CSE 316: Fundamentals of Software Development

Stony Brook University

Programming Assignment #3

Spring 2022

Assignment Due: Friday, Apr 8th, 11:59 PM.

Learning Outcomes

After completing this homework assignment, you will be able to

1. Learn server-side programming.
2. Understand the principles of NoSQL Databases.
3. Gain experience with full-stack development using Node and MongoDB

Introduction

In this assignment, we will augment the mock stackoverflow.com web application that we have been building with a server. This server will host all the static and dynamic resources required by the application. The server will run on the Node platform, which is convenient since we can now write JavaScript code for both the client and the server. We will also use MongoDB as the back-end database to store data that will persist across user sessions. We will still use React as the front end to render content on the browser.

Getting Started

We will use MongoDB as the NoSQL database to store data related to this application. Follow the instructions in the official MongoDB documentation to install the free community edition. On Windows, you should unselect the option *"MongoDB as a Service"* to complete the installation. After you install it, follow the instructions to start MongoDB as a **background service**. When you install, MongoDB, the Mongo Shell (**mongosh**) should also have been installed. If it wasn't then follow the instructions here. The Mongo Shell is used to interact with the databases in MongoDB. If *mongosh* is successfully installed then the command **mongosh** should connect to the local instance MongoDB on your machine and open an interpreter where we can type commands to interact with MongoDB. Try the command **show dbs** and you should see a list of existing databases in your local instance. **Note that by default, the MongoDB service will run on *127.0.0.1* (localhost), port *27017*. It is recommended that you do not change these settings for grading convenience.**

Install Node.js. We will use this to manage React and the packages needed to run our server. When you install Node.js, it will come with the **npm** package manager, which will also get installed. We will use **npm** to install dependencies and also to start the react application.

Download/clone your personal GitHub repository. The repository has a *server* and *client* directory. Each directory has the `package.json` and `package-lock.json` files which list the dependencies of the *server* and *client* applications respectively. In each of the directories run **npm install** to install the necessary dependencies. The following paragraphs list the dependencies that will be used.

We will use the express framework to write server-side code. Install express in the server directory using the command **npm install express**, if not already installed. If you don't yet understand how to use express, look at the lecture notes on Express in Blackboard under *Course Documents*. For more detailed guidance look at the official Express documentation.

We will use the mongoose data modeling library. Mongoose will help us connect with a MongoDB instance and define operations to manage and manipulate the data according to the needs of our application. Install it in the server directory using **npm install mongoose**, if not already installed.

We will use the nodemon process manager so we don't have to restart the server every time we save changes to our server during the development process. Install it in the server directory using **npm install nodemon**, if not already installed. Alternatively, if the local install does not work, you can install nodemon globally using the command **npm install -g nodemon**. This is a good option for nodemon since it can be used across multiple node projects. To run the server using nodemon use the command **nodemon server/server.js** instead of **node server/server.js**.

We will use the axios library to send HTTP requests to our server from our client application. Refer to the lecture notes on express, which demonstrates how axios is used in conjunction with React and Express. Install it in the client directory using **npm install axios**, if not already installed.

We will use the cors middleware to enable CORS to enable seamless connection between the client and the server during the development process. This is typically removed when the application is deployed in production to prevent CORS attacks. However, since we are assuming a development environment in this homework, we will keep the middleware.

Grading

We will clone your repository and run your code in the Chrome web browser as a react application. You will get points for each functionality implemented. Make sure you test your code in Chrome. The rubric we will use is shown below:

1. Banner: 5 pts.
2. All Questions Page: 10 pts.
3. Post a New question: 10 pts.
4. Searching by text: 5 pts.
5. Searching by tags: 5 pts.
6. Answers Page: 5 pts.
7. Post a new answer: 10 pts.
8. All Tags page: 5 pts.
9. Questions of a tag: 10 pts.
10. Data Model: 10 pts.
11. Server: 20 pts.
12. Code Modularity: 5 pts.

Total points: 100 pts.

Note, the application must be made using node, mongodb, and react. You will not receive credit if you use anything else. You will be penalized if bad coding practices are found in your codebase.

Client/Server Application Architecture

The homework repository is structured as a client/server application. It has 2 directories – **server** and **client**. The **server** directory contains the data model in the **models** directory in files *answers.js*, *questions.js*, and *tags.js*. These files are empty. You should fill them up with the schema definition for each corresponding document in our MongoDB collection as defined in the **Data Model** section. The **server** directory has a test script called **populate_db.js**. You should run this script to verify that your document schema is defined correctly. Read the instructions at the top of the script to see how to run it. If this script throws an error, you will know that something is wrong with the schema definition and you have to fix it. **You must not change this test script. If you do, you will not get any credit**.

The **server/server.js** file is the main server script. We will run this script in Node to start your server using the command **node server/server.js**. On running the script, a server should start in https://locahost:8000. Further, the server should connect to a running instance of MongoDB on server launch. The MongoDB instance should run with default settings, that is, **mongodb://127.0.0.1:27017/**. **The database name must be fake_so**. When the server is terminated (using CTRL+C), the database should also be disconnected and the message **"Server closed. Database instance disconnected"** should be displayed.

The **client** directory has the same structure as that of the React application you made in homework 2. You can reuse all of the code that you wrote for homework 2 here. You should use Axios in the client application to send HTTP method requests to the server.

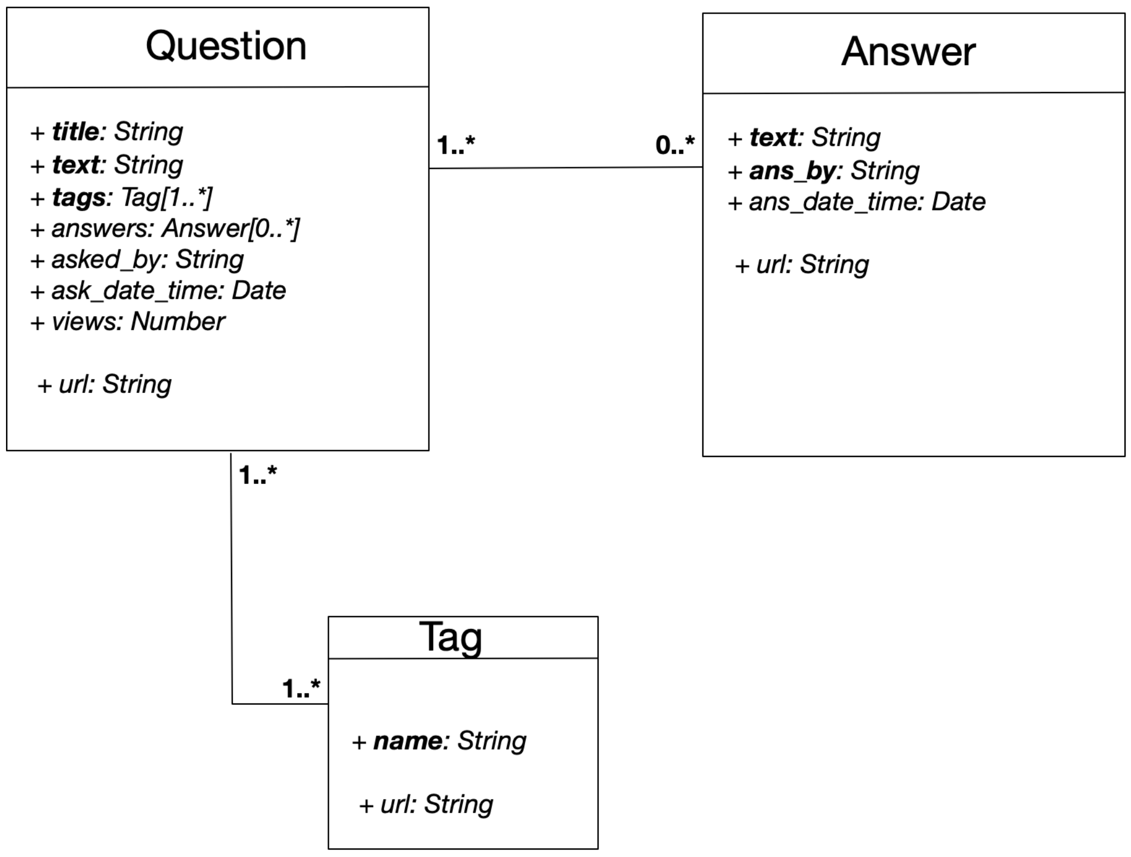
Summary of the default host/port settings:

Client Instance	**https://localhost:3000**
Server Instance	**https://localhost:8000**

Database Instance	**mongodb://127.0.0.1:27017/fake_so**

Data Model

The primary data elements we need to store for this application are questions, tags, and answers. To this end, we will use a UML association notation to describe the data model.



The UML model describes the schema for all documents in our MongoDB database. All elements in a document, except *url*, are fields, The *url* element is a read-only (*get*) virtual method that returns the URL for the document. So, they should return the following strings:

- Question.url returns *posts/question/_id*.
- Answer.url returns *posts/answer/_id*.
- Tag.url returns *posts/tag/_id*.

The elements highlighted in bold are **required fields**.

Additional Constraints

- *Question.title* must not be more than 100 characters.
- *Question.ask_date_time* must have the current timestamp as the default value.
- *Question.views* must have 0 as the default value.
- *Question.asked_by* must have ‘Anonymous’ as the default value.
- *Question.ask_date_time* and *Answer.ask_date_time* must have the current timestamp as the default value.

Note the UML association diagram shows edges between each document model. These edges have multiplicity associated with them as specified on the endpoints. For example, **0..***, on the endpoint of the edge to *Answer* shows that a question can have 0 or more answers. Similarly, an answer is associated with 1 or more questions.

Application Behavior and Layout

The front-end functional requirements for this application are the same as homeworks 1 and 2. So, you can reuse the React code and CSS you created for those homeworks. For convenience, the requirements have been listed below again.

—-----------------------

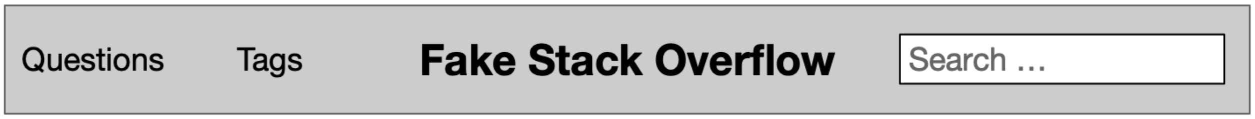
We will mimic the original stackoverflow.com website as much as possible. Although, we won’t be implementing all of its features. You can visit stackoverflow.com for inspiration. The layout is quite simple. It has two parts – a **banner** and the **main body**. The *banner* should remain constant, that is, it should have the same UI elements throughout and should be displayed at the top of the page. The *main body* will be displayed below the banner and will render relevant content based on user interactions with the web page.

Banner

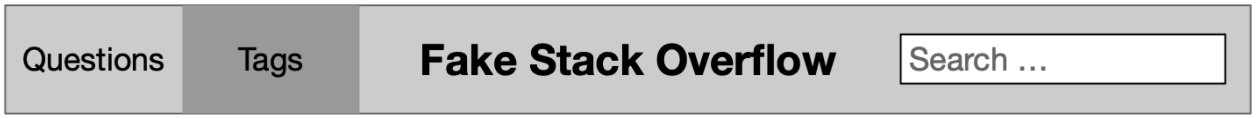
The banner should have the following UI elements arranged horizontally:

1. A *link* with the name **Questions**.
2. A *link* with the name **Tags**.
3. The *name* of the application (**Fake Stack Overflow**).
4. A *search box* where users can do a text search.

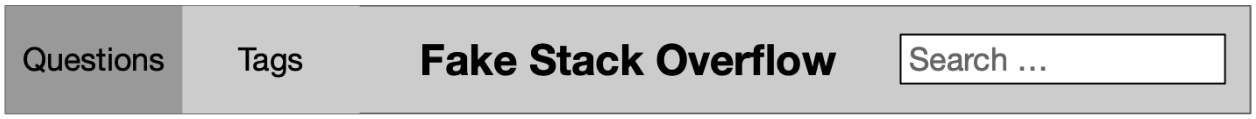
Below is an example of how the banner should look:



Notice that the banner has a light grey background. The links are styled as blocks with no borders. Hovering over a link with the mouse highlights them. For example, hovering on *Tags* should look as follows:



Similarly, hovering on *Questions* should look as follows:



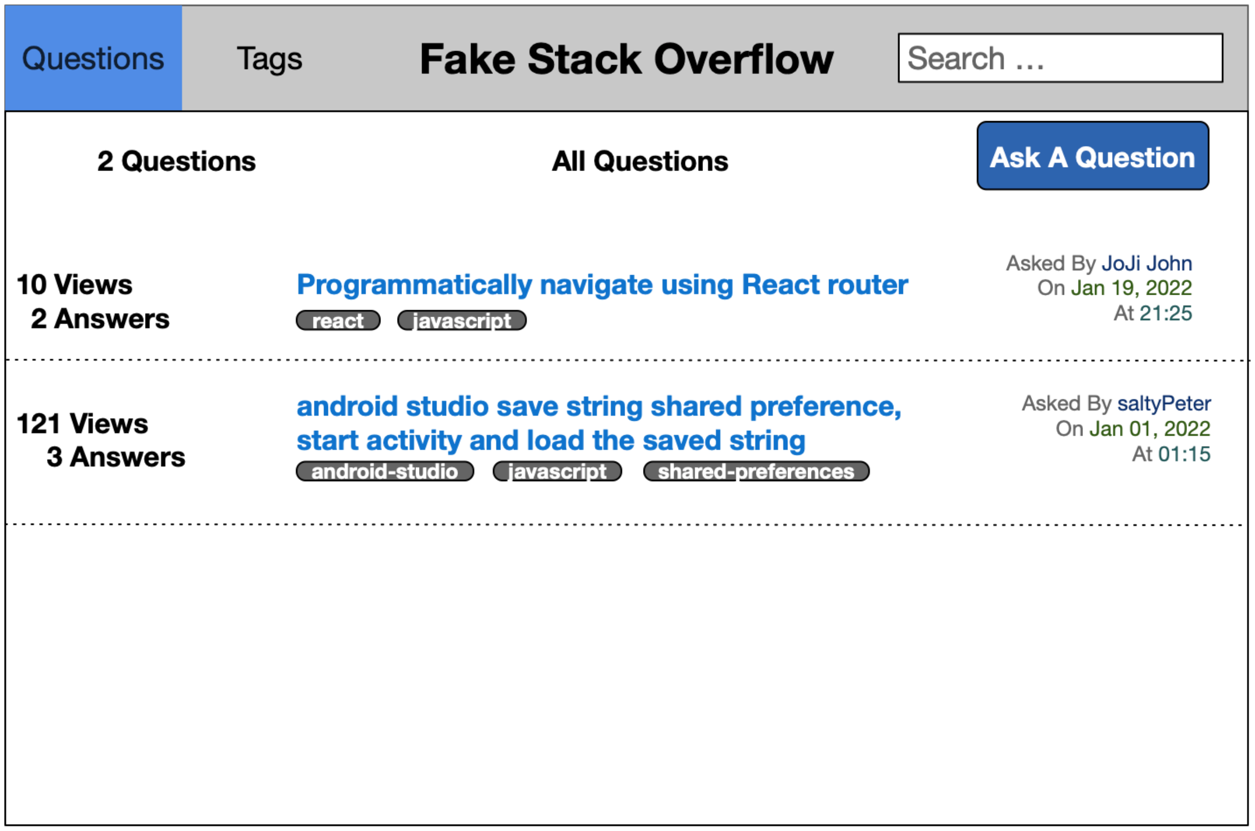
The font sizes shown in the figures above and in all subsequent images are relative to this document. You should select font sizes so that your content is clearly visible and scales accurately when rendered in a full-sized browser window.

All Questions Page

When a user loads the application in the browser for the first time, the banner should be displayed at the top of the page. The *Questions* Link should be highlighted with the color **#0281E8** to indicate that the user is currently viewing all questions. The *main body* of the page should render all the questions that have been asked in a tabular format as follows:

- A header row with 3 columns. The first column should display the text **N Questions**, where N is the total no. of questions that have been asked. The second column should display a title with the text **All Questions** to indicate that all questions that have been asked are being displayed. The third column should display a *button* with the label **Ask A Question**. The button should have the color code **#165A92**. The contents in the columns have no other style constraints. However, make sure that they are clearly visible.
- The second column must occupy the maximum width. The first and the third columns should be of the same width but lesser than the second column.
- A row for each question. A row should have 3 columns.
  - The first column should display the text N1 views first and then N2 answers in separate lines, N1 is the no. of views for the question and N2 is the no. of answers.
  - The second column should display the question's title as a link followed by a list of tags in a new line. Hovering over the title's link should highlight the link with a deeper shade of the existing text color. The list of tags should have rounded borders and should be displayed beside each other. There should be 4 tags per line. For example, if the question has 7 tags, they should be displayed in two lines with the first line showing 4 tags and the next 3 tags.
  - The third column should display three lines. The first line should display the text **asked by <user>**, where <user> is the username of the person that asked the question. The second line should display the text **on <Month Day, Year>** and the third line should display the time as **at <hh: min>**.
- The questions should be displayed in ascending order of the day and time they were asked. In other words, the most recently asked questions should be displayed first.
- Make sure that all fonts and content are clearly legible.
- After each question row, a horizontal divider should be drawn. You can choose the style of this divider.
- There should be no other borders surrounding the questions being displayed.
- If the total no. of questions does not fit on the page, then the *main body* must be made scrollable. Note the banner must remain fixed to the top of the page.

Below is an example of how the page should look.

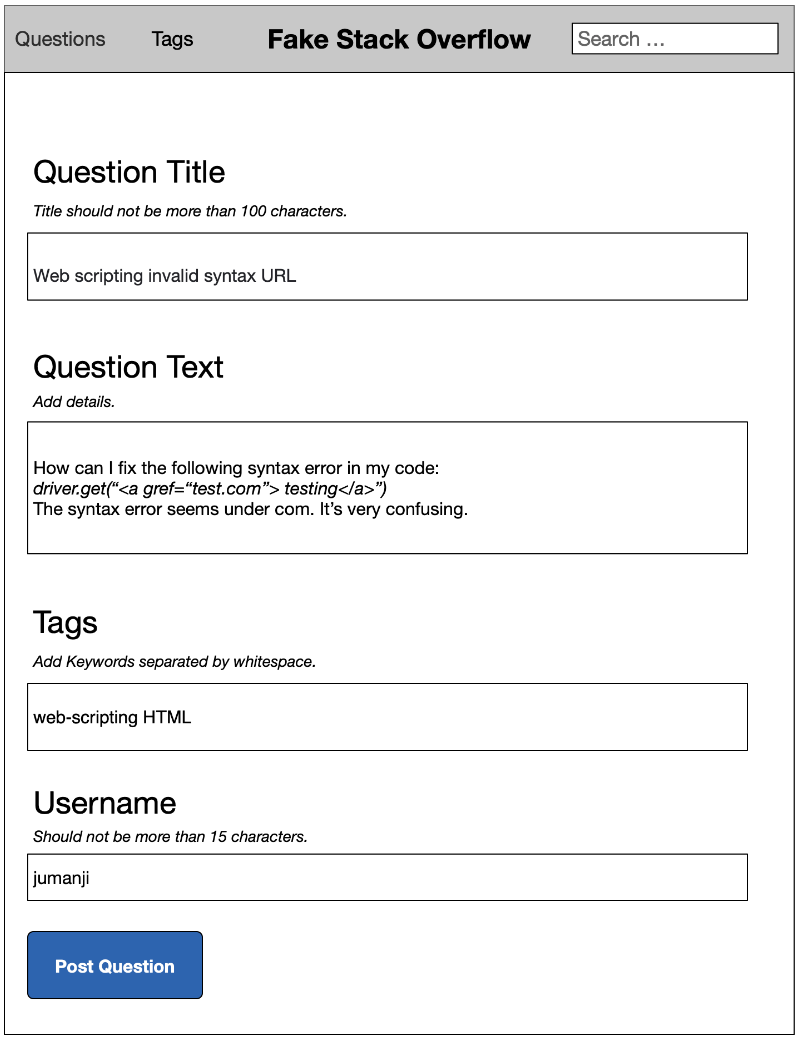


New Question Page

When a user clicks on the **Ask A Question** button, the *main body* section of the page should display a form with the following inputs fields:

- A text box for question title. The title should not be more than 100 characters and should not be empty.
- A text box for question text. Should not be empty.
- A text box for a list of tags that should be associated with the question. This is a space-separated list. A user is allowed to enter duplicate tag names but only one of those should be saved in the underlying model. Tag names are case insensitive. This means that “JavaScript” and “javascript” should count as one tag.
- A text box for the username of the user asking the question. The username should not be more than 15 characters (may be empty).

There should be a button with the label *Post Question* and hex code **#165A92** as the background color. Each field in the form should have an appropriate hint to help the user enter the appropriate data. An example of such a page is shown below:



Question Title

Title should not be more than 100 characters.

Web scripting invalid syntax URL

Question Text

Add details.

How can I fix the following syntax error in my code:
driver.get("<a gref="test.com"> testing</a>")
The syntax error seems under com. It's very confusing.

Tags

Add Keywords separated by whitespace.

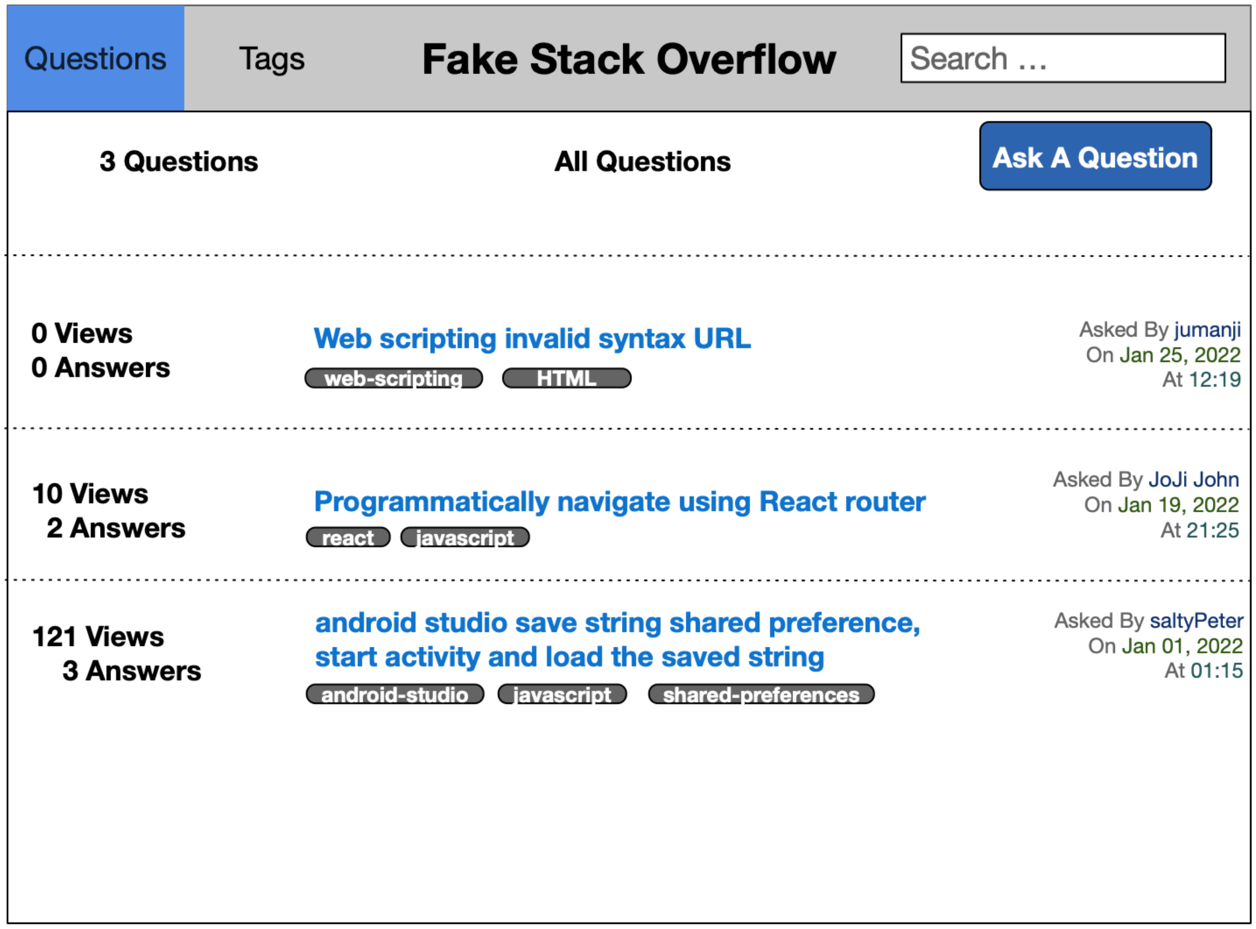
web-scripting HTML

Username

Should not be more than 15 characters.

jumanji

When the *Post Question* button is pressed, the question should be added to the *data object* in *model.js*. If the question is added successfully then the *main body* section of the page should display all the questions including the question currently added in sorted order of the time they were posted. Further, the page should also display the total no. of questions, which should have incremented by 1. For example, in the page shown below, the first question displayed was most recently asked by the user *jumanji* using the inputs on the previous page.

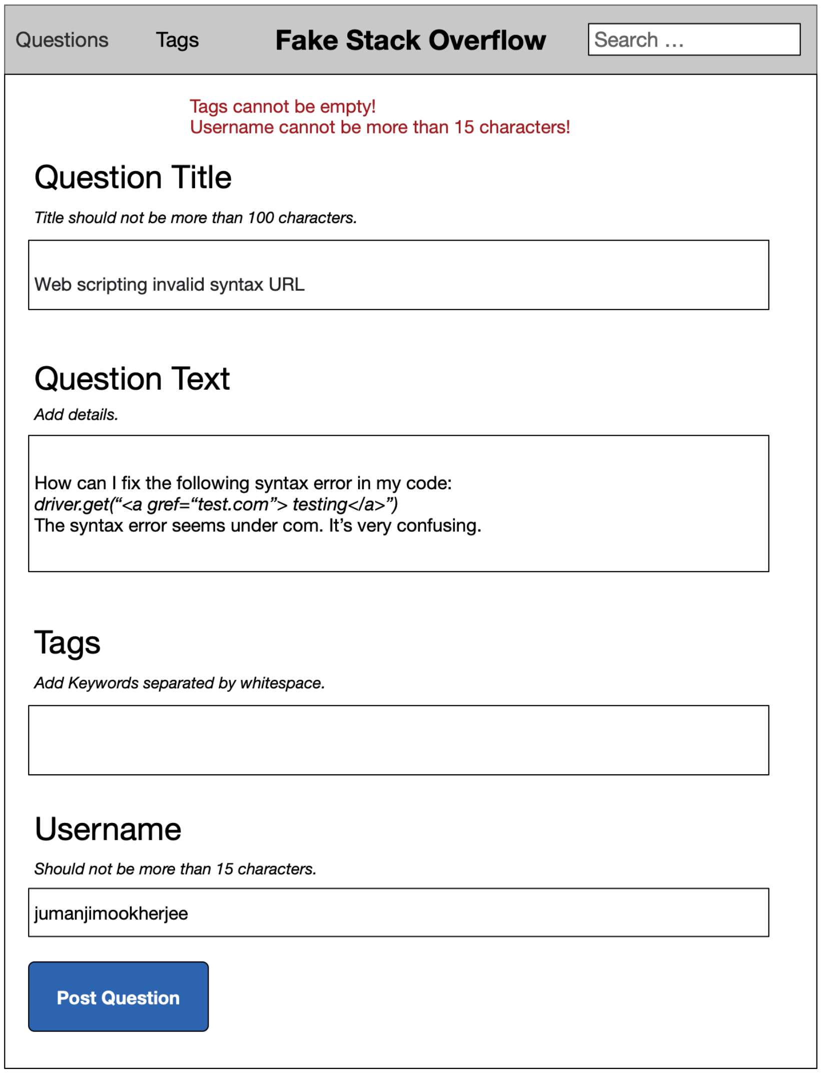


0 Views
0 Answers
Web scripting invalid syntax URL
web-scripting HTML
Asked By jumanji
On Jan 25, 2022
At 12:19

10 Views
2 Answers
Programmatically navigate using React router
react javascript
Asked By JoJi John
On Jan 19, 2022
At 21:25

121 Views
3 Answers
android studio save string shared preference, start activity and load the saved string
android-studio javascript shared-preferences
Asked By saltyPeter
On Jan 01, 2022
At 01:15

An error will occur if unexpected data is entered in any of the input fields or a runtime error occurs when updating the *data object*. If an error occurs, the *main body* of the page should still display the form with appropriate error messages at the top of the form. The error messages' font color should be red. For example, in the figure shown below, the user did not add any tags to the question and entered a username that is more than 15 characters.



Tags cannot be empty!
Username cannot be more than 15 characters!

Question Title

Title should not be more than 100 characters.

Web scripting invalid syntax URL

Question Text

Add details.

How can I fix the following syntax error in my code:
driver.get("<a gref="test.com"> testing</a>")
The syntax error seems under com. It's very confusing.

Tags

Add Keywords separated by whitespace.

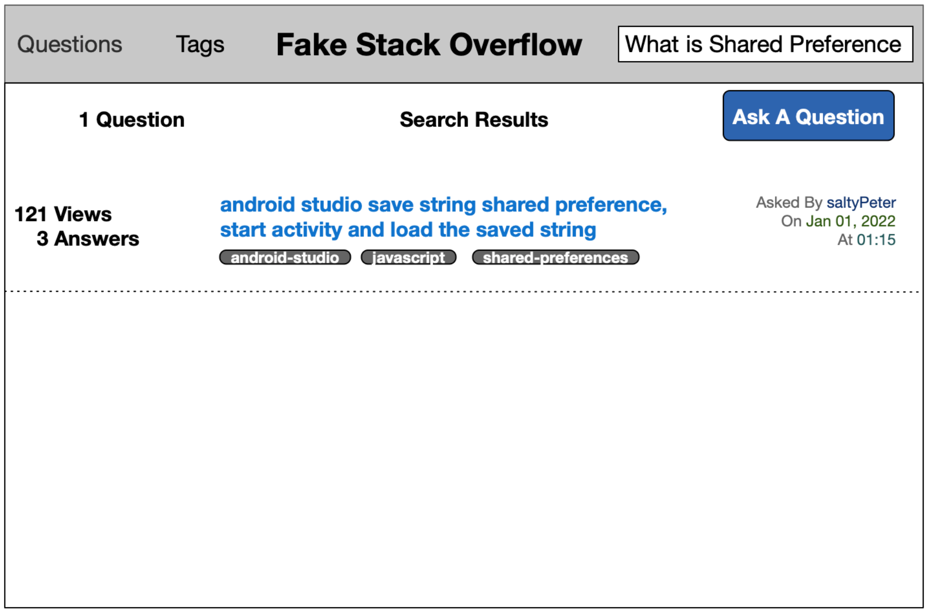
Username

Should not be more than 15 characters.

jumanjimookherjee

Searching

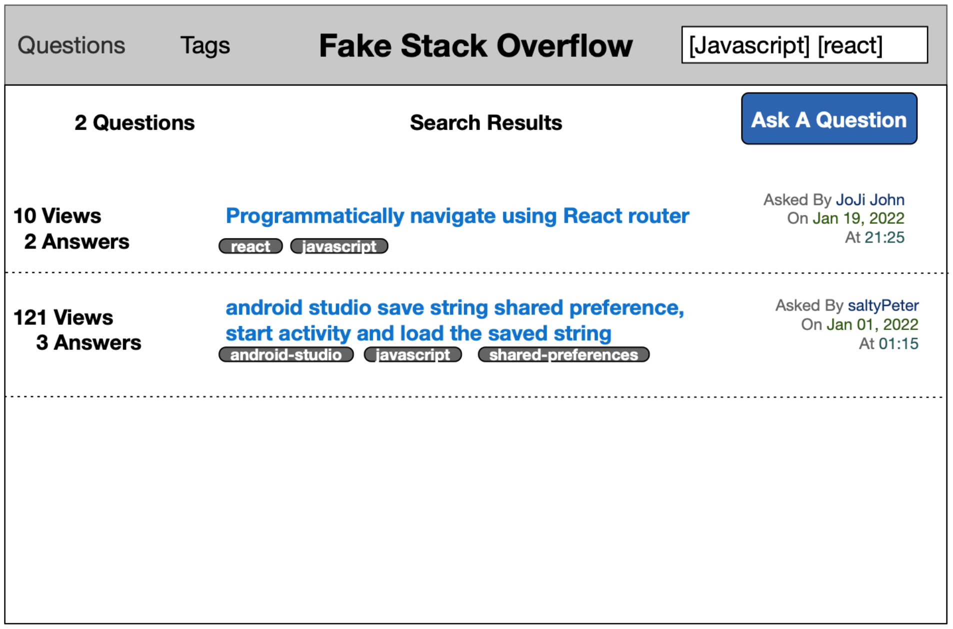
A user can search for certain questions based on words occurring in the question text or title. On pressing the ENTER key, The search should return *all questions for which their title or text contains at least one word in the search string*. For example, in the example shown below, there is only one question in our data model that matches the search string.


Questions Tags **Fake Stack Overflow** What is Shared Preference

1 Question **Search Results** **Ask A Question**

121 Views
3 Answers
android studio save string shared preference, start activity and load the saved string
android-studio javascript shared-preferences
Asked By saltyPeter
On Jan 01, 2022
At 01:15

Further, if a user surrounds individual words with [] then all questions corresponding to each tagname in [] should be displayed. *The search results should be displayed when the user presses the* ***ENTER*** *key*. See the example in the figure below.


Questions Tags **Fake Stack Overflow** [Javascript] [react]

2 Questions **Search Results** **Ask A Question**

10 Views
2 Answers
Programmatically navigate using React router
react javascript
Asked By JoJi John
On Jan 19, 2022
At 21:25

121 Views
3 Answers
android studio save string shared preference, start activity and load the saved string
android-studio javascript shared-preferences
Asked By saltyPeter
On Jan 01, 2022
At 01:15

Note the searching is **case-insensitive**. A search string can contain a combination of [tagnames] and non-tag words. When this happens, all questions tagged with each [tagname] and all questions with text or title containing at least one of the non-tag words should be displayed.

If the search string does not match any question or tag names then display the **No Questions Found**. The total number of questions displayed should be 0 and the page title and the button should remain.

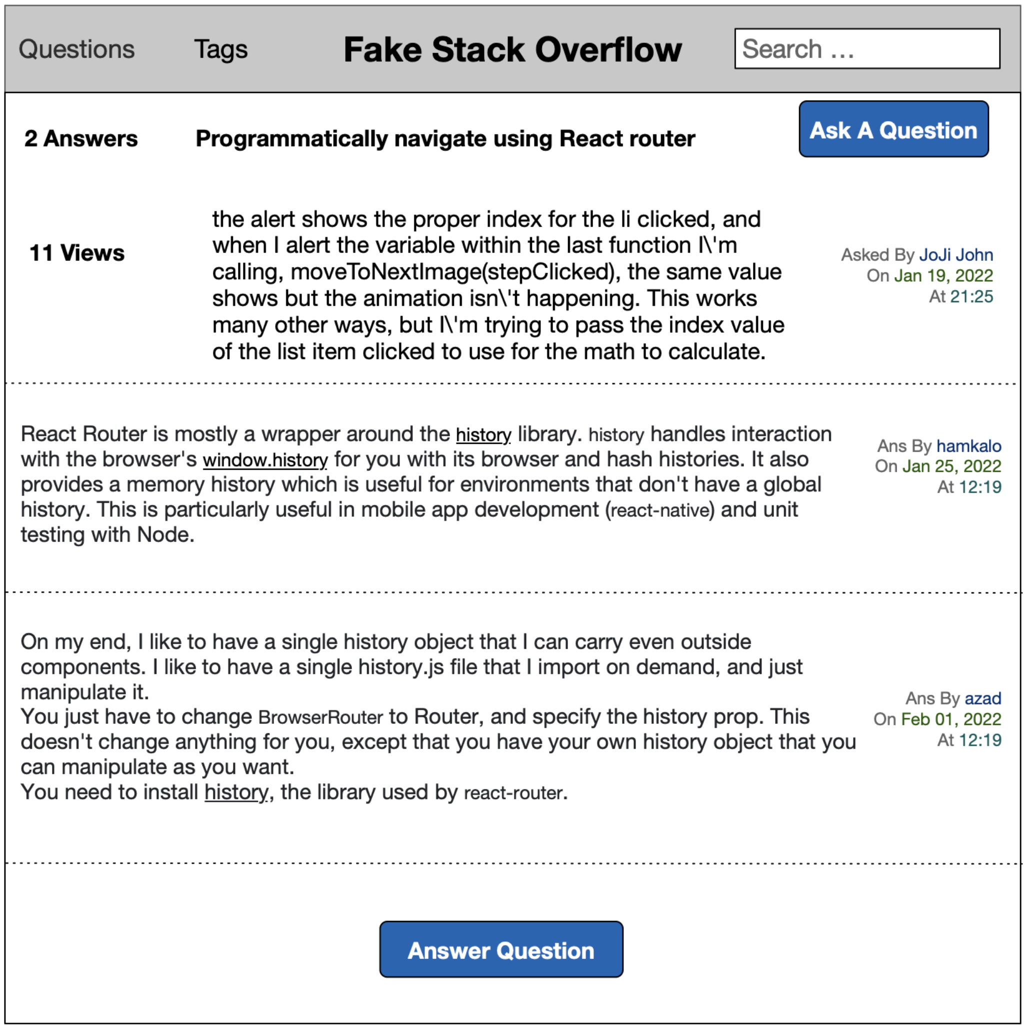
Answers Page

Clicking on a question link should increment by 1 the no. of views associated with the question and load the answers for that question in the *main body* of the page. Note the banner should still remain at the top of the page. The answers should be displayed in a tabular format as follows:

- A header row with 3 columns. The first column should display the text **N answers**, where N is the total no. of answers given for the question. The second column should display the title of the question in bold. The third column should display a *button* with the label **Ask A Question**. You are free to add other style constraints to the elements other than what has already been mentioned. However, make sure that they are clearly visible.
- The second column must occupy the maximum width followed by the first column and then the third column.
- The second row should display 3 columns.
    - The first column should display the text **N views** indicating the no. of times the question has been viewed (including this one).
    - The second column should display the question text.
    - The third column should display three lines. The first line should display the text **asked by <user>**, where <user> is the username of the person that asked the question. The second line should display the text **on <Month Day, Year>** and the third line should display the time as **at <hh: min>**.
- The answers to the questions should be displayed in subsequent rows. An answer row should have 2 columns.
    - The first column should display the answer.
    - The second column should display three lines. The first line should display the text **Ans by <user>**, where <user> is the username of the person that asked the question. The second line should display the text **on <Month Day, Year>** and the third line should display the time as **at <hh: min>**.
- If no. of answers do not fit on the page, then add a scroll bar.
- The answers should be displayed in ascending order of the day and time they were posted. In other words, display the answers that were posted most recently first.
- At the end of all the answers, you should display a *button* with the label **Answer Question**. This button should be centered relative to the page. It should have rounded borders on all four sides. It should have hex code **#165A92** as the background color. Make sure that the button and the label are clearly visible.

- After each answer row, a horizontal divider should be drawn. You can choose the style of this divider.
- There should be no other borders surrounding the answers being displayed.

Shown below is an example of the ‘answers’ page for a question.



2 Answers **Programmatically navigate using React router**

11 Views

the alert shows the proper index for the li clicked, and when I alert the variable within the last function I\'m calling, moveToNextImage(stepClicked), the same value shows but the animation isn\'t happening. This works many other ways, but I\'m trying to pass the index value of the list item clicked to use for the math to calculate.

Asked By JoJi John
On Jan 19, 2022
At 21:25

React Router is mostly a wrapper around the history library. history handles interaction with the browser's window.history for you with its browser and hash histories. It also provides a memory history which is useful for environments that don't have a global history. This is particularly useful in mobile app development (react-native) and unit testing with Node.

Ans By hamkalo
On Jan 25, 2022
At 12:19

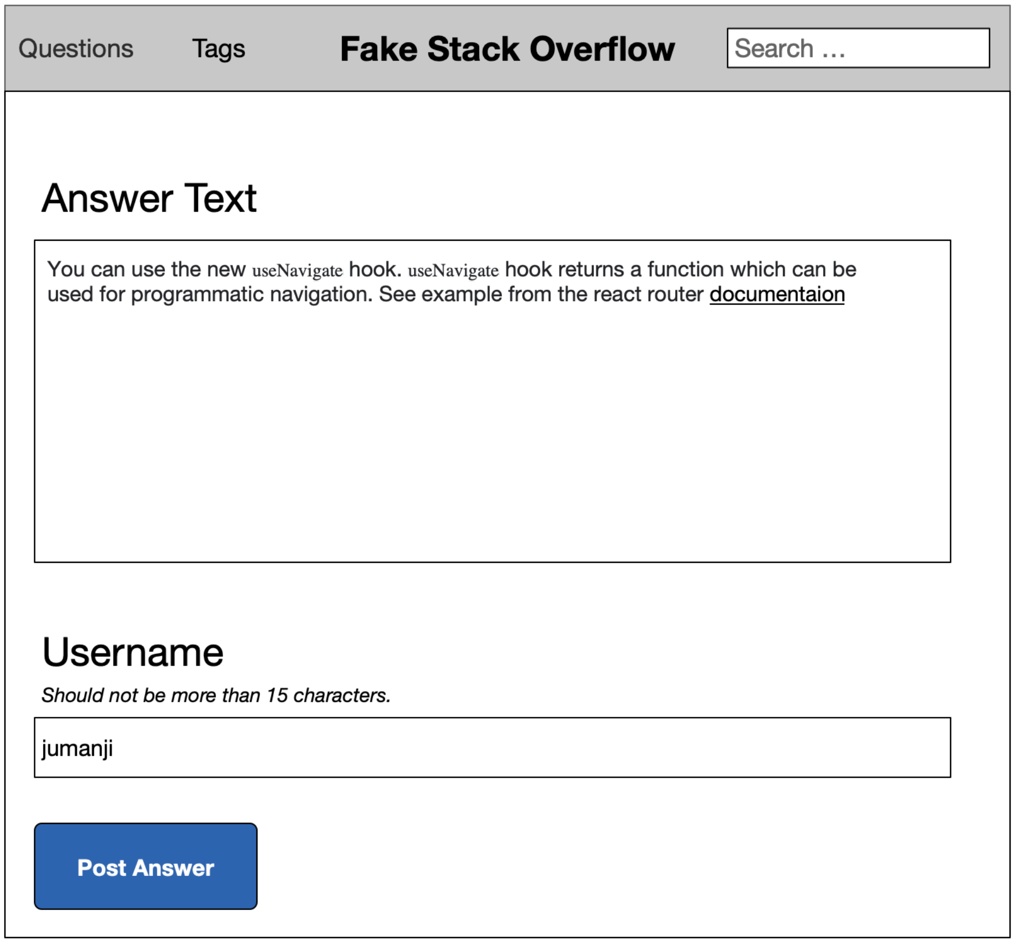
On my end, I like to have a single history object that I can carry even outside components. I like to have a single history.js file that I import on demand, and just manipulate it.
You just have to change BrowserRouter to Router, and specify the history prop. This doesn't change anything for you, except that you have your own history object that you can manipulate as you want.
You need to install history, the library used by react-router.

Ans By azad
On Feb 01, 2022
At 12:19

Pressing the *Ask A Question* button on this page will render elements as described in the **New Question Page** section.

New Answer Page

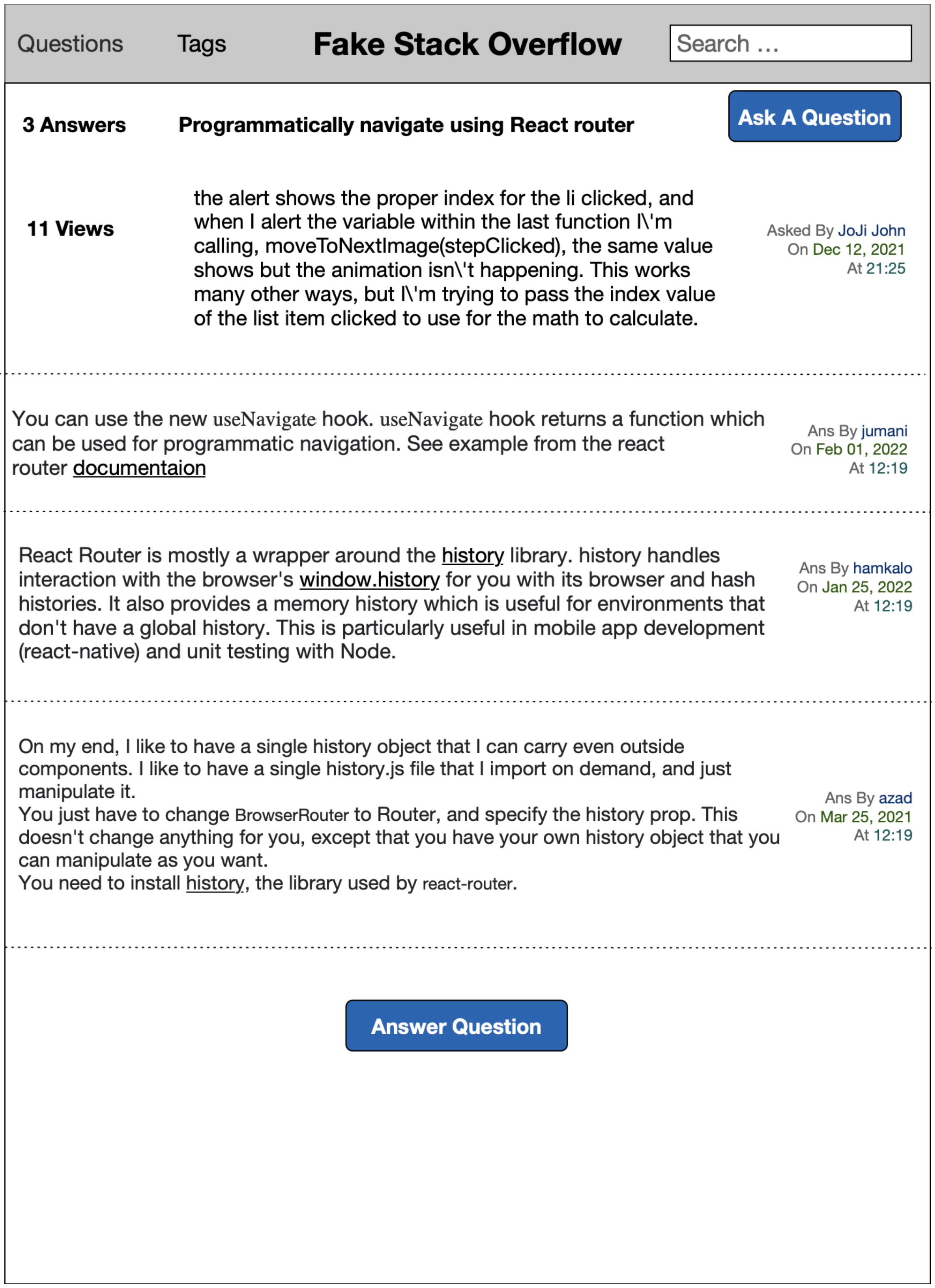
Pressing the *Answer Question* button will display a page with input elements to enter the new answer text and username. Note the banner should remain at the top of the page. The figure below shows an example of the same.



You can use the new useNavigate hook. useNavigate hook returns a function which can be used for programmatic navigation. See example from the react router documentaion

jumanji

Pressing the *Post Answer* button, should capture the answer text and the username and update the data model. If the data entered satisfies all the necessary constraints and no runtime error occurs, then all the answers are displayed as shown on the **Answers Page.** As an example see the figure below.



3 Answers **Programmatically navigate using React router**

11 Views

the alert shows the proper index for the li clicked, and when I alert the variable within the last function I\'m calling, moveToNextImage(stepClicked), the same value shows but the animation isn\'t happening. This works many other ways, but I\'m trying to pass the index value of the list item clicked to use for the math to calculate.

Asked By JoJi John
On Dec 12, 2021
At 21:25

You can use the new useNavigate hook. useNavigate hook returns a function which can be used for programmatic navigation. See example from the react router documentaion

Ans By jumani
On Feb 01, 2022
At 12:19

React Router is mostly a wrapper around the history library. history handles interaction with the browser's window.history for you with its browser and hash histories. It also provides a memory history which is useful for environments that don't have a global history. This is particularly useful in mobile app development (react-native) and unit testing with Node.

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On Jan 25, 2022
At 12:19

On my end, I like to have a single history object that I can carry even outside components. I like to have a single history.js file that I import on demand, and just manipulate it.
You just have to change BrowserRouter to Router, and specify the history prop. This doesn't change anything for you, except that you have your own history object that you can manipulate as you want.
You need to install history, the library used by react-router.

Ans By azad
On Mar 25, 2021
At 12:19

Note how there are now 3 answers for this question since a new answer was posted.

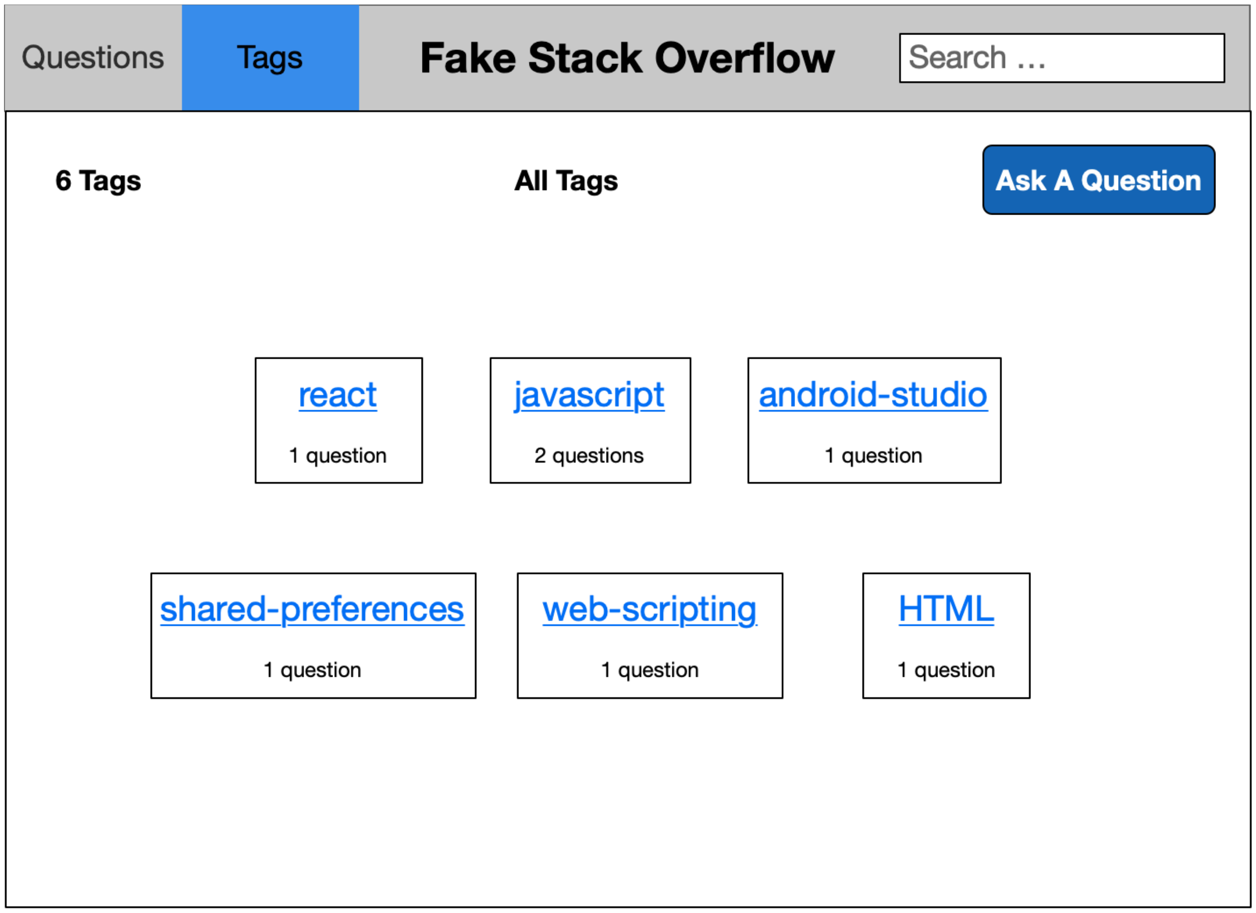
If the answer text is empty or the username is more than 15 characters (**username must not be empty**) or a runtime error occurs, then display error messages in red on the same page similar to the *new question* page.

Tags Page

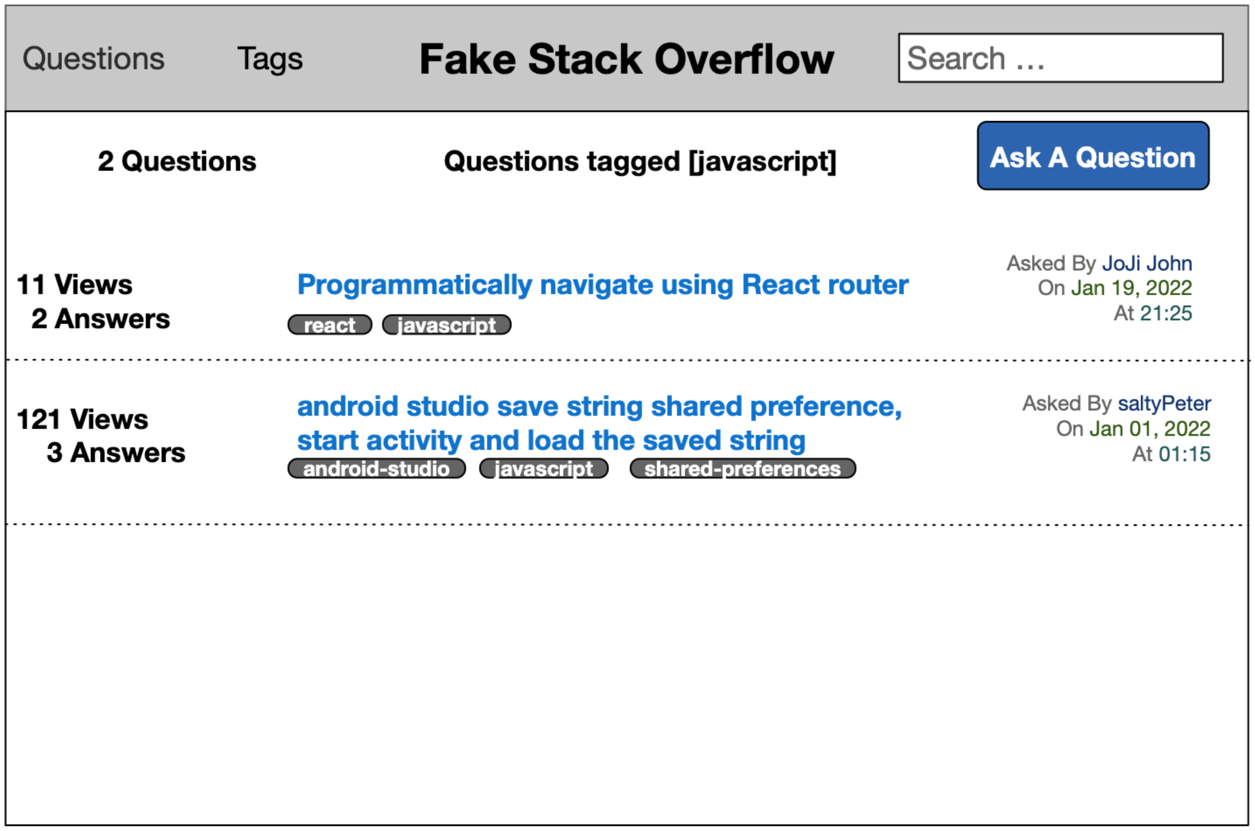
Clicking on the *Tags* link in the banner should display the list of all tags in the system. Additionally, the *Tags* link in the banner should be highlighted with hex code **#0281E8**. The page should render the following elements in a tabular format:

1. A header row with 3 columns. The first column should display the text **N Tags** in the first column, **N** is the no. of tags in the system. The second column should display the text **All Tags**. The third column should display the button with the label **Ask A Question**. This is the same button that was described in the *Questions* and *Answers* pages.
2. The following rows should display the tags in groups of 3, that is, each row should have at most 3 tags. Each tag should be displayed in a block with black-colored borders. The block should display the tag name as a link and the no. of questions associated with the tag in a new line in the same block.

The figure below shows an example of the page.



Upon clicking a tag link, the questions associated with the tag should be displayed. For example, if the *javascript* tag is clicked then the page shown below is displayed. All questions associated with the *javascript* tag are rendered.



Submitting Code

You can submit code to your GitHub repository as many times as you want till the deadline. After the deadline, any code you submit will be rejected. To submit a file to the remote repository, you first need to add it to the local git repository in your system, that is, the directory where you cloned the remote repository initially. Use the following commands from your terminal:

`$ cd /path/to/cse316-hw3-<username>` (skip if you are already in this directory)

```
$ git add <filename-you-want-to-add>
```

To submit your work to the remote GitHub repository, you will need to commit the file (with a message) and push the file to the repository. Use the following commands:

```
$ git commit -m "<your-custom-message>"

$ git push
```

Finally, submit your GitHub username to the listing created in Blackboard for this homework. This will help us locate your repository easily.