**Title: Binary to Decimal Converter**

**Tool Details:**

* **Backend:** Node.js with Express.js
* **Frontend:** Web Components (vanilla JavaScript, no frameworks)
* **Database:** Not required (processing happens in memory)
* **AI Integration:** Convert binary numbers to decimal dynamically

**Goal:** Candidates will learn how to build an Express.js backend that converts binary numbers to decimal and integrate it with a WebComponent-based frontend. They will practice API request handling, user input validation, and real-time UI updates.

**Assignment Description:** Candidates will create a Binary to Decimal Converter where users can input a binary number, send it to the backend via an API request, and receive the converted decimal number. The frontend will dynamically display the conversion result.

**Tasks & Steps:**

1. **Backend Development:**
   * Set up an Express.js server.
   * Create an API endpoint that receives a binary number and converts it to decimal.
   * Validate input to ensure only valid binary numbers are accepted.
   * Return the decimal conversion result.
2. **Frontend Development:**
   * Create a Web Component with an input field for entering a binary number and a convert button.
   * Send the binary number to the backend via a fetch API request.
   * Receive the response and dynamically display the decimal result.
3. **Result Display:**
   * Show the binary number entered by the user.
   * Display the converted decimal number dynamically when the API responds.

**Mathematical Calculation/Steps:**

* Validate that the input contains only 0s and 1s.
* Convert the binary number to decimal using the formula:

**Decimal = Σ (bit × 2^position)** (where position starts from 0 on the right)

* Return the converted decimal value.

**Third-Party Packages (if required):**

* express (for backend server)
* cors (to allow frontend-backend communication)
* body-parser (to handle JSON requests)

**Acceptance Criteria:**

* The backend should correctly process binary-to-decimal conversion.
* The frontend should capture user input and dynamically update the UI.
* The API should return a valid decimal result.
* The Web Component should encapsulate input handling and result display.
* Users should receive an error message for invalid binary input.

**Submission Guidelines:**

1. Fork the provided repository.
2. Create a folder with your name inside the repo.
3. Implement both backend and frontend in the designated folder.
4. Push the completed code to your forked repo.
5. Submit a pull request for review.

The assignment is complete when the backend correctly converts binary to decimal, returns accurate responses, and the frontend successfully updates the UI based on API responses.