
```

```
                    tablet text COLLATE pg_catalog."default",
                    job_id integer,
                    payment_id integer,
                    contract_id integer,
                    location_id integer,
                    CONSTRAINT customer_pkey PRIMARY KEY (customer_id),
                    CONSTRAINT customer_contract_id_fkey FOREIGN KEY (contract_id)
                       REFERENCES public.contract (contract_id) MATCH SIMPLE
                       ON UPDATE NO ACTION
                       ON DELETE NO ACTION
                       NOT VALID,
                    CONSTRAINT customer_job_id_fkey FOREIGN KEY (job_id)
                       REFERENCES public.job (job_id) MATCH SIMPLE
                       ON UPDATE NO ACTION
                       ON DELETE NO ACTION
                       NOT VALID,
                    CONSTRAINT customer_location_id_fkey FOREIGN KEY (location_id)
                       REFERENCES public.location (location_id) MATCH SIMPLE
                       ON UPDATE NO ACTION
                       ON DELETE NO ACTION
                       NOT VALID,
                    CONSTRAINT customer_payment_id_fkey FOREIGN KEY (payment_id)
                       REFERENCES public.payment (payment_id) MATCH SIMPLE
                       ON UPDATE NO ACTION
                       ON DELETE NO ACTION
                       NOT VALID
                 )

                 TABLESPACE pg_default;

                 ALTER TABLE public.customer
                    OWNER to postgres;
```

- SQL code for external data set:

```
                 CREATE TABLE public."Telecom_churn_preared"
                 (
                    "customerID" "char",
                    gender "char",
                    "SeniorCitizen" integer,
                    "Partner" "char",
                    "Dependents" "char",
                    tenure integer,
                    "PhoneService" "char",
                    "MultipleLines" "char",
                    "InternetService" "char",
                    "OnlineSecurity" "char",
                    "OnlineBackup" "char",
                    "DeviceProtection" "char",
```

```
            "TechSupport" "char",
            "StreamingTV" "char",
            "StreamingMovies" "char",
            "Contract" "char",
            "PaperlessBilling" "char",
            "PaymentMethod" "char",
            "MonthlyCharges" integer,
            "TotalCharges" "char",
            "Churn" "char",
            PRIMARY KEY ("customerID")
        );

            ALTER TABLE public."Telecom_churn_prepared"
              OWNER to postgres;
```

- SQL code for each sheet in the database:

1. Internal KPIs

```
SELECT
  AVG(CAST(CAST(age AS BIGINT) AS DOUBLE PRECISION)) AS "avg:age:ok",
  AVG(CAST(CAST(children AS BIGINT) AS DOUBLE PRECISION)) AS "avg:children:ok",
  AVG(income) AS "avg:income:ok",
  AVG("tenure (customer)") AS "avg:tenure (customer):ok",
  AVG(CAST(CAST(yearly_equip_faiure AS BIGINT) AS DOUBLE PRECISION)) AS
"avg:yearly_equip_faiure:ok",
  churn
FROM db2002.TableauTemp.Telcom_churn_prepared#csv
LEFT JOIN public.Tableau_54_548151A4-808E-4B39-82AB-822B71B3E426_1_FQ_Temp_1 AS
FQ_Temp_1
ON Telcom_churn_prepared.csv.gender = FQ_Temp_1.gender
WHERE churn IN ('No', 'Yes') AND churn IS NOT NULL
GROUP BY churn


SELECT
  customer.age,
  customer.children,
  CAST(customer.churn AS TEXT) AS churn,
  CAST(customer.gender AS TEXT) AS gender,
  customer.income,
  customer.tenure AS "tenure (customer)",
  customer.yearly_equip_faiure
```

FROM public.customer AS customer;

2. External KPIs

```
SELECT
   AVG(CAST(CAST(FQ_Temp_1.age AS BIGINT) AS DOUBLE PRECISION)) AS "avg:age:ok",
   AVG(CAST(CAST(FQ_Temp_1.children AS BIGINT) AS DOUBLE PRECISION)) AS
"avg:children:ok",
   AVG(CAST(FQ_Temp_1.income AS DOUBLE PRECISION)) AS "avg:income:ok",
   AVG(CAST(FQ_Temp_1."tenure (customer)" AS DOUBLE PRECISION)) AS "avg:tenure
(customer):ok",
   AVG(CAST(CAST(FQ_Temp_1.yearly_equip_faiure AS BIGINT) AS DOUBLE PRECISION)) AS
"avg:yearly_equip_faiure:ok",
   FQ_Temp_1.churn AS churn
FROM db2002.TableauTemp."Telcom_churn_prepared#csv" AS Telcom_churn_prepared_csv
LEFT JOIN public."Tableau_54_548151A4-808E-4B39-82AB-822B71B3E426_1_FQ_Temp_1" AS
FQ_Temp_1
ON Telcom_churn_prepared_csv.gender = FQ_Temp_1.gender
WHERE Telcom_churn_prepared_csv.Churn IS NOT NULL AND FQ_Temp_1.churn IN ('No', 'Yes')
GROUP BY FQ_Temp_1.churn;
```

```
SELECT
  CAST("customer"."gender" AS TEXT) AS gender
FROM
  public.customer AS customer
```

3. Total Charges/Monthly Charges

```
SELECT
  "Telcom_churn_prepared.csv"."Churn" AS Churn,
  "Telcom_churn_prepared.csv"."TotalCharges" AS TotalCharges,
  AVG(CAST("Telcom_churn_prepared.csv"."MonthlyCharges" AS DOUBLE PRECISION OR NULL))
AS "avg:MonthlyCharges:ok"
FROM
  db2002.TableauTemp."Telcom_churn_prepared#csv" AS "Telcom_churn_prepared.csv"
  RIGHT JOIN public."Tableau_76_EE64E27A-CAE8-45DC-8CF3-F4D798A01945_1_FQ_Temp_1"
AS "FQ_Temp_1"
  ON ("Telcom_churn_prepared.csv"."gender" = "FQ_Temp_1"."gender")
GROUP BY 1, 2
```

```
SELECT
```

```
  CAST(MIN("FQ_Temp_1"."age") AS BIGINT OR NULL) AS "lower:none:age:qk",
  CAST(MAX("FQ_Temp_1"."age") AS BIGINT OR NULL) AS "upper:none:age:qk"
FROM
  "db2002"."TableauTemp"."Telcom_churn_prepared#csv" "Telcom_churn_prepared.csv"
  FULL JOIN "public"."Tableau_74_C9FC2789-A743-4F14-9254-BBBA7FDBD4EA_1_FQ_Temp_1"
"FQ_Temp_1"
    ON ("Telcom_churn_prepared.csv"."gender" = "FQ_Temp_1"."gender")
```

```
SELECT
  "customer"."age" AS "age",
  CAST("customer"."gender" AS TEXT) AS "gender"
FROM "public"."customer" "customer"
WHERE
 ("customer"."age" >= 19) AND
 ("customer"."age" <= 89)
```

```
SELECT
  "customer"."age" AS "age",
  CAST("customer"."gender" AS TEXT) AS "gender"
FROM "public"."customer" "customer"
```

4. Tenure vs Bandwidth

```
SELECT
    AVG(CAST(""FQ_Temp_1""."" tenure (customer)"" AS DOUBLE PRECISION OR NULL)) AS
""avg:tenure (customer):ok"",
    ""FQ_Temp_1""."" bandwidth_gp_year"" AS ""bandwidth_gp_year"",
    ""FQ_Temp_1"".""churn"" AS ""churn""
FROM
    ""db2002""."" TableauTemp""."" Telcom_churn_prepared#csv""
""Telcom_churn_prepared.csv""
    RIGHT JOIN ""public""."" Tableau_86_DA64948F-4FFE-43C1-A4B3-
EF3754D5015E_1_FQ_Temp_1"" ""FQ_Temp_1""
        ON (""Telcom_churn_prepared.csv""."" gender"" = ""FQ_Temp_1""."" gender"")
GROUP BY
    2, 3
```

```
SELECT
 "customer"."age" AS "age",
 "customer"."bandwidth_gp_year" AS "bandwidth_gp_year",
 CAST("customer"."churn" AS TEXT) AS "churn",
```

```
  CAST("customer"."gender" AS TEXT) AS "gender",
  "customer"."tenure" AS "tenure (customer)"
FROM "public"."customer" "customer"
WHERE (("customer"."age" >= 18) AND ("customer"."age" <= 89))
```

```
SELECT
  "customer"."age" AS "age",
  CAST("customer"."gender" AS TEXT) AS "gender"
FROM
  "public"."customer" "customer"
```

5. Age & TechSupport

```
SELECT
   "Telcom_churn_prepared.csv"."Churn" AS "Churn",
   "Telcom_churn_prepared.csv"."TechSupport" AS "TechSupport",
   COUNT("FQ_Temp_1"."age") AS "cnt:age:ok"
FROM
   "db2002"."TableauTemp"."Telcom_churn_prepared#csv" "Telcom_churn_prepared.csv"
   INNER JOIN "public"."Tableau_96_866DCDED-AF37-427A-9031-
24C0D2D43DF5_1_FQ_Temp_1" "FQ_Temp_1"
      ON ("Telcom_churn_prepared.csv"."gender" = "FQ_Temp_1"."gender")
WHERE
   (NOT ("Telcom_churn_prepared.csv"."TechSupport" IS NULL))
GROUP BY
   1,  2
```

```
SELECT
  MIN(""FQ_Temp_1"".""monthly_charge"") AS ""lower:none:monthly_charge:qk"",
  MAX(""FQ_Temp_1"".""monthly_charge"") AS ""upper:none:monthly_charge:qk""
FROM
  ""db2002"".""TableauTemp"".""Telcom_churn_prepared#csv""
""Telcom_churn_prepared.csv""
  FULL JOIN
  ""public"".""Tableau_94_EAFB3348-8B07-4EB2-933E-C8A2FF56EAE7_1_FQ_Temp_1""
""FQ_Temp_1""
  ON (""Telcom_churn_prepared.csv"".""gender"" = ""FQ_Temp_1"".""gender"")
```

```
SELECT
   customer.age AS age,
   CAST(customer.gender AS TEXT) AS gender,
   customer.monthly_charge AS monthly_charge
FROM
```

```
   public.customer customer
WHERE
   customer.monthly_charge BETWEEN 79.97886 AND 290.160419


SELECT CAST(customer.gender AS TEXT) AS gender,
customer.monthly_charge AS monthly_charge
FROM public.customer customer
```


6. Techie & Yearly Equip Failure

```
SELECT
   "Telcom_churn_prepared.csv"."Churn" AS "Churn",
   SUM(CAST("FQ_Temp_1"."yearly_equip_faiure" AS BIGINT OR NULL)) AS
"sum:yearly_equip_faiure:ok",
   "FQ_Temp_1"."techie" AS "techie"
FROM
   "db2002"."TableauTemp"."Telcom_churn_prepared#csv" "Telcom_churn_prepared.csv"
   LEFT JOIN "public"."Tableau_105_104FF3E1-CD0B-48DB-8A74-
CF11E80B7D05_1_FQ_Temp_1" "FQ_Temp_1"
      ON ("Telcom_churn_prepared.csv"."gender" = "FQ_Temp_1"."gender")
WHERE
   NOT ("Telcom_churn_prepared.csv"."Churn" IS NULL)
GROUP BY
   1, 3



SELECT
   Telcom_churn_prepared.gender AS gender
FROM
   db2002.TableauTemp.Telcom_churn_prepared Telcom_churn_prepared
   FULL JOIN public.Tableau_106_F543AA05-E4AD-41F3-B374-CC322C398189_1_FQ_Temp_1
FQ_Temp_1
      ON (Telcom_churn_prepared.gender = FQ_Temp_1.gender)
GROUP BY
   1
ORDER BY
   gender ASC NULLS FIRST
SELECT CAST(customer.gender AS TEXT) AS gender
FROM public.customer customer

SELECT CAST(customer.gender AS TEXT) AS gender,
CAST(customer.techie AS TEXT) AS techie,
customer.yearly_equip_faiure AS yearly_equip_faiure
```
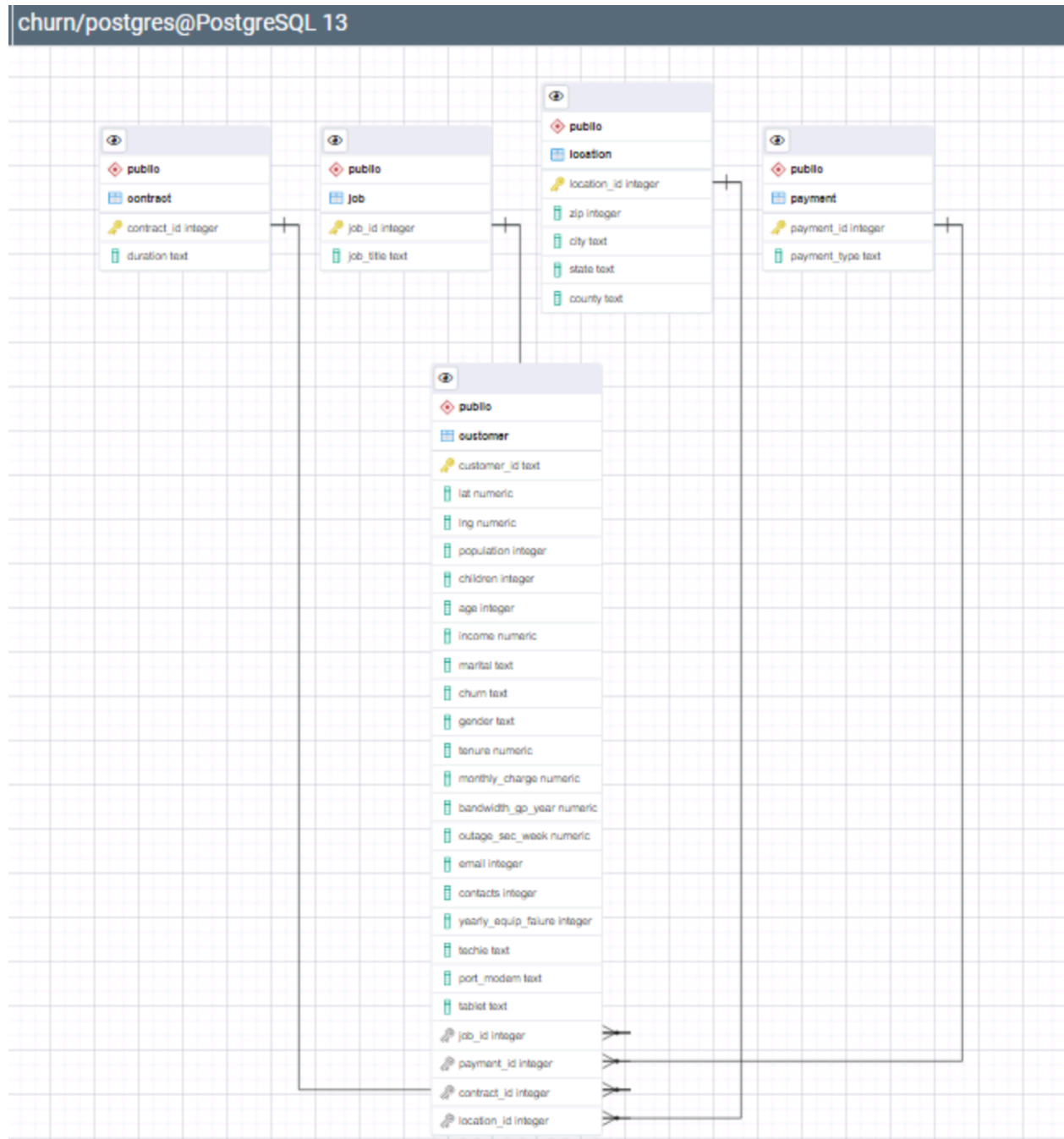
FROM public.customer customer

ERD of churn dataset (Page, n.d.)*:*

Part 2: Storytelling with Data

B. Panopto Storytelling with Data

   Link to panopto presentation:

https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=35da2090-ac5a-4072-afaa-aff500327e43

Part 3: Report

C1. Dashboard Alignment

Churn refers to the percentage of customers who discontinue using the service during a certain time period. For telecommunication companies churn rates can indicate how well the company is retaining customers and where they need to take steps to improve services or customer experience. By analyzing churn data from two different telecom services and identifying why customers are leaving, telecommunication data from multiple companies can be used to make improvements to the series and to take actions to reduce churn and increase tenure. The original churn dataset included five tables with the primary table "customer" containing the most information such as churn, age, children, gender, monthly charges, tenure, techsupport, techie, yearly equipment failure, bandwidth_Gp_year. The additional external churn data set provides similar data including churn, monthly charges, tenure, total charges, monthly charges, and gender.

C2. Business Intelligence Tool

PostgreSQL is a relational database management system with many advantages. these advantages including its open-source software which means that it is free to use, modify, and distribute. PostgreSQL is compatible with many different operating systems. PostgreSQL can handle large amounts of data and supports multi-user environments. PostgreSQL also offers many advanced features such as geographic data.

Tableau was used as the business intelligibility tool for this course for data visualization and analysis capabilities. There are several advantages to using Tableau. One benefit is its user-friendly interface. Tableau is simple drag and drop interface that allows for easy visualization. Tableau enables users to analyze large datasets quickly and easily due to is flexible data analysis tools. Tableau also offers advanced analytics tools such as predictive modeling and forecasting, and data blending.

C3. Data Cleaning

The data visualizations were formed and completed by understanding the audience and the audience's needs in reducing the churn of the telecom customers. The primary audience is executive leaders, managers, and department heads of the telecom organization. The audience's communication style was considered, and the data was formed in a way to engage and displays the essential points of the data. The data visualizations were kept simple and to the point (*Best Practices for Telling Great Stories*, n.d.). Data from two different telecom companies was used to understand market trends and establish industry benchmarks.

Tableau allows for data visualization through the use of interactive features. I utilized features such as filters to present the data for effective storytelling. For example, I used an interactive filter, slider, with age so the data could be viewed based on a specific age. Another element of effective storytelling used to engage the audience was choosing the right chart type and keeping it simple. I used scatter plots to show the most effective relationship between variables. I also used a map for increased visualization of data and bar graphs for easy comparison of the data.

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To make sure the dashboard is accessible for individuals with colorblindness the color-blind palate was used. (*5 Tips on Designing Colour-Blind-Friendly Visualizations*, n.d.)The colors chosen were used to highlight key information and draw attention to important data points. Colors were also used consistently throughout the dashboard for an easy-to-read design. A neutral background (white) was used to make the data stand out and reduce visual clutter.

Universal access to the presentation was provided by making the Tableau presentation easily assessable and easily readable. Simple and clear language was used to make the presentation easy to understand by all. Colors were chosen to provide sufficient contrast for increased attention. A clear front size and style were chosen for clear and easy-to-read. Appropriate data visualization was used to effectively communicate the message of churn factors. Labels were used on the charts/graphs to explain what the data represents and provide more context.

C4. Dashboard Creation

Internal KPIs:
1. Right Click on null vales and then exclude
2. Under Churn Tables choose "customer" table:
   - Drag BandwidthGBYear to "Columns"; change measure to Average
   - Drag Income to "Columns"; change measure to Average
   - Drag MonthlyCharges to "Columns"; change measure to Average
   - Drag Children to "Columns"; change measure to Average
   - Drag Tenure to "Columns"; change measure to Average
   - Drag Age to "Columns"; change measure to Average
   - Drag Churn to the rows column

3. Drag each of the variables listed in the columns section down to the x-axis to create measure values on the horizontal bar graph (default graph).
4. Move measured names from rows to columns
5. Move the measured values under "Marks"
6. Under "marks" Click the icon next "measure names" and change it to text
7. Under "marks" click the icon next to "churn" and click color

External KPIs:
1. Right Click on null vales and then exclude
2. Under Telcom_churn_prepared Tables choose "customer" table:
   - Drag MonthlyCharge to "Columns"; change measure to Average
   - Drag SeniorCitizen to "Columns"; change measure to Count
   - Drag TotalCharges to "Columns"; change measure to Average
   - Drag Tenure to "Columns"; change measure to Average
   - Drag Churn to the rows column
3. Drag each of the variables listed in the columns section down to the x-axis to create measure values on the horizontal bar graph (default graph).
4. Move measured names from rows to columns
5. Move the measured values under "Marks"
6. Under "marks" Click the icon next "measure names" and change it to text
7. Under "marks" click the icon next to "churn" and click color

Total Charges/Monthly Charges:
1. Under Telcom_churn_prepared Tables choose "Monthly Charges" table:
   - drag "Monthly Charges" to rows; right click and change measure to average
   - drag "Total Charges" to columns; right click and change to dimension
2. Drag Churn1 under Telcom_churn_prepared table under Marks
3. Under "marks" click the icon next to "churn" and click color
4. To add age interactive filter:
   - Drag Age under "filters"
   - A filter field box [Monthly Charge] pop up box will appear
   - Click all values
   - Click Next
   - A filter [Age] will appear
   - Select Range of values and click "ok"
   - right click age then click show filter
5. Under Marks click drop down box that says "automatic" and then click circle to change to scatterplot

Tenure vs Bandwidth

1. Under Customer Tables choose "Bandwidth GP year":
   - drag " Tenure": to rows; right click and change measure to average
   - drag " Bandwidth GP year":" to columns right click and change to dimension
2. Drag Churn1 under Telcom_churn_prepared table under Marks
3. Under "marks" click the icon next to "churn" and click color
4. To add age interactive filter:
   - Drag Age under "filters"
   - A filter field box [Age] pop up box will appear
   - Click all values
   - Click Next
   - A filter [Age] will appear
   - Select Range of values and click "ok"
   - right click age then click show filter
5. Under Marks click drop down box that says "automatic" and then click circle to change to scatterplot

Age & Tech Support
1. Under Customer Tables":
   - drag " Age" to rows; right click and change measure to count
   - drag " TechSupport" to columns right click and change to dimension
2. Drag Churn under Marks
3. Under "marks" click the icon next to "churn" and click color
4. To add monthly charge interactive filter:
   - Drag monthly charge under "filters"
   - A filter field box [Monthly Charge] pop up box will appear
   - Click all values
   - Click Next
   - A filter [Monthly Charge] will appear
   - Select Range of values and click "ok"
   - right click monthly charge then click show filter
5. Under Marks click drop down box that says "automatic" and then click bar to change to bar chart

Techie & Yearly Equip Failure
1. Under Customer Tables":
   - drag " Yearly Equip Failure" to rows; right click and change measure to sum
   - drag " Techie" to columns right click and change to dimension
2. Drag Churn under Marks
3. Under "marks" click the icon next to "churn" and click color
4. To add monthly charge interactive filter:

          - Drag monthly charge under "filters"
          - A filter field box [gender] pop up box will appear
          - Click all values
          - Select Range of values and click "ok"
          - right click gender then click show filter
     5. Under Marks click drop down box that says "automatic" and then click bar to change to bar chart

Churn Findings:
     1. Click new dashboard
     2. On the left side of under sheets, drag and drop each sheet on to the dashboard
     3. Arrange sheet in desired order and adjust size
     4. To place filter with each graph
          - click on graph
          - click arrow
          - click floating
          - adjust position of interactive filter to desired position

C5. Data Analysis Results

Data can be analyzed in relation to factors such as gender, income, monthly charges, age, children, tenure, techie, and tech support. Once patterns and trends have been identified stakeholders can use the information to improve customer retention efforts, target market efforts, and optimize pricing strategies. When examining the Internal vs External dashboard there are two scatterplots entitled "Total Charges vs Monthly Chares" and "Bandwidth vs Tenure". Both of these scatter plots indicate a positive slope. This means that there is a positive relationship between the two variables plotted. When looking at the plot from the internal chart. The total charges and average monthly charges have a positive relationship. It would be important for executive leaders to examine why customers are leaving a service provider. By examining the relationship between total charges and churn, leaders can gain insights into whether customers who spend more money are more likely to churn. Leaders can gain insights into whether customers who have higher monthly charges are more likely to churn. By examining total charges vs monthly charges one can gain information to see if those customers who are spending more money each month are also using more services or having higher-end plans. This gives leaders marketing direction. There was also a positive relationship between bandwidth and tenure. This relationship can provide insight into whether customers who have higher bandwidth usage then to stay with the company for a longer period. Understanding this relationship will give leaders ability to tailor the company's offering to customers and ensure they are meeting the needs of the target market.

The graph "Age and TechSupport" can provide insights into variations in customer behavior and preferences regarding age, contacting tech support, and churn rates. The data can provide insights into customer satisfaction levels in different states regarding customer loyalty and demographics. For example, younger customers may have a higher churn rate due to their

tendency to switch providers more frequently while older customers may be more loyal. It can also reveal if the company may need to improve its support services, train its agent better, or offer more comprehensive resources to customers who are younger. The data indicates that there is no relationship among a customer's age and contract tech support are related to churn.

The graph "Techie & yearly Equip Failure" can provide insights on identifying trends and areas of improvement in their product offerings, technical support, and customer experience which could help reduce churn rates and retain more customers. Techie data can reveal whether customers who have a high level of technical knowledge are churning at a higher rate. Yearly equipment failure data can provide insights into the quality and reliability of the company's products. If customers who experience frequent equipment failures are churning at a higher rate, this could indicate that the company's products are not meeting expectations. The presented data indicates that those customers who do not consider themselves techie are less likely to churn.

C6. Analysis Limitations

There are several limitations to consider when using data from an outside source. It is important to consider the accuracy and completeness of the data. The quality of the data may be compromised by errors or omissions leading to inaccurate or incomplete analysis. When using Tableau for analysis one limitation is that it requires a certain level of technical skills to use effectively and functionality may be sufficient for all types of analysis. More complete analysis may require more specialized tools or programming languages that may not be available in tableau. SQL also has limitations. One limitation of SQL is it is primarily designed for working with structured data stored in a relational database. It is difficult to use with unstructured and semi-structed data. SQL can be complex and difficult to learn for those who are not familiar with programming or database concepts.

D. Web Sources

5 tips on designing colour-blind-friendly visualizations. (n.d.). Tableau.
     https://www.tableau.com/en-gb/blog/examining-data-viz-rules-dont-use-red-green-
     together

Connect to a Custom SQL Query. (n.d.).
     Tableau.https://help.tableau.com/current/pro/desktop/en-us/customsql.htm

Telcom Customer Churn. (n.d.). www.kaggle.com.
     https://www.kaggle.com/datasets/blastchar/telco-customer-churn

 Page, D. (n.d.). ERD Tool — pgAdmin 4 7.0 documentation.
      https://www.pgadmin.org/docs/pgadmin4/development/erd_to ol.html

E Sources

Knaflic, C. N. (2015). *Storytelling with data: A data visualization guide for business professionals*.
     Wiley .(Chapter 1, Chapters 3-5, Chapters 7 - 8).
     https://ebookcentral.proquest.com/lib/westerngovernorsebooks/reader.action?docID=418

     7267&ppg=1