Motivation

It's no secret that we're still embroiled in the global COVID-19 pandemic. It is also no secret that every corner of the world is trying to gather and study data about infections both domestically and abroad. However, due to the large scale of both the crisis itself and the resulting influx of data, it can be hard to sort through what's been happening for the last year and a half. Thus, our website will aggregate covid information by **country** and **city** to make it clear which areas have been hit the hardest at which times throughout the pandemic.

User Stories

From our Customers:

- Phase 1
  - Hey Development team, I am a middle school student who is responsible for delivering morning announcements over the intercom. The start of my announcement involves reading daily statistics for cases in our area. It would be awesome if the data could be updated at minimum, everyday. This way I can provide the most recent, accurate information to my classmates.
    - Our Response: "Hello. Though we will be dynamically filling out statistics each day in a future phase of our project, it is unfortunate that we will not be able to implement your dynamic request in this phase." There was not much we could do for this story in this first phase due to requiring a dynamic addition of data to our database, so we could not complete it.
    - Their Response: As an assessment of user story 1 from phase 1, I agree with your team's decision that this user story is a solution you will come to a solution with in a later phase. As for time estimates, I believe that this solution will take about 1 hour to complete when ready to implement. I believe this to now be a phase 4 goal, and we can approach readjusting this milestone as your team continues to develop.
    - Most recent response: To provide an update to this request, this is something we're looking into. Our current implementation has our API read from our database which is statically populated. Implementing your request would require updating our database with new data daily, which of course is not impossible, but is not trivial either. We'll try to implement your request by phase 4.
  - Hey Development team, I am a mother of three so I am usually pretty busy

throughout the day. I try my hardest to keep up with recent news and updates on COVID in order to keep my family as safe as possible. Sometimes, however, it's hard to keep up with so much; so, I was wondering if this website could contain a feature that displays major news regarding covid for example, new outbreaks in the area, government announcements, etc. This would be awesome because it would be a centralized location that can keep me informed and my family safe.

- ■ Our Response: "Hello. We will retain this feature as an idea to implement in the next phases of our project. But for now, we just have information about key locations and their Covid statistics." This once again would require looking at data dynamically, which is not a part of this phase.
- ■ Their Response: As an assessment of user story 2 from phase 1, I agree with your team's decision that this user story is a solution you will come to a solution with in a later phase. As for time estimates, I believe that this solution will take about 2 hours to complete when ready to implement. I believe this to now be a phase 4 goal, and we can approach readjusting this milestone as your team continues to develop.
- ■ Final response: Fortunately, this is something we were able to implement in phase 2! By visiting our home page, you can see local COVID updates in your area or see local updates for whatever city or state you're viewing on our website!

○ Hey Development team, I am a pediatric doctor who hears from a lot of patients that they have trouble finding testing locations. As a result, I would think it would be amazing if there was a feature that showed nearby testing locations for users based on the address they search. Available and reachable testing is very important in beating this virus because we can take proper precautions for infected individuals.

- ■ Our Response: "Hello. In the near future, we will be implementing searching to our databases, but for now we are trying to maintain only small amounts of information on our website. Please look forward to the convenience that will come when searching is implemented." This would require a search, which is a dynamic procedure that we do not have right now. On top of that, we only have six total locations
- ■ Their Response: As an assessment of user story 3 from phase 1, I agree with your team's decision that this user story is a solution you will come to a solution with in a later phase. As for time estimates, I believe that this solution will take about 3 hours to complete when ready to implement. I believe this to now be a phase 4 goal, and we can approach readjusting this milestone as your team continues to develop.
- ■ Final response: Fortunately, this was another request that we were

able to implement in this phase! Our home page automatically contains information about finding COVID tests in your local area!

○ Hey Development team, I am a math teacher at my local high school. After seeing numbers all day, I think my students and I can both agree we don't enjoy seeing a list of statistics. I request a feature that visualizes the data, and can provide a better visualization of the severity of these stats. Whether this be through charts, graphs, etc, I think this feature would better deliver the goal of this website in informing the population about COVID data.

■ Our Response: "Hello. I am afraid that all we can do right now is show the statistics directly in the form of numbers. However, in the future, we will be making our information more friendly to the eyes with things like charts and graphs." We thought that it would be better to wait until the next phase for this so that we could turn our data into graphics with code.

■ Their Response: As an assessment of user story 4 from phase 1, I agree with your team's decision that this user story is a solution you will come to a solution with in a later phase. As for time estimates, I believe that this solution will take about 2 hours to complete when ready to implement. I believe this to now be a phase 3 goal, and we can approach readjusting this milestone as your team continues to develop.

■ Final response: We implemented a graph in the covid timelines page of each country's trends. It definitely made sense to add such a feature, thank you for bringing it up.

○ Hey Development team, I am an elderly man who is a high risk individual. I think this website will be great for me to identify the general threat of my surrounding neighborhood. But, because I am older I have trouble navigating complicated websites. I would love it if there was a feature that could make it easy to generate a search for my address. This would help because it would be friendly for me to take advantage of the data you provide and stay safe.

■ Our Response: "Hello. This is a feature we will keep in mind when making the search features of the website. For now, we are not in a phase to implement this feature." This request was another request that we could not do in the first phase because it seemingly requires that we use their location.

■ Their Response: As an assessment of user story 5 from phase 1, I agree with your team's decision that this user story is a solution you will come to a solution with in a later phase. As for time estimates, I

believe that this solution will take about 1 hour to complete when ready to implement. I believe this to now be a
phase 4 goal, and we can approach readjusting this milestone as your team continues to develop.

- ■ Final response: This is also a request that we were able to implement in this phase! The requestor states that they have difficulty using technology and would like to search their address to find COVID data in their area, however, we took it one step further and on our home page automatically display COVID data in the user's area!

- Phase 2
    - ○ I am an elderly person trying to use your website. I have terrible eyesight as it is, and the blurriness of your pictures bothers my headaches even more. If you could find clear pictures to place in your cards by the end of phase 2, that would be awesome.
        - ■ Our Response: I am very sorry to hear about your poor eyesight and constant headaches. We have taken action to alleviate your terrible terrible pain and replaced our images with ones that are of higher resolution. Hopefully, they meet your expectations.
    - ○ I am an elderly person trying to gain information from your website. My brain has admittedly slowed down over the years. It is hard to read the large numbers on the covid page for the number of cases and the number of deaths. If you could add commas so it's easier to read, that would be appreciated.
        - ■ Our Response: Hey there! I think that most people (including myself) would appreciate this feature so I went ahead and changed our website so that all large numbers are comma-separated. Thanks for bringing this up!
    - ○ I am a middle aged man using the website. I like the convenience it provides, but I do have a request that may improve convenience. Currently, I have to click on the date to see the data visualization for a covid entry. Because I like to check everyday, it would be nice if the most recent entry's data was on the entry page before having to click on the date. For the rest of the dates, clicking will suffice I am just concerned with the most recent entry.
        - ■ Our Response: We have changed the approach to how we display our data. We have separated the entries by countries so you will no longer have to click on the specific date to see the data you are after. The covid totals such as "cases", "Deaths", and "recoveries" will be listed along with the country. Selecting your country will take you to a timeline of daily information instead of totals from most

recent to oldest dates. I think you will find this new design more convenient and thank you for bringing it up.
- ○ I am a elderly woman who is very concerned about covid. As a result, I am always tracking where covid is growing and prevalent. It would be appreciated if you could add a message on the home page with the most impacted country and city from the most recent covid entry.
  - ■ Our Response: Thank you for your suggestion! Unfortunately, we are unable to fulfill your request for phase II, but we will see what we can do to implement this suggestion during the next phase!
- ○ Hi Development team, I am a geography teacher at a high school. I want my student's to learn about locations covid is impacting, and have recommended your website as a source. An addition to your Country page that I believe would be helpful to conceptualizing covid's impact is to have the total number of cases for each country added to the table on the country page.
  - ■ Our Response: That's a great suggestion but we believe it would be best to keep general information and covid information separate. Do not worry though, we have added a very noticeable button that links you straight to that specific country's covid information for easy access when you want to know how that country is doing.
- ● Phase 3
  - ○ Hi Development Team, I really enjoy your website! I am visually impaired so sometimes I find it hard to see where my mouse is. I would love if you could add a feature where the text color of a car.
    - ■ Our Response: Hello we definitely considered the problem you are experiencing. We have now fixed the issue by changing the card color back to black and it will change to blue as you hover over it. This should hopefully help you keep track of where the mouse is.
  - ○ Hi Development team. I am a fan of the website, in particular the countries page. I love the addition of flags. However, the zero frame between the top of the box and the flag is slightly displeasing. If this could be fixed that would be awesome.
    - ■ Thank you for bringing it up. It was displeasing and we have now taken care of it. This took about 10 minutes.
  - ○ Hey COVIDDB team, I am a fan of the website. On the cities page it seems a little illogical in the way the grid is listed. It would make more sense to me if country and population were listed before latitude and longitude. Thanks!
    - ■ Our Response: That is a great observation and we have now made the change. It definitely makes more sense to display the more relevant information first and it helps our website aesthetically. This took 10 minutes to refactor.

- Hey Covid DB team. Awesome website, I love the information it provides to me and my family. I was wondering if countries could be listed in the grid alphabetically. This way it would make more sense and flow more logically. Thanks!
    - Our Response: We have now implemented sorting on all of our pages. This will allow you to sort countries/cities in alphabetical order as well as by population and land mass. This took about an hour to implement.
- Hey COVIDDB team. I am an avid user of your website, and I am grateful for the information you provide. I have a request for cities to be arranged alphabetically by name. I think this would provide great logical flow to the website.
    - Our Response: We have now implemented sorting on all of our pages. This will allow you to sort countries/cities in alphabetical order as well as by alphabetical country name and population. This took about an hour to implement.

To our Developers:
- Phase 1:
    - Hello. I am the mother of 4 children, and I want to plan a trip to reward them for doing well so far in class. On this trip, I want to treat them to the cuisine of the world. If I could easily see the different foods around the world, that would be nice.
        - Their Response: We place a picture of the main dish or dishes of each country on the food and tourism page for that country and we hope that should help in this scenario! We will look into maybe adding pictures of more dishes for each country in Phase 2.
        - Our Response (assessment): Thank you! All these new foods look divine! I hope that I will be able to see more of them when you all get more information about more locations and more foods by the end of **this phase**. I think that this will take a while, maybe 3 hours?
    - Hello. I am a Journalist, and I am writing a piece about countries with the best views. My company is giving me an amount of money to visit these places to report about them first hand. I would like to be able to see the locations where they have places that I can sightsee, such as parks and famous spots in the area.
        - Their Response: We have attached a tourism video for each country on the food and tourism page, and we have also listed some of the more popular tourist attractions for that country. We would look into trying to provide the location of the tourist attraction in phase 3!
        - Our Response (assessment): Thank you for getting to most of the issues that I listed. There is a lot that needs to be done in this phase, so I am grateful for what I can see on your website.

Hopefully by **Phase 3** I will be able to see locations on your website. This should not take more than an hour I would hope.

- ○ Hello. A friend and I wanted to go to a particular country to see if we could better learn the people there. We want to learn the language, learn about the people, and know about the locations where a guide could take us around the area. Being able to see these things together would be nice!
    - ■ Their Response: We have listed basic facts about the country on the demographics page for that country, including the main languages spoken there. Furthermore, we have some popular tourist locations listed on the food and tourism page, which we hope should help with this!
    - ■ Our Response (assessment): Thank you for implementing this for me. I should have seen that this would have been impossible to implement in **Phase 1** since you were all trying to learn the ropes for programming a webpage and did not have much of an information base yet.
- ○ Hello. I am looking to work in a foreign country as a writer. I want to work somewhere where the government is not oppressive, since I want to express myself freely, but I also like to use the ocean as an inspiration. Being able to see if a country is an island nation would be nice to fit my needs.
    - ■ Their Response: We have some information regarding the water area of the country on the geography page for that country. However, we will look into trying to specifically categorize a country as an island nation in Phase 3! Unfortunately, we don't have information on the type of government, but we will try finding it!
    - ■ Our Response (assessment): I see that trying to ensure that no other options show up when I am trying to find my new home would be out of the scope of what you all are currently trying to accomplish. I hope I am able to see this implemented by **Phase 3** of your project! I think it would take two hours to implement.
- ○ Hello. I am a rich oil baron billionaire hoping to start a tourism business in a wealthy country. I need some way to launder this money. Anyways, I would like to be able to sort the various locations by their GDP so that I may be capable of milking the most amount of money out of the people. On top of this, I will also be purchasing and constructing local restaurants in the area, so weeding out the areas devoid of restaurants or people would be nice.
    - ■ Their Response: We will enable sorting countries by their GDP within the table on the demographics page during Phase 3.

Additionally, we will be enabling sorting by population, so you can find areas devoid of people.
- Our Response (assessment): I agree that my need is a problem for another time. Hopefully, by the end of the **3rd phase** of the project, I will be capable of finding my new prospects. I think that sorting items will take an hour to have placed into your website.
- Phase 2:
  - As an avid tourist, I am always interested in learning about a country's culture. Can your website provide information about a country's culture or local traditions/customs? If possible, it'd be nice if your sources come from within the country so they're likely to be more accurate.
    - Their Response: On our Food and Tourism pages, we have included some of the traditional food items and dishes of each country, and each of their pictures. We also have a video explaining the culture and tourism of the country, which we hope will give an insight into the local traditions and customs in most cases!
    - Our Response (assessment): Thank you so much for taking my request into consideration. This is exactly what we were looking for. Adding the pictures and video definitely provides a complete experience on the website and gives insight into the local traditions and customs.
  - Whenever I go on a vacation with my family, I am constantly worried about some no-good criminal robbing us and spoiling the vacationing mood. Is it possible for your website to provide any information regarding the crime rate of a country? I think this could help users make sure they pick a safe country to visit.
    - Their Response: We looked into displaying crime rates but this is a little tough to implement, given the variation of safety across a country. However, we will look into finding more data or some sort of safety index to display in Phase 3!
    - Our Response (assessment): Thank you for taking into consideration my request. You are right, measuring safety is not one of the easiest things. There may be some data source that indexes countries by safety rating; our request may be out of scope but I look forward to hearing about any progress.
  - My asthma can get pretty bad when I am exposed to heavily polluted air. Is it possible for your website to provide information about the air quality of a country? It would be a lot more convenient for me if your website could provide this kind of information all in one spot.

- Their Response: We will be sure to include some information on air quality for a country in the Food and Tourism instance pages for the safety of those wanting to visit a country, most likely by the end of the next phase!
- Our Response (assessment): I understand on holding off our request. Although I am very interested and concerned for my well being and those of others regarding information on air pollution from countries, your website already displays plenty of very useful information. I look forward to hearing any further progress.
- I'm heading over to Japan in a couple of months, but I'm not sure how much money I have in Japanese Yen. Can your website provide information about the currency exchange rate between US dollars and the currency of the country in question? Maybe also some information about how to exchange currency?
  - Their Response: While we don't have information on exchange rates just yet, we will look into this right now and have some information on it in the Food and Tourism instance pages by the end of Phase 3!
  - Our Response (assessment): I noticed you did add plenty of more information on the Food and Tourism instance page and I am pleased with all the information it has to offer. I would definitely benefit from exchange rates being present if I plan to visit that country. Since there is already plenty of information, placing our request on phase 4 is perfect for adding any more information that is already present.
- My worst fear is to visit a country and end up swimming in rain throughout my vacation. Is it possible for your website to provide information about the country's weeklong weather forecast? It may be particularly helpful to have weather information for popular airports. ■ Their Response: We have included data about average temperatures for the coldest and warmest months for that country, and we hope that will give you a decent idea as to what type of weather to expect!
  - Our Response (assessment): Asking for daily weather forecasting might have been out of scope but I appreciate the addition of average temperatures. Displaying the coldest and warmest months for the country definitely gives me a decent

idea on what to expect during my vacation.
- Phase 3
    - Hello, I am a geography teacher and I was using your page to show my students the different countries that came up in each continent. I noticed the website also displayed subregions which I thought was very useful to explain to my students how it went from continents to subregions. Would it be possible to filter the countries by subregions in order to show which countries are most likely to interact with each other.
        - Their Response: We have enabled filtering countries by the regions they belong in on the Geography page and we hope that will be useful for your purposes. This took around 15 minutes to implement.
        - Our Response (assessment): Thank you for adding this feature. This will definitely serve my class in explaining adjacent countries in subregions to my students. 15 minutes sounds about the right amount to implement.
    - Hello I recently got into looking at maps and all the other countries in the world and your website is helping me out a lot. I was on your geography page and I wanted to look at countries in order from the most south to the most north. I think it has to do with the number latitude but I'm not sure. It would help me a lot if I could choose to have the countries that are most south or most north in order.
        - Their Response: We have enabled sorting by latitude on the main Geography page, so we hope that allows you to find countries in order from south to north. This took around 15 minutes to implement.
        - Our Response (assessment): Thank you for taking my request into account. It makes sense to be able to sort by Southmost/Northmost countries when talking about geography.
    - I think your page is a great resource for a paper I am writing on the most visited countries in the world. I think your page has all the information I need but it would help me out a lot if I could sort the countries by most visited and most lucrative. In sorting for tourism revenue I think it would also help me to know in what currency the value is based on. I am not sure if it is in dollars or that country's currency.
        - Their Response: We have enabled sorting by tourism revenue on the Food and Tourism model page, which should allow you to see which countries have a high level of tourism. We have also added a dollar sign in front of the values, implying that the values are in US dollars. This took around 15 minutes to implement.
        - Our Response (assessment): Thank you for taking a look at my request. I think being able to see countries sorted by the values provided in the page is an indispensable feature for the website. I also appreciate the addition of the dollar sign as it clarifies in what

currency you have the data displayed.

- Hello, I am a culinary student and as I was browsing your page I noticed you listed the main dishes of each country. Having a picture definitely made me try them all, but it would be incredibly convenient if you could provide some recipes, videos or more information on the dish. Especially since most of these dishes are in their native language and I would love to know more about them and even try cooking them.
    - Their Response: We have a video for each country on the tourism page of that country that may talk more about the popular foods of that country, but we will look into including recipes for the specific food items we have displayed during Phase 4.
    - Our Response (assessment): The video you provide for each country does encompass a lot of the major cultural characteristics I would casually be interested in. Assigning this request to phase 4 seems appropriate since there is plenty of information already. I look forward to any further progress as I think this would take about an hour to implement depending on finding the right data.
- I really love your website and all the information it shows but when it comes to the number data I am having a really hard time reading it with my old eyes and long numbers. Would it be possible for the numbers to be separated by commas to make them easier to read.
    - Their Response: We completely understand your concern regarding this and will be implementing it during the next phase for large numbers such as the GDP and tourism revenue of countries!
    - Our Response (assessment): Thank you for looking into it. It would help me out a lot to have the numbers be broken down by commas and I think it would also help your page in the way it looks and displays data. I think this should take around 30 minutes.

RESTful API

We designed our RESTful API using Postman:

https://documenter.getpostman.com/view/17756516/UUy4cRDr

Endpoints:

Country:

-All:

https://crown19db.me/api/v1/models/country/all

Fetch data about all the countries in the database

-All Reduced:

https://api.crown19db.me/v1/models/country/all/reduced

Fetch data about all the countries in the database with fewer attributes

-By Name:
 https://api.crown19db.me/v1/models/country/name=<countryname>
        Fetch data about one particular country by Name
-By ID:
 https://crown19db.me/api/v1/models/country/id=<countryId>
        Fetch data about one particular country by ID
-By Query:
https://api.crown19db.me/v1/models/country?continent=<continent>
&lang=<language>&zone=<timezone>&q=<search>&sort=<area,
population or official name>&page=<number>&perPage=<number>
        Fetch data about all countries based on filter parameters
        continent, language, timezone; search parameter q; and
        sorting parameters

City:
        -All:
         https://crown19db.me/api/v1/models/city/all
                Fetch data about all the cities in the database
        -By Name:
         https://api.crown19db.me/v1/models/city/name=<cityname>
                Fetch data about one particular city by Name
        -By ID:
         https://crown19db.me/api/v1/models/city/id=<cityId>
                Fetch data about one particular city by ID
        -By Query
        https://api.crown19db.me/v1/models/city?population=<num-num>&
          continent=<name>&region=<name>&q=<search>&sort=<name,
        country, population>&page=<number>&perPage=<number> Fetch
                data about all cities based on filter parameters
                population, continent, region; search parameter q; and
                sorting parameters

Covid:
        -All: https://crown19db.me/api/v1/models/covid/all
                Fetch data about every Country's Covid data
        -by Country ID:
        https://api.crown19db.me/v1/models/covid/country_id=<countryId>

Fetch data about one Country's Covid data by Country ID

-CovidInstance by Country ID:

https://api.crown19db.me/v1/models/covidInstance/country_id=<countryId>

Fetch data for timeline of a Country's Covid Data by Country ID

-By ID:

https://crown19db.me/api/v1/models/covid/id=<countryId>

Fetch data about one Country's Covid data by ID

-By Query

https://api.crown19db.me/v1/models/covid?cases=<num1-num2>&recovered=<num1-num2>&deaths=<num1-num2>&q=<search>&sort=<country, cases, recovered, deaths>&page=<num>&perPage=<num>

Fetch data about all country covid instances based on filter parameters cases, recovered, deaths; search parameter q; and sorting parameters

Misc:

-Global Search

https://api.crown19db.me/v1/models/all?q=<search>

Fetches any instances from any model containing search parameter q

-Documentation:

https://api.crown19db.me/

Links to Postman Documentation

Models

- ● Countries
  - ○ Gdp
  - ○ Population
  - ○ Population density
  - ○ Flag
  - ○ Land area
  - ○ Map
  - ○ Capital
  - ○ Covid info

- Cities (counties or states)
  - Name
  - Latitude
  - Longitude
  - Population
  - Map
  - Time zone
  - Country
  - Country covid info
- Country Covid cases timeline
  - Country instances
    - Name
    - Capital city
    - Total cases
    - Total deaths
    - Total recovered
    - Timeline of the country stats per day
      - New cases that day
      - Deaths that day
      - Cases daily
      - Deaths daily
      - Recovered that day

Tools

- Tools
  - HTML for frontend work
    - A mark-up language that tells your browser how to display our website.
  - React for frontend work
    - Used to create the frontend in a component-based way with convenient packages to easily implement things like page routing. Mainly serves as an easier way to write HTML and interweave it with TypeScript.
  - Typescript for frontend work
    - Used to implement any dynamic part of the website (such as dynamic git statistics). Used as an alternative to JavaScript so type

        mismatching can be caught at compile time rather than runtime.
- ○ Postman for API design and testing the API
  - ■ A tool to conveniently and concisely document the API for our website.
- ○ Discord for team communication
- ○ React Bootstrap for CSS
  - ■ A framework for CSS that makes it easier to write CSS for our website so our website is appealing to the human eye.
- ○ Amazon Web Services for hosting our website
  - ■ A cloud-based platform that is used to host our website.
- ○ Git and Gitlab for collaboration, version control, continuous integration, issue tracking, and many other tools
  - ■ Git - Used for version control of source code; helps developers work on the same codebase while working on their own systems by automatically merging their work into a single codebase.
  - ■ GitLab - A remote repository that serves as a third party hosting our codebase in a centralized spot.
- ○ Python's unittest library for testing
  - ■ Python's built in unit testing framework helped us test the backend functions for our website.
  - ■ https://docs.python.org/3/library/unittest.html
- ○ Jest for Frontend testing
  - ■ Jest is a unit testing framework for Javascript. The main feature used from the framework was the snapshot testing tools for our objects.
  - ■ https://jestjs.io/
- ○ Selenium for testing
  - ■ Selenium is an open-source automated testing framework used to validate web applications across different browsers and platforms. It was used to test our website's GUI.
  - ■ https://www.selenium.dev/
- ○ COVID-19 Dashboard (https://trekhleb.dev/covid-19/)
  - ■ Interactive graph embedded in our covid timeline instances. The graph displays the specific countries trends in "confirmed", "deaths", and "recovered".
- ● Data Sources
  - ○ For the Covid-19 Cases Data, we used this site as a source.
    https://data.humdata.org/dataset/novel-coronavirus-2019-ncov-cases
  - ○ For the general data of a city, we used this site as a source.

https://simplemaps.com/data/world-cities

- APIs
  - For the general data of a country, we used this API as a source. https://restcountries.com/v3.1/all

Hosting

After some initial troubles securing a domain name because of restriction of the phrase "covid", we registered our domain "crown19db.me" through NameCheap and hooked it up to our React App using AWS Amplify. Once NameCheap and AWS were communicating we enabled SSL and now our app is just waiting for a back end and more data.

Phase 2 Features

- Database:
  - Our database was constructed using AWS's RDS tool to create a database instance using PostgreSQL. Then, by using PGAdmin4 and our own backend code, we populated our database. In making this database, the tutorial from Caitlin was followed.
- Pagination:
  - Our models utilize the react-paginate module to implement pagination in our three models. Each of our models has a certain amount of instances on each page based on the type of model. For the countries model page, we have the number of total countries divided by twelve. The cities model page has the number of total cities divided by ten. Lastly, the covid country data model page uses the same semantic as the cities model.
- Additional Features implemented during this Phase:
  - We implemented something that one of our customers asked for which was a search feature for covid cases and testing in their area. We embedded Bing into the Splash page for that feature.
  - Our third model was refactored in this phase to more easily be able to get data and connect the different models. A piece of media that we employed for this model was a graph, which was implemented in this phase.

Phase 3 Features

- Sorting
  - We implemented at least 3 types of sorting in each of our models pages: ○ **Countries**- Alphabetical Name (A-Z, Z-A), Land Mass (asc, desc), Population (asc, desc)
    - **Cities**- Alphabetical Name (A-Z, Z-A), Alphabetical Country Name (A-Z, Z-A), Population (asc, desc)
    - **Covid**- Alphabetical Name (A-Z, Z-A), Number of cases (asc, desc), Number of recoveries (asc, desc), Number of deaths (asc, desc)
- Filtering
  - We implemented filtering in all model pages to display instances that meet the desired parameters:
  - **Countries**- By Continents and by Population size range
  - **Cities**- By Continents and by Population size range
  - **Covid**- By number of cases range, number of deaths range, and number of recoveries range
- Search and Global Search
  - We implemented a search function in each of the models to find instances with attributes that contain a substring of the search parameter
  - We also implemented a global search in the splash page that finds instances across all models with attributes that contain a substring of the search parameter
- Backend Pagination
  - In this phase, we moved pagination from our frontend to our backend. This allowed us to include pagination in queries to postman and our database. Pagination remained the same from phase 2.

Phase 4 Features
- Our Visualizations:
  - Our provider's visualizations all utilize Recharts to make three different visualizations.
    - The first visualization shows the relationship between cases and deaths for each country. It is implemented by using a grouped bar chart, with the x-axis representing the country and the y-axis representing the number of cases and deaths.
    - The second visualization visualizes the covid timelines of the top five countries. It uses a line chart to implement this visualization. The dates are on the x-axis, and the number of

cases is on the y-axis.
- ■ The third visualization shows the top 100 countries in terms of covid deaths, and what percent they represent among deaths worldwide. This is done by using a pie chart.
- ● Provider's Visualizations:
  - ○ Our provider's visualizations also all utilize Recharts to make three different visualizations.
    - ■ The first visualization shows the relationship between each country and the percent of their GDP that relies on tourism. This is shown through a bar chart where the x-axis represents the countries and the y-axis represents the percentages.
    - ■ The second visualization shows the relation between countries and their exports by showing the amount of the top exports of all the countries. This is done through a radar chart.
    - ■ The third visualization shows the relation between countries and their income levels by showing the number of countries that fall under each level of income. This is done through a funnel chart.