CS 171

Midterm Project

Midterm Schedule:

1) Midterm Exam (50 points)
    a) On-campus students: due today at 4:00 pm on paper;
    b) DCE students: due on Wednesday, March 9th 2016 at 11:59 pm EST on Canvas)
2) **Midterm Project** (50 points)
    a) due on Sunday, March 13th 2016 at 11:59 pm EST on Vocareum

The midterm project must be completed entirely on your own, and may not be discussed with anybody else!

- You have to finish the midterm exam before you are allowed to start with the midterm project!
- You have to write your solutions entirely on your own
- You cannot share written materials or code with anyone else
- You may not provide or make available solutions to individuals who take or may take this course in the future
- No Piazza!

Your submitted code will be automatically checked for plagiarism. If you are using external resources, make sure to indicate the sources.

The Honor Code

Harvard College is an academic and residential community devoted to learning and the creation of knowledge. We – the academic community of Harvard College, including the faculty and students – view integrity as the basis for intellectual discovery, artistic creation, independent scholarship, and meaningful collaboration. We thus hold honesty – in the representation of our work and in our interactions with teachers, advisers, peers, and students – as the foundation of our community.

The Harvard College Honor Code

Members of the Harvard College community commit themselves to producing academic work of integrity – that is, work that adheres to the scholarly and intellectual standards of accurate attribution of sources, appropriate collection and use of data, and transparent acknowledgement of the contribution of others to their ideas, discoveries, interpretations, and conclusions. Cheating on exams or problem sets, plagiarizing or misrepresenting the ideas or language of someone else as one's own, falsifying data, or any other instance of academic dishonesty violates the standards of our community, as well as the standards of the wider world of learning and affairs.

1 Problem Definition

Your proposed design has been picked by the editor-in-chief of the *Gotham Times*. You have to create a website (storytelling approach) to draw attention on the topic Malaria and on the work of the *WHO Global Malaria Programme* which has been trying to eliminate the deadly disease over the past few decades. You should present the information in a comprehensible manner for all people who are interested in the topic, and not necessarily only for physicians and experts.

The team has total confidence in you and gives you all the freedom you need to complete the web page. That means you can build up on your previous sketches or you can think about a radically new concept.

However, there are still some requirements from the editor:

- The editor is very enthusiastic about **choropleth maps** and requires you to implement it in your website
- Overall you must **implement two different visualizations** (one choropleth map and one visualization that is not a map)

Please read the instructions carefully before you start implementing anything!

CS171 Note:
This project will give you a chance to apply what you have learned so far in this course and to create a visual storytelling website in a condensed form. We are definitely aware of the fact that these stories need a significant amount of work. Therefore, we provide the data and the key facts in an easy and comprehensible manner. You don't have to write a news article from scratch! Just copy the given paragraphs or search for additional resources online or in the World Malaria Report 2015. You can use common visualization types and you don't have to implement complex interactions. We will go into more detail on the particular requirements in the implementation section.

Implementation Requirements:

- Choropleth map **(25 points)**
    - Choropleth of Africa, showing the currently selected attribute from the provided dataset **data/global-malaria-2015.csv**
    - A combobox allowing the user to select which attribute from the provided dataset should be displayed in the choropleth map
    - Appropriate color scale for choropleth map
    - Legend for map
    - Correct updating of the visualization whenever the selection of the combobox is changed
    - Tooltips showing additional information for each country when hovering
- Visualization 2 **(15 points)**
    - Implementation of either a sketch from the midterm exam or, alternatively, a tree hierarchy visualization
    - Scales, axes, and labels have to be appropriate
- Final website **(10 points)**
    - Integration of text, images, visualizations, or other visual elements into an engaging website
    - Styled with CSS and following design principles learned in class
    - Clear, informative, and engaging storytelling

2 Instructions

1) Download the resources

Please download all the resources as a ZIP-file from Canvas (under the module for week 7).

The template is based on the front-end framework *Bootstrap* (v3.3.6) and beyond that, it includes the following JavaScript libraries:

- jQuery (v2.1.4)
- D3.js (v3)
- Queue.js (v1.0.7)
- TopoJSON.js (v1.6.19)

Tip: As part of the template you have also downloaded the CSS toolkit FontAwesome which makes it very easy to use icons in web projects. Maybe you have already used Bootstrap icons. The integration of FontAwesome is similar but with the benefit that you have a much larger variety of icons.

2) Familiarize yourself with the resources, especially with the provided datasets

The journalists from the *Gotham Times* are aware of the fact that the story and the visualizations need a significant amount of work. Therefore, they have already collected a wealth of information and summarized it in an easy and comprehensible manner.

Feel free to customize the provided datasets to your needs.

Textual Content: data/textual-content.pdf

This files contains some informative text blocks about Malaria. You don't have to integrate all the different text blocks (but should include at least two) and there is no specific ordering to them. However, these text blocks will help you to transform a web page with a simple visualization into an insightful, data-driven article. Reading these text blocks will also give you some background knowledge on Malaria.

Dataset 1: data/global-malaria-2015.csv

This dataset contains detailed information about malaria cases in 100 countries worldwide. The CSV file consists of the following fields:

- `WHO_region`
- `Country`
- `Code` - three-letter country code
- `UN_population`
- `At_risk` - % of population at risk
- `At_high_risk` – % of population at high risk
- `Suspected_malaria_cases`
- `Malaria_cases` - diagnosed cases

Dataset 2: data/global-funding.csv

This dataset contains the total funding for malaria control and elimination (in millions USD) provided by donor governments, multilateral organizations, and domestic sources between 2005 and 2013.

Dataset 3: data/malaria-parasites.json

This JSON file contains data about malaria parasites in a hierarchical structure (tree).

Dataset 4: data/africa.topo.json

The TopoJSON file (extension of GeoJSON) contains the data of the boundaries for the African countries.

Photo resources

If you want to include photos in your web page you can either use placeholders or proper images, for example from these websites:

- http://www.who.int/campaigns/world-health-day/2014/photos/malaria/en/
- https://extranet.who.int/photolibrary/guest_eng.htm
- http://science.nationalgeographic.com/science/photos/malaria

Please make sure to include the correct references if you use external resources.

Malaria key facts and quotes

Here are some informative key facts and quotes about Malaria, that you might want to include in your website:

- **RISK:** About ***3.2 billion people*** – almost half of the world's population – are at risk of malaria.

- **CASES:** ***214 million*** malaria cases reported worldwide in 2015.

- **INCIDENCE:** ***37%*** global decrease in malaria incidence between 2000 and 2015.

- **MORTALITY:** ***60%*** decrease in global malaria mortality rates between 2000 and 2015.

- "Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female mosquitoes."

- "Young children, pregnant women and non-immune travellers from malaria-free areas are particularly vulnerable to the disease when they become infected."

- "Malaria is preventable and curable, and increased efforts are dramatically reducing the malaria burden in many places."

3) Think about the structure of your storytelling website

Your sketches from the midterm exam should help you to get started (especially the sketch of the website).

You are free to decide which data you want to use and how the content structure should look like, with a few restrictions:

- You have to **implement a choropleth map** for the African continent and integrate it into your website.
- You have to **implement a second visualization** and integrate it into your website. You can choose if you want to implement either one of your own visualization designs (but not another map) or implement a tree visualization of the mosquito hierarchy (d3.layout.tree).

Interactive storytelling - background
Interactive storytelling is characterised by a mixture of visualizations, graphics and conventional blocks of texts. The New York Times constantly demonstrates, in an impressive way, what it means to transform traditional elements of journalism into interactive online experiences:
http://www.nytimes.com/interactive/2014/12/29/us/year-in-interactive-storytelling.html

4) Prepare the basic HTML structure

Implement the web page with HTML and CSS, including text, images and layout. Specify also the positions of your visualizations (i.e., create empty containers for the SVG elements).

5) D3 Implementation

Some helpful implementation hints:

- General hints:
  - When reading in data, make sure to process necessary data (e.g., convert strings to numbers), or create a new data structure if you feel that would be helpful.
  - If you are only interested in African countries, make sure to filter the data for these tasks.
  - Make sure you check for missing values in the data. You can check if a number is valid by using `isNaN()`. This will be especially important for the choropleth when you want to assign different colors to countries, based on a specific data attribute. If that attribute is not a number, you need to set the color manually, e.g., to white.
  - If you want to use colorbrewer for creating the color scale, feel free to include additional js or css files.
- Choropleth hints:
  - When reading in the data, it might be very helpful to create a new JS object of the format

```
var malariaDataByCountryId = {
          country1_iso_code: {data_of_country1},
          country2_iso_code: {data_of_country2},
          ...};
```

    That will allow you to access the data of a country, given its country ID.
  - In *data/africa.top.json* the country ID is called `adm0_a3_is`. This country ID matches with the field `Code` in *data/global-malaria-2015.csv*.
  - Make sure to look at the file structure of the *data/africa.top.json* file, so that you know how to access the relevant fields to convert the file from topojson to geojson.

5.1) Implement a choropleth map

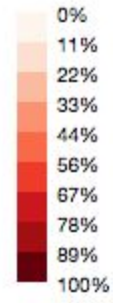
Create a choropleth map of Africa that maps/displays data about malaria from the given CSV file: **data/global-malaria-2015.csv**

Use a combobox to allow users to interactively change the attribute that is being visualized: *"UN population", "At risk", "At high risk", "Suspected malaria cases"* or *"Malaria cases"*.

The dataset contains key values for many different countries around the world. The WHO African region is particularly affected by the disease. For that reason, we are providing a TopoJSON file for the African continent (*data/africa.topo.json*). You can create a mapping between africa.topo.json and the CSV file by using the country ID (three characters). Hint: In *data/africa.top.json* the country ID is called *adm0_a3_is*.

Color Scale, legend, and tool tips:

- Please choose a proper color scale for your choropleth! The ColorBrewer by Cynthia Brewer might be helpful: https://github.com/mbostock/d3/wiki/Ordinal-Scales#colorbrewer
- Add a legend to your choropleth map. The legend should show the used color scale as well as some textual labels. Make sure to update the legend whenever the current combobox selection changes.



Example legend for choropleth

- Add tool tips to your map that show detailed information for individual countries

5.2) Implement the second visualization

*Choose between Option **A** or **B**. You only have to implement one of the two given options!*

OPTION A: Implement your own visualization

You can implement one of your designs that you created in the Midterm Exam.

Restrictions:

- You must not implement another map view
- You must visualize data from either the **global-malaria-2015.csv** or **global-funding.csv** dataset
- Your visualization must be sufficiently complex (e.g., not just an HTML table). But we assume that all your designs from the Midterm Exam meet that criteria.

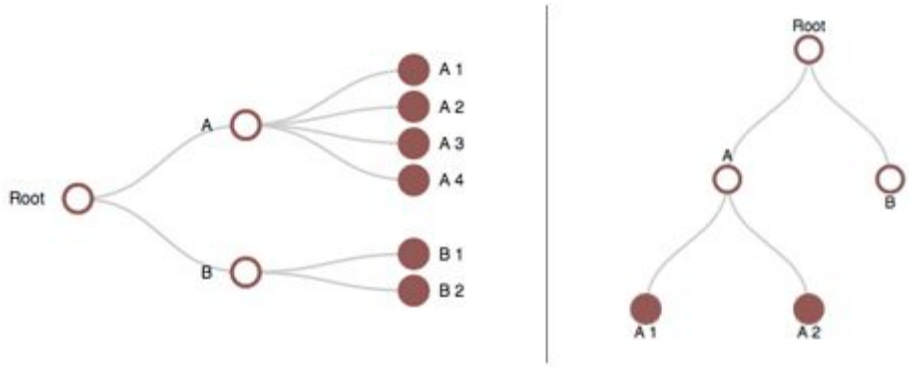
OPTION B: Implement a D3 tree visualization

You should use the *d3.layout.tree* component to create a basic tree visualization of the provided dataset **data/malaria-parasites.json.**

D3 Tree Layout: https://github.com/mbostock/d3/wiki/Tree-Layout

Decisions on the appearance of the tree are up to you, but we expect you to add appropriate CSS rules, labels, colors, etc.

Examples:



A collapsable tree is very useful if the dataset is larger but it is not required to implement this feature.

6) Finalize your web page

Make sure that your content/structure is understandable, easy to follow and visually appealing for the general public.

Check your overall color scheme, the font sizes, the correct implementation of the visualization and ensure that there is enough spacing between your elements.

7) Submit your work on Vocareum

Submission instructions:

1. Go to Canvas → Modules → Midterm *(redirect to Vocareum)*
2. Upload your implementation under *'work'*. (Depending on your project structure you might have to create new directories in Vocareum. You can upload multiple files at once into the same directory or directly upload your zipped directory tree.)

For your final submission you will have to:

1. **Click the 'submit' button on Vocareum**
2. Double-check your 'latest submission', check that your web page and all the visualizations are working as expected. You can run them directly in Vocareum and look at them in a new window
3. Upload a teaser image of your article (under 'Action' → 'upload gallery thumbnail')