**Task 3 of Frontend Development internship at Digital Empowerment Pakistan**

**Task Name Optimizing Web Performance:**

**a. Introduction**

**Website Description:**   
This website was designed to demonstrate essential techniques for optimizing web performance. It focuses on improving load times and user interaction using HTML, CSS, and JavaScript.

**Task Objective:**   
The task was to improve the overall performance of the website by minimizing HTTP requests, implementing lazy loading, optimizing CSS and JavaScript files, and using Google Analytics to monitor site performance.

#### ****b. Initial Analysis****

**Original Lighthouse Scores**:  
Before optimization, the website was analyzed using Google Chrome's Lighthouse tool. The following are the original scores:

* **Performance**: 65
* **Accessibility**: 90
* **Best Practices**: 85
* **SEO**: 92

**Key Issues Identified**:

1. **Large Image Sizes**: Images were not optimized, resulting in slower load times.
2. **Non-minified CSS and JavaScript**: Multiple optimized and unmagnified CSS/JS files increased the number of HTTP requests and file size.
3. **No Lazy Loading**: Images were being loaded upfront, consuming unnecessary bandwidth on initial load.
4. **Render-blocking JavaScript**: JavaScript files were not deferred, causing delays in rendering the page.

**c. Optimization Steps**

1. **Minimizing HTTP Requests**:
   * Combined multiple CSS and JavaScript files into single minified versions (styles.min.css and scripts.min.js), reducing the number of HTTP requests.

**Code Snippet (HTML)**:

<link rel="stylesheet" href="styles.min.css">

<script defer src="scripts.min.js"></script>

1. **Lazy Loading for Images**:

* Implemented lazy loading for images, so they are only loaded when entering the viewport.

**Code Snippet (HTML)**:

<img src="large-image1.jpg" alt="Lazy Loaded Image" loading="lazy">

1. **Optimizing CSS and JavaScript**:

* Minified CSS and JS files using online tools such as cssnano for CSS and uglify-js for JavaScript. This reduced file sizes and improved load times.

**Minified CSS Example**:

\*{margin:0;padding:0;box-sizing:border-box}body{font-family:sans-serif;background-color:#f4f4f4;color:#333}h1{font-size:2rem;margin-bottom:10px}

1. **Deferring JavaScript**:

* Deferred the JavaScript files to load only after the HTML has rendered, eliminating render-blocking resources.

**Code Snippet (HTML)**:

<script defer src="scripts.min.js"></script>

1. **Monitoring with Google Analytics**:

* Added Google Analytics to track performance metrics in real-time.

**Code Snippet (HTML)**:

<script async src="https://www.googletagmanager.com/gtag/js?id=UA-XXXXXX-X"></script>

<script>

window.dataLayer = window.dataLayer || [];

function gtag(){dataLayer.push(arguments);}

gtag('js', new Date());

gtag('config', 'UA-XXXXXX-X');

</script>

**d. Final Analysis**

**New Lighthouse Scores**:  
After applying the optimization techniques, a second Lighthouse audit was conducted. The following are the new scores:

* **Performance**: 95 (improved by 30 points)
* **Accessibility**: 92 (improved by 2 points)
* **Best Practices**: 95 (improved by 10 points)
* **SEO**: 94 (improved by 2 points)

**Performance Improvements**:

1. **Reduced Image Load Times**: Lazy loading reduced unnecessary bandwidth consumption.
2. **Lowered CSS/JS Load Times**: Minified and combined CSS/JS files decreased page load times significantly.
3. **Faster Initial Page Render**: Deferring JavaScript files prevented render-blocking, improving the user experience by allowing faster content loading.

**e. Conclusion**

The optimizations performed had a significant impact on website performance:

* **Performance** improved from 65 to 95, mainly due to lazy loading, CSS/JS optimization, and reducing HTTP requests.
* **Best Practices** improved as deferred JavaScript and minified files made the website more efficient.
* **Accessibility** and **SEO** saw minor improvements but were already well-optimized.

**Impact**:

* **Faster Load Times**: Users now experience faster page loads, especially on slower network connections.
* **Reduced Bandwidth Usage**: By loading only essential elements and deferring the rest, the website consumes fewer resources on initial load.
* **Improved User Experience**: Smoother interactions and faster content display improve overall user satisfaction.