Project Plan: Interactive Visual Simulation of Regular Expression to Minimal DFA

Date: April 18, 2025

# Phase 1: Planning & Setup

- ✅ Form group and submit project proposal  
- ✅ Select and finalize project topic: Regular Expression → Minimal DFA visualizer

# Phase 2: Implementation (Now until April 19)

## Week 1: Regular Expression Parser + Thompson's Construction (RE → NFA)

- [ ] Implement regular expression parser  
- [ ] Implement Thompson’s construction to convert RE to ε-NFA  
- [ ] Create visual representation of the resulting NFA  
- [ ] Write unit tests for regex patterns like `a\*`, `a|b`, `(ab)\*`, etc.

## Week 2: Subset Construction (ε-NFA → DFA)

- [ ] Implement ε-closure and subset construction algorithm  
- [ ] Visualize DFA state creation with step-by-step state labels  
- [ ] Highlight state merging and dead states  
- [ ] Add ability to trace a string through the DFA

## Week 3: Hopcroft's Minimization (DFA → Minimal DFA)

- [ ] Implement Hopcroft's algorithm  
- [ ] Visualize partition refinement steps  
- [ ] Show minimized DFA structure  
- [ ] Allow comparison between original DFA and minimized DFA

## Week 4: Interactive Visualization & Input Testing

- [ ] Build frontend (React or JS + HTML Canvas / SVG)  
- [ ] Interface features:  
 • Step-by-step transformations  
 • State transitions and highlights  
 • Input test strings to trace across automata  
- [ ] Add annotations and tooltips for theory explanations

# Phase 3: Evaluation & Testing (April 15–18)

## Correctness

- [ ] Compare results with theoretical solutions  
- [ ] Validate against online RE/DFA tools

## Usability

- [ ] Conduct peer usability tests  
- [ ] Collect feedback on clarity and educational value

## Performance

- [ ] Test with complex regex (e.g., `(a|b)\*abb`)  
- [ ] Profile algorithm time and memory usage

# Phase 4: Final Report & Deliverables (Due April 20)

- [ ] Write final report (3–5 pages, academic format)  
- [ ] Include visuals, performance data, conclusions  
- [ ] Prepare presentation slides (15–20 mins total)  
- [ ] Submit report, code, and slides in a zip file on Canvas