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4-2 Milestone: Algorithms and Data Structures Enhancement Narrative

The artifact I selected for this category of enhancement is the same web application as the first: the Grazioso Salvare rescue animal dashboard from CS-340. This project centers around a data-driven dashboard that connects to a backend API and presents database information through an interactive user interface featuring a dynamic data table, visualization, and map. For this milestone, I focused on improving the core logic governing how data is fetched, managed, and displayed, specifically how algorithms and data structures handle pagination, selection, and sorting operations.

I chose this artifact because it provides a natural environment to demonstrate proficiency in algorithms and data structure design. The previous version relied on repetitive API calls and static data loading patterns that limited scalability and responsiveness. My enhancements modernize this process by introducing an in-memory caching system that preloads the full dataset upon initialization. This reduces redundant network requests and optimizes performance by minimizing the time complexity of subsequent data operations. Once the data is stored in memory, the application uses TanStack Table, a high-performance library for managing tabular data and one proven to handle far greater workloads than our example dataset. Its internal algorithms efficiently handle sorting, filtering, pagination, and row selection, all of which demonstrate real-world data structure manipulation in action.

This improvement better showcases my skills in applying algorithmic reasoning to practical software design. By moving data handling to the client side, I implemented a more efficient memory-resident model that relies on JavaScript's array-based data structures to

dynamically manage dataset transformations. The pagination system now calculates visible ranges based on state-driven page indexes, avoiding full reloads and demonstrating an understanding of algorithmic partitioning. Additionally, the Pagination component I've created dynamically generates pagination controls based on the total number of items and page size, showcasing how algorithmic logic can be used to make a user interface adapt intelligently to varying data conditions.

The design process itself was as much about problem solving as coding. While TanStack Table's Svelte documentation was somewhat vague, understanding its data flow and reactive context deepened my appreciation for how abstract data structures translate into rendered views. The biggest challenge was maintaining reactivity while managing derived states, such as sorting order and page indexes, which required careful consideration of how updates propagate through the component tree. Once implemented correctly, the table behaved exactly as intended: fast, predictable, and elegant, though I'm still working on the UI-side of the advanced table operations, so these not all this functionality is included in the code snapshot submitted this week.

The new front-end supports automatic light and dark mode styling and maintains a fully responsive design across screen sizes. Though I have not yet reintroduced the search functionality originally planned, the groundwork for it is solidly in place: the query logic is now backend-ready and will be surfaced in a future update once I refine the UI to support it safely and efficiently. In the meantime, the newly implemented data-handling logic and improved pagination represent meaningful progress toward my planned outcomes for this enhancement.

Overall, this milestone strengthened both my technical and problem-solving skills. I learned how to better leverage client-side data management, understand the inner workings of a

complex data table library, and improve the responsiveness and maintainability of a modern web application. The process reaffirmed the importance of pairing sound algorithmic design with thoughtful user experience—two sides of the same coin in building software that is both powerful and approachable.