Documentation

(Group 28)

**Group Information**

Project Name - LDU Factorization

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Overview of Project

In this project we developed a web application which demonstrates factorization of a matrix into LDU(Lower, Diagonal, Upper) matrix. User can access the application through-

* Give Input for dimension
* Give input for matrix A
* Will compute the Upper triangular matrix along with all elimination matrix.
* Determine the Lower triangular matrix by calculating inverse of elimination multiplication matrices.
* Construct Diagonal Matrix.
* Will Verify the LDU factorization.

HTML Elements

* **Dimension of Matrix**-

The button (<button onclick="takeorder('showmatrix')">) allow user to give input for desired matrix dimension.

* **Upper Triangular Matrix (U)**:

Users can compute UUU by clicking <button onclick="Umatrix('showUmatrix')">.

In the div of id=”showUmatrix” all the elimination matrices will display.

* **Matrix (L)**:

Users can calculate LLL with <button onclick="lmatrix('showlmatrix')">.

The result is displayed in div with id="showlmatrix".

* **Updated Upper Matrix**:

In the div with id="UUmatrix", by clicking on <button onclick="UUmatrix('uumat')"> user will get the Updated Upper triangular matrix.

* **Diagonal Matrix:**

In the div with id="dmaat", by clicking on <button onclick="Dmatrix('dmat')"> allow user display diagonal matrix.

* Finally, user will compare A’= LDU’ and at last A=A’ will verify the result.

CSS Styling

**General Page Styling**

* Sets font to sans-serif and applies a radial gradient background (white to gray).
* Centers content vertically and horizontally using flexbox.
* Ensures full viewport height (100vh) for the layout.

**Header Styling**

Title (#title):

* Centers the header text.
* Sets a font size of 3rem for emphasis.

**Info Section**

Container (#info):

* Utilizes a flexbox layout for horizontal alignment of items.
* Adds 5rem padding and fixes height at 10rem for spacing.
* **Member Info Cards**

Card (.member\_info):

* Semi-transparent white background with padding for content spacing.
* Includes rounded corners and shadow effects for a card-like appearance.
* Hover: Adds a radial gradient background (blue-magenta), increases height slightly, and changes text/icons to white.

**Image (.img img):**

* Displays images in a circular format with border-radius: 50%.
* Fixed size (7rem x 7rem).

**Button Styling**

Button (.button button):

* Dark blue background, white text, and no border for a clean look.
* Adds dimensions (10rem x 3rem) and centers buttons within their container.
* Hover: Changes background color to magenta for interactivity.

**Icons Styling**

Icon Container (.icons):

* Flexbox layout for horizontal alignment of icons.
* Adds spacing between icons for clarity.

**Responsive Design for Smaller Screens**

* Adjusts layout by reducing padding for screens under 768px.
* Buttons become full-width, and font sizes adapt for better readability on smaller devices.

JAVA Script Logic

* **Matrix Formation**

In the function *multwomat(m,mm)*, we have initiated the result matrix & multiplied two matrices m and m, by assuming both matrices are square & will store the final result in mult.

* **Creating an Elementary Matrix**

*function makeEM(row, col, value), is creating an elementary function.*

* **Entering the input**

*function takeorder(id),* is allowing users to give input for a square matrix.

* **Creating U Matrix along with all Elimination Matrices**

*function Umatrix(id),* is core part of the code , where it is calculating the U factor of LDU factorization along with all elimination matrices.

* **Calculating L matrix**

*function lmatrix(id),* is calculating the L part of LDU factorization along with the calculation of inverse of multiplication of all elimination matrices.

* **Generating U’ Matrix**

*function UUmatrix(uumat)*, is deriving U’ from U matrix , by ensuring that each row of U′ has a leading 1 in the pivot position.

* **Calculating D Matrix**

*function Dmatrix(dmat),* is responsible for constructing the diagonal matrix D from the upper triangular matrix U in the LDU factorization process.

* **Multiplication of all three factors**

*function multiplyLDU(LDU*), is multiplying all three factors i.e. L,D & U and verifying the factorization.

The application successfully demonstrates LDU factorization by decomposing a matrix A and reconstructing it through multiplication of L, D, and U′.