ASSIGNMENT-2 REPORT

Group - 8A:

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Problem Description

We are required to develop a 'data structures learning software', to teach students fundamental concepts of Data Structures and Algorithms, using step by step explanations. The problem at hand is the lack of effective and engaging educational resources for teaching data structures to students. So, we propose the development of a software application designed to teach students the fundamental concepts of data structures through step-by-step explanations, interactive modules, and engaging graphics.

Significance and Target Audience

Traditional methods of teaching often rely on static textbooks or lectures, which may not effectively convey complex concepts or engage students in active learning. Our solution aims to bridge the gap between theoretical knowledge and practical understanding. The **target audience** here would mainly include students learning data structures for the first time, or those needing a refresher.

Tools to be used

1. Development Environment:

   - Visual Studio: Microsoft Visual Studio provides a comprehensive integrated development environment (IDE) for building ASP.NET web applications using Visual Basic.

2. Backend:

   - ASP.NET: ASP.NET is a web application framework for building dynamic web pages and web applications using Visual Basic.

   - Visual Basic (VB.NET): VB.NET is the primary programming language used in ASP.NET applications for server-side logic and code-behind files.

3. Database:

- ODBC Database: ODBC is a free, open-source relational database management system that can be used as the backend database for our ASP.NET application.

Solution

The proposed solution will include a basic website-like design. The software will feature a login page that grants access to registered users and allows new users to register. Upon successful login, users will be presented with a dashboard displaying available learning modules and their progress bars, enabling them to track their advancement through the curriculum. Clicking on the topic name will take the user to the corresponding tutorial page which would cover the study material and include interactive graphics for understanding. Quizzes will be included to enhance understanding and the quiz scores will be tracked.

Database Design

The database will be used for:

1. User login and authentication- user id, password and user name.
2. Fetching the progress in each module for a given user- user id, module name, points scored
3. Storing quiz questions and answers for different modules- module name, question number, question, options, correct answer

Features to be added

1. User Authentication:
   - The software will incorporate a secure user authentication system, requiring users to log in with valid credentials.

- User registration functionality will be provided for new users to create accounts and access the platform.

2. Module Selection and Progress Tracking:
   - The dashboard will display a list of available learning modules, organized by topic (e.g., searching, sorting, arrays, stacks, queues, linked lists, etc.).
   - Each module will be accompanied by a progress bar indicating the user's completion status, allowing them to track their progress within the curriculum.

3. Interactive Learning Modules:
   - Each learning module will contain interactive resources, including textual explanations, visual demonstrations, and interactive simulations.
   - Tutorial topics covered: Arrays, Stacks, Queues, Sorting, Searching, Linked Lists. Extra topics such as vector, map, set can also be included.

4. Quizzes and Assessments:
   - Quizzes will be included in each module to assess the user's understanding of the covered material.
   - Immediate feedback will be provided upon completion of quizzes, allowing users to review their answers and understand any mistakes.

5. Error handling: The program will exit gracefully in case of error, while displaying user-friendly error messages.
   - Input validation: Only number-based inputs will be allowed in all the interactive modules. Limits of the numerical inputs shall be defined according to the max and min value of the Double data type in Visual Basic.
   - Database related errors: Handle exceptions that may occur during database operations, such as connecting to the database, executing queries, or handling data retrieval errors.

- Authentication errors: Users trying to login with incorrect password or id.

6. Documentation:
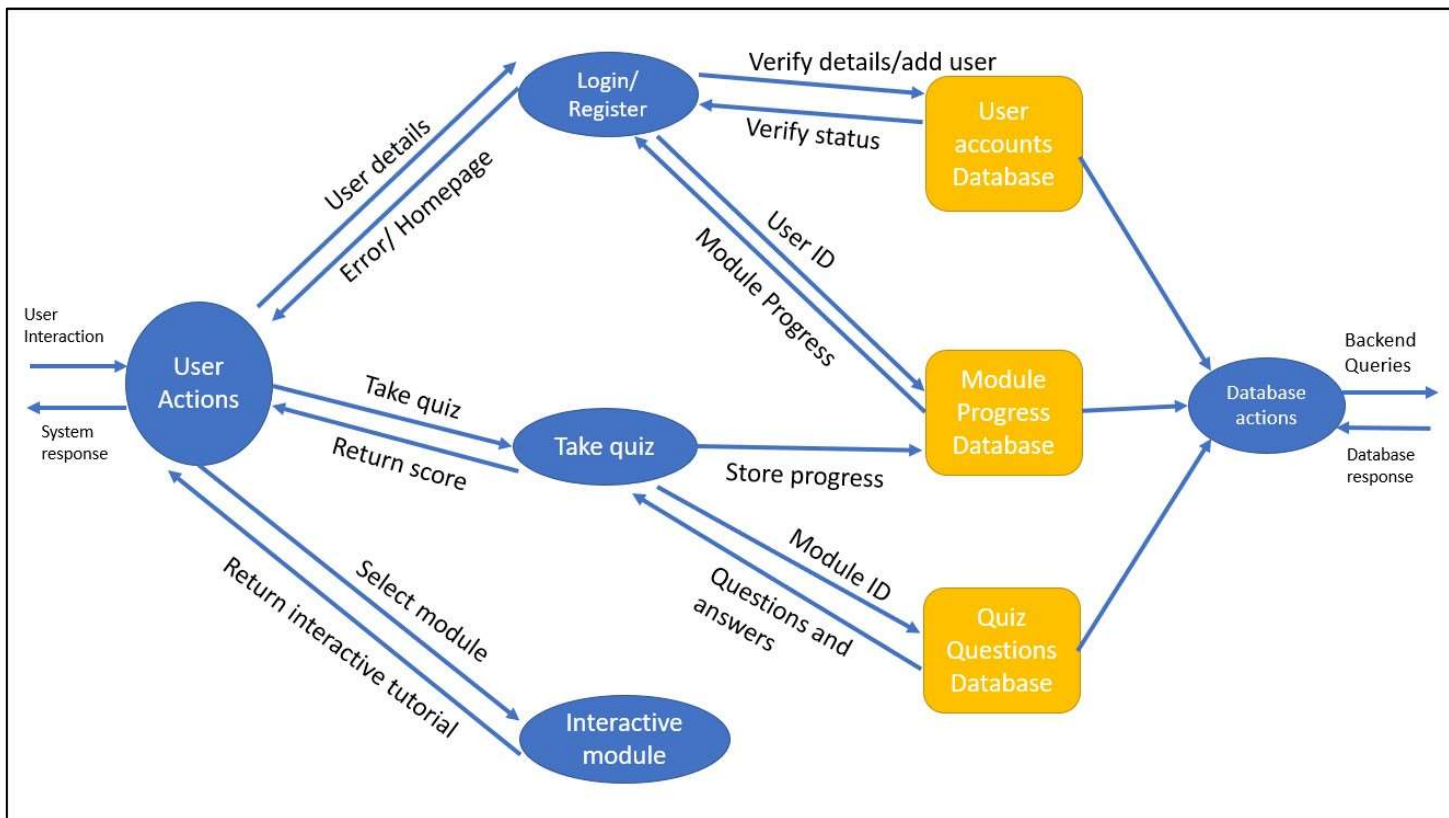   - The final software will include inline comments, user documentation and technical documentation.
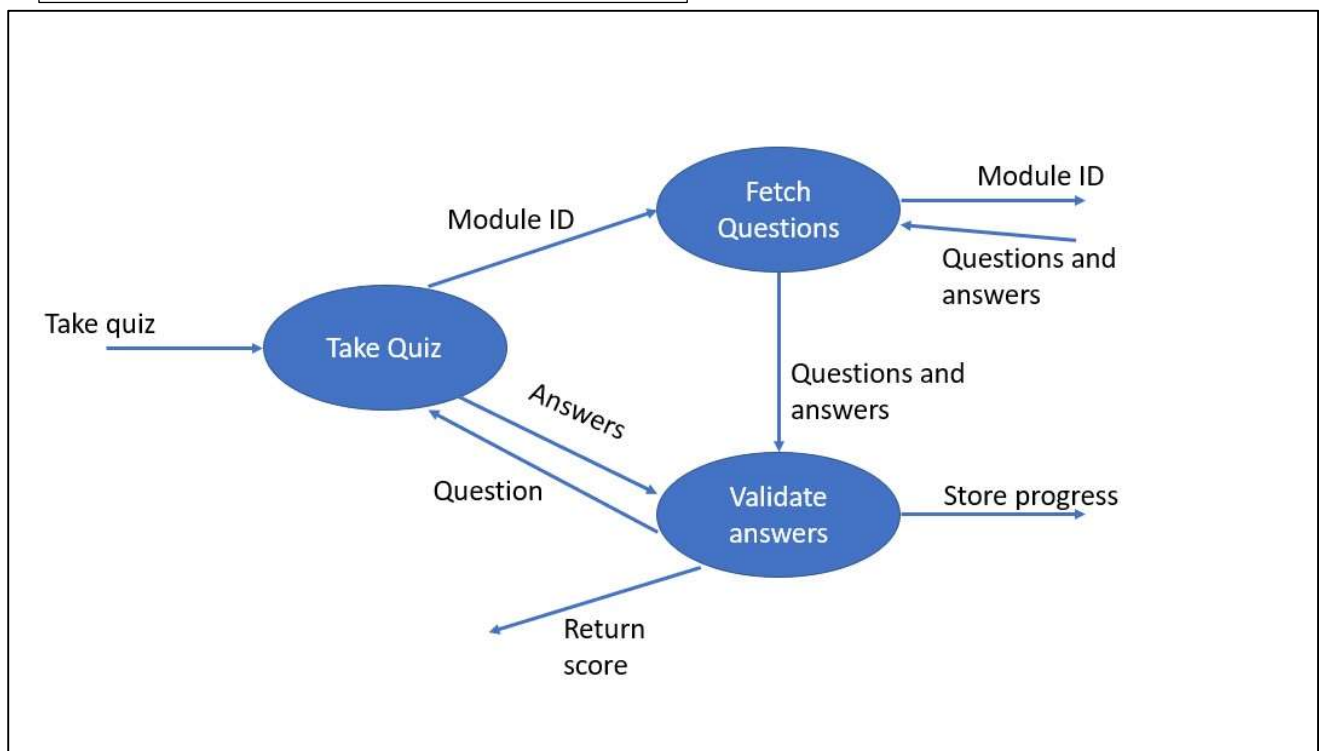
Data Flow Diagram (DFD)
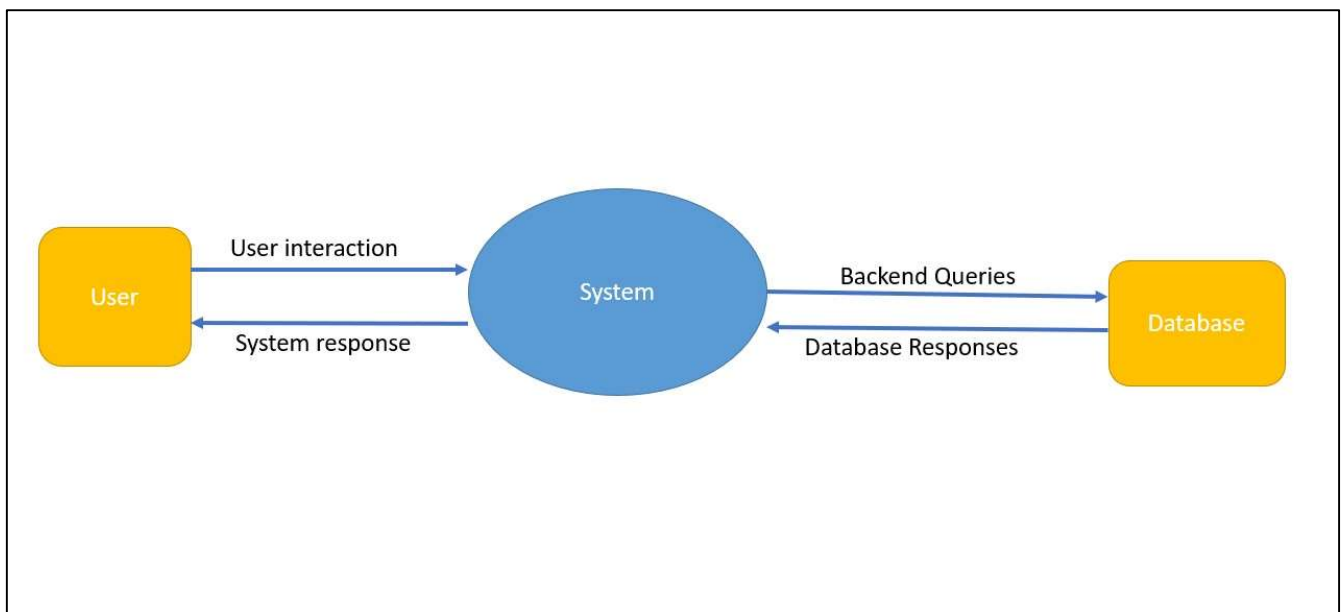
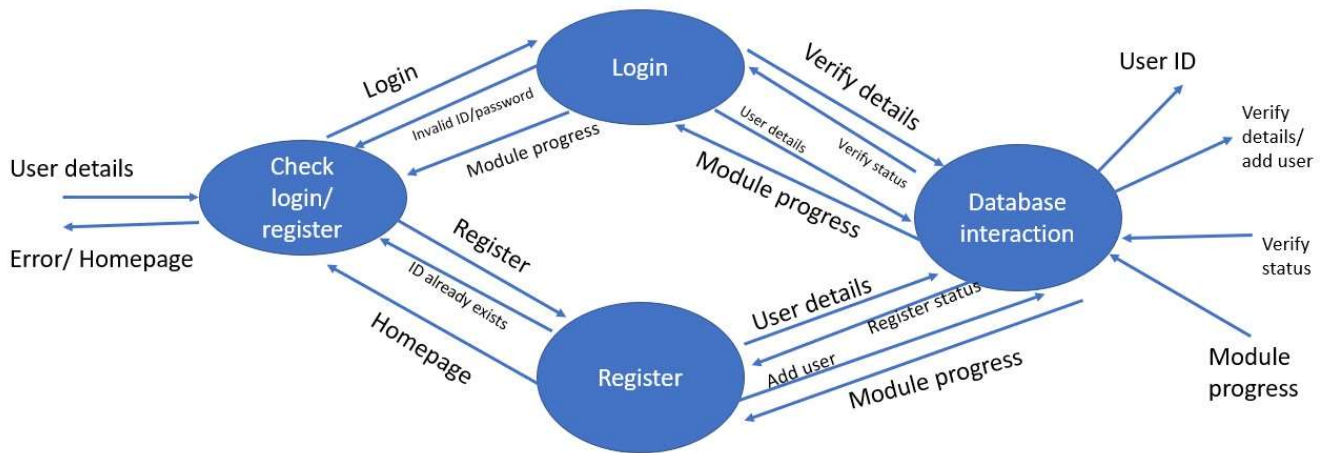The following are different levels of DFDs:

Level 0 DFD:

Level-1 DFD:

Level-2 DFD for Take Quiz:

Level-2 DFD for Login/Register:

Initial Design

AlgorithmicAtlas

Learn Data Structures and Algorithms in an easy, interactive way!

Topics   Quizzes

Arrays:

An array is a fixed-size collection of similar data items stored in contiguous memory locations. It can be used to store the collection of primitive data types such as int, char, float, etc, and also derived and user-defined data types such as pointers, structures, etc. Following are interactive exercises to learn arrays:

Enter array: `12,24,54,3,89,45,7`

Output: Array size= 7, Index range= [0,6]

Access array index: `2`

Output: A[2] = 54

Update Array index with a number:

Index: `3`

New number: `29`

Output: New Array= 12,24,54,29,89,45,7

Enter input array separated by commas

`6,5,2,3,4`

SORT

STEP-1

| 6 | | 5 | | 2 | | 3 | | 4 |

STEP-2

| 5 | | 6 | | 2 | | 3 | | 4 |