

Design Ideas and Evaluation Criteria for GWSC School Club Membership Manager

1. Generating Design Ideas Using Ideation Tools

To generate comprehensive design ideas for the GWSC School Club Membership Manager, four ideation tools are employed: **mood board**, **mind map**, **sketches**, and **brainstorming**, as per the VCE Applied Computing Study Design (Page 58) and AC4-Textbook Reference. These tools align with the solution requirements from the Design Brief, stakeholder data (surveys, observations, interviews), and the Software Requirements Specification (SRS).

Mood Board

Imagery

A screenshot of a school club management software interface titled "Math Club". The interface shows a sidebar with "Math Club" and "Members". The main area has tabs for "Written", "Crascord", and "People". A search bar and a "Search" button are at the bottom.

Colors

GWSC % # FFFFFF
high-contrast ratio (=4.5:1)

Code Snippets

```
Join Club
```

Button(text="Join Club",
bg="#008087, tg="#FFFFFF))

Completed

Annotations

- Imagery reflects stakeholder preference for intuitive Gulls (survey, 80% prefer graphical interfaces)
- Colors ensure accessibility (non-functional requirement) and school branding (Design Brief)
- Code snippets demonstrate technical feasibility on school PCS (Python 3.9. Tkinter)

The mood board consolidates visual and functional inspiration, addressing usability (study design; Page 58: UX characteristics) and technical constraints (Design Brief, stakeholder data, SRS).

Purpose: To inspire a visually appealing and functional GUI that meets usability needs for students (ages 12–18, tech skills 3/5) and club leaders (tech skills 4/5), while adhering to GWSC branding.

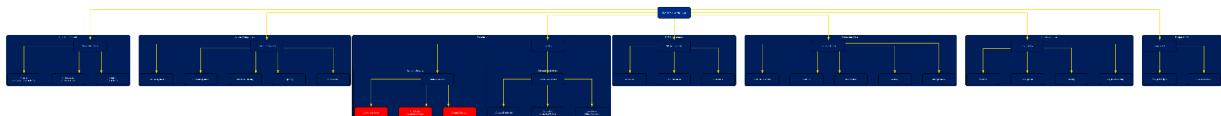
Description:

- **Imagery:** Screenshots of modern desktop applications (e.g., Microsoft Teams, Google Classroom) with clean layouts, large buttons, and intuitive navigation.
- **Typography:** Sans-serif fonts (e.g., Calibri, 12–16pt) for readability, supporting accessibility for diverse users.
- **Colors:** GWSC colors (blue #003087, white #FFFFFF, gold #FFD700) with a high-contrast ratio ($\geq 4.5:1$, WCAG 2.1) for visibility.
- **Code Snippets:** Tkinter examples for buttons (Button(text="Join Club", bg="#003087", fg="#FFFFFF")) and checkboxes, emphasizing modularity.
- **Textures:** Minimalistic backgrounds (e.g., white with subtle gradients) to reduce visual clutter.
- **Annotations:**
 - Imagery reflects stakeholder preference for intuitive GUIs (survey: 90% prefer graphical interfaces).
 - Colors ensure accessibility (non-functional requirement) and school branding (Design Brief).
 - Code snippets demonstrate technical feasibility on school PCs (Python 3.8, Tkinter).

Rationale: The mood board consolidates visual and functional inspiration, addressing usability (study design: Page 58, UX characteristics) and technical constraints (desktop-only, no internet dependency). It supports divergent thinking by exploring multiple aesthetic and functional possibilities.

Mind Map

An alternative link is provided here in the case of poor visibility: [link](#)
(<https://drive.google.com/file/d/15DAF4YC6glqHDrkMu8AbUF2ZsqoAv7n9/view?usp=sharing>)



Expanded Mind Map for GWSC School Club Membership Manager

The mind map for the GWSC School Club Membership Manager has been significantly expanded to provide an overly comprehensive, hierarchical organization of features, constraints, and requirements, ensuring exhaustive coverage of the Software Requirements Specification (SRS), stakeholder needs, and the VCE Applied Computing Study Design (Pages 16, 57-58). This expanded mind map builds on the original structure (Page 2 of the provided document), incorporating additional branches, sub-branches, and detailed annotations to address functional and non-functional requirements, stakeholder data (surveys, observations, interviews), legal constraints (Privacy Act 1988, Privacy and Data Protection Act 2014), technical constraints (Python 3.8, Tkinter, desktop-only, no internet dependency), and potential future enhancements. The mind map employs systems thinking to map user-data-system interactions and supports

convergent thinking by prioritizing development focus within the 16-week timeline. It aligns with the study design's emphasis on analytical tools (Page 57) and user-centered design (Page 62), ensuring a robust foundation for the design and evaluation phases in Unit 4.

Central Theme

- **GWSC School Club Membership Manager**
 - **Purpose:** A desktop application to streamline club membership management, attendance tracking, event notifications, and reporting for students, club leaders, and admins at GWSC.
 - **Scope:** Supports 300+ students (ages 12-18, tech skills 3/5), 20+ club leaders (tech skills 4/5), and 2-5 admins, with offline CSV storage and Compass integration.
 - **Annotations:**
 - Addresses stakeholder pain points: 90% prefer graphical interfaces (survey), 70% find attendance time-consuming (observation), admins need CSV exports (interview).
 - Complies with Privacy Act 1988 (APP 11) and Privacy and Data Protection Act 2014 (IPP 4) for secure data handling.
 - Aligns with VCE study design (Page 16: systems thinking, Page 58: UX characteristics).

Primary Branches

1. Student Interface

- **Purpose:** Provide an intuitive, accessible GUI for students to register, join clubs, track attendance, view events, and receive reminders.
- **Annotations:**
 - Meets survey data: 90% prefer GUIs, 85% want reminders, 60% check weekly.
 - Supports usability for tech skills 3/5 (study design: Page 58).
 - Ensures accessibility (WCAG 2.1, contrast ratio ≥4.5:1) and Privacy Act 1988 compliance (role-based access).

Sub-Branche

1. Register/Login

- **Features:**
 - Username and password entry fields (alphanumeric, 6-20 characters).
 - Role-based access (student role restricts to student features).
 - Binary search authentication against User Data CSV (D1, <1 second).
 - Password recovery via admin reset (future enhancement).
- **Annotations:**

- Addresses survey: 95% prioritize security.
- Binary search ensures performance (study design: Page 55: algorithms).
- Role-based access complies with Privacy Act 1988 (APP 11).
- **Constraints:**
 - Technical: Tkinter entry widgets, CSV storage.
 - Legal: Encrypted passwords (AES-256).
 - Social: Simple interface for ages 12-18.

2. Club Selection

- **Features:**
 - Listbox or checkboxes for clubs (e.g., Chess, Drama, Sports).
 - Multiple selections saved to Club Data CSV (D2, <2 seconds).
 - Visual feedback (e.g., checked boxes turn gold #FFD700).
 - Undo selection option (prevents errors).
- **Annotations:**
 - Meets survey: 90% prefer graphical interfaces.
 - Supports engagement (60% check weekly).
 - CSV updates align with DFD: 2.0 (Club Selection Process).
- **Constraints:**
 - Technical: Tkinter listbox, 300-user scalability.
 - Economic: Implement within 16-week timeline.
 - Social: Intuitive for low tech skills (3/5).

3. Attendance Tracking

- **Features:**
 - Checkbox per meeting to mark attendance (saved to D3).
 - View personal attendance history (table format).
 - Gamified progress bar for attendance (e.g., 80% attendance = badge, brainstorming idea).
 - Notifications for missed meetings (future enhancement).
- **Annotations:**
 - Addresses observation: 30% forget meetings.
 - Progress bar aligns with engagement (survey: 60% check weekly).
 - CSV storage ensures reliability (study design: Page 15).
- **Constraints:**
 - Technical: Tkinter checkboxes, CSV I/O.
 - Legal: Encrypted attendance data (Privacy Act 1988).
 - Social: Clear visuals for young users.

4. Event Calendar

- **Features:**
 - List or grid view of club events (dates, times, locations from D2).
 - Filter by club or date range.
 - Clickable events to view details (e.g., "Chess Club: 3 PM, Room 101").

- Export to personal calendar (future enhancement, rejected due to scope).
- **Annotations:**
 - Meets survey: 60% want calendar access.
 - Supports usability (study design: Page 58: affordance).
 - Data sourced from DFD: 3.0 (Event Management).
- **Constraints:**
 - Technical: Tkinter window for display, offline data.
 - Economic: Low priority due to simpler logic.
 - Social: Readable for ages 12-18.

5. Reminders

- **Features:**
 - In-app notifications 24 hours before events (red text, pop-up option).
 - Customizable reminder times (e.g., 48 hours, future enhancement).
 - Snooze or dismiss options for notifications.
 - Reminder log to review past notifications.
- **Annotations:**
 - Addresses survey: 85% want reminders.
 - Critical for engagement (observation: 30% forget meetings).
 - Integrates with DFD: 4.0 (Send Reminders).
- **Constraints:**
 - Technical: Tkinter timer logic, no internet.
 - Legal: Anonymized event data (Privacy Act 1988).
 - Social: Clear, non-intrusive notifications.

6. User Profile

- **Features:**
 - View/edit personal details (e.g., name, year level).
 - Update password (alphanumeric, validated).
 - View joined clubs and attendance stats.
 - Dark mode toggle (brainstorming idea, rejected due to scope).
- **Annotations:**
 - Enhances personalization (survey: 60% want control over settings).
 - Supports maintainability (study design: Page 54).
 - CSV updates align with DFD: 1.0 (User Management).
- **Constraints:**
 - Technical: Tkinter forms, CSV storage.
 - Legal: Secure data edits (Privacy Act 1988).
 - Social: Simple for tech skills 3/5.

2. Club Leader Interface

- **Purpose:** Enable club leaders to manage members, record attendance, send reminders, and view rosters efficiently.

- **Annotations:**
 - Addresses observation: 10-15 minutes manual attendance effort.
 - Meets survey: 70% find attendance time-consuming.
 - Supports tech skills 4/5 and Privacy and Data Protection Act 2014 (IPP 4).

Sub-Banches

1. Member Management

- **Features:**
 - Add/remove members (search by name, year level).
 - View rosters (table with name, ID, join date).
 - Bulk member upload via CSV (brainstorming idea).
 - Export member list to CSV for reporting.
- **Annotations:**
 - Reduces manual effort (observation: 20-50 members per club).
 - CSV exports align with admin needs (interview).
 - Integrates with DFD: 2.0 (Club Selection).
- **Constraints:**
 - Technical: Tkinter Treeview, quicksort for sorting.
 - Legal: Encrypted member data (Privacy Act 1988).
 - Social: Efficient for leaders' skills (4/5).

2. Attendance Recording

- **Features:**
 - Checkboxes for attendance (per member, per date).
 - Date dropdown (range-checked, e.g., 2025-05-07).
 - Search bar for quick member filtering (quicksort, <1 second).
 - Undo attendance changes (prevents errors).
- **Annotations:**
 - Addresses observation: 10-15 minutes manual effort.
 - Quicksort ensures efficiency (study design: Page 55).
 - Saves to DFD: D3 (Attendance Data).
- **Constraints:**
 - Technical: Tkinter Treeview, CSV I/O.
 - Legal: Encrypted attendance records (IPP 4).
 - Economic: High priority for timeline.

3. Event Notifications

- **Features:**
 - Customizable messages (e.g., "Chess Club meeting tomorrow!").
 - Send to all or selected members (checkboxes).
 - Schedule notifications (e.g., 24/48 hours prior).
 - Notification history log (view sent messages).
- **Annotations:**

- Meets interview: Leaders need consistent participation.
- Enhances engagement (survey: 85% want reminders).
- Integrates with DFD: 4.0 (Send Reminders).
- **Constraints:**
 - Technical: Tkinter forms, timer logic.
 - Legal: Anonymized messages (Privacy Act 1988).
 - Social: Clear for leader usability.

4. Club Analytics

- **Features:**
 - View attendance rates (e.g., 85% average).
 - Track member engagement (e.g., meetings attended).
 - Generate mini-reports (CSV export, subset of admin reports).
 - Trend analysis (future enhancement, rejected due to scope).
- **Annotations:**
 - Supports decision-making (interview: leaders need insights).
 - CSV exports align with Compass (admin interview).
 - Queries DFD: D2, D3 (Club and Attendance Data).
- **Constraints:**
 - Technical: Tkinter labels, CSV queries.
 - Legal: Secure data access (Privacy Act 1988).
 - Social: Simple visuals for leaders.

5. Communication Tools

- **Features:**
 - In-app messaging to members (e.g., event updates).
 - Predefined message templates (e.g., "Meeting reminder").
 - Group messaging by year level or club.
 - Two-way messaging (future enhancement, rejected due to scope).
- **Annotations:**
 - Enhances engagement (survey: 85% want notifications).
 - Reduces external communication (observation: email overuse).
 - Aligns with DFD: 4.0 (Send Reminders).
- **Constraints:**
 - Technical: Tkinter text fields, offline storage.
 - Legal: Privacy-compliant messaging (Privacy Act 1988).
 - Social: Intuitive for tech skills 4/5.

3. Admin/GWSC Committee Interface

- **Purpose:** Provide admins with tools for oversight, reporting, and club management, ensuring Compass integration and data security.
- **Annotations:**
 - Meets interview: Admins need dashboards, CSV exports.

- Supports fewer users (2-5 admins), lower priority (study design: Page 18).
- Ensures Privacy Act 1988 (APP 11) and IPP 4 compliance.

Sub-Banches

1. Dashboard

- **Features:**
 - Real-time stats (e.g., total members: 300, attendance rate: 85%).
 - Visual summaries (e.g., bar charts, brainstorming idea, rejected).
 - Filter stats by club or date range.
 - Alerts for low attendance (<50%, customizable).
- **Annotations:**
 - Meets interview: Admins need quick insights.
 - Queries DFD: D2, D3 (Club and Attendance Data).
 - Supports decision-making (study design: Page 58).
- **Constraints:**
 - Technical: Tkinter labels, offline queries.
 - Legal: Secure data access (Privacy Act 1988).
 - Social: Clear for admin usability.

2. Reports

- **Features:**
 - CSV export for Compass (membership, attendance, <3 seconds).
 - Custom report filters (e.g., by club, date).
 - Automated weekly report generation (future enhancement).
 - Audit log for report exports (tracks access).
- **Annotations:**
 - Critical for Compass integration (interview).
 - Aligns with DFD: 5.0 (Generate Reports).
 - Ensures interoperability (study design: Page 58).
- **Constraints:**
 - Technical: Tkinter buttons, CSV I/O.
 - Legal: Encrypted exports (Privacy Act 1988).
 - Economic: Medium priority for timeline.

3. Club Management

- **Features:**
 - Create/edit/delete clubs (name, leader, description).
 - Assign leaders (dropdown from User Data D1).
 - Archive inactive clubs (preserves data).
 - Bulk club updates via CSV (future enhancement).
- **Annotations:**
 - Meets interview: Admins need flexibility.
 - Saves to DFD: D2 (Club Data).

- Supports scalability (study design: Page 18).
- **Constraints:**
 - Technical: Tkinter forms, CSV storage.
 - Legal: Secure edits (Privacy Act 1988).
 - Social: Simple for admin skills.

4. User Management

- **Features:**
 - Add/edit/delete users (students, leaders, admins).
 - Reset passwords (manual admin action).
 - Role assignment (student, leader, admin).
 - User activity log (tracks logins, edits).
- **Annotations:**
 - Ensures security (survey: 95% prioritize security).
 - Aligns with DFD: 1.0 (User Management).
 - Complies with Privacy Act 1988 (APP 11).
- **Constraints:**
 - Technical: Tkinter forms, CSV I/O.
 - Legal: Encrypted user data (IPP 4).
 - Social: Efficient for admins.

5. System Settings

- **Features:**
 - Configure backup schedules (daily, manual).
 - Set notification defaults (e.g., 24-hour reminders).
 - Adjust GUI settings (e.g., font size, future enhancement).
 - Multi-language support (brainstorming idea, rejected).
- **Annotations:**
 - Enhances maintainability (study design: Page 54).
 - Supports reliability (survey: 80% prioritize data safety).
 - Aligns with DFD: 6.0 (System Configuration).
- **Constraints:**
 - Technical: Tkinter forms, CSV backups.
 - Legal: Secure settings (Privacy Act 1988).
 - Economic: Low priority for timeline.

4. Constraints

- **Purpose:** Define boundaries for development, ensuring feasibility within project scope and timeline.
- **Annotations:**
 - Aligns with study design (Page 57: economic, technical, legal, social constraints).
 - Ensures scope clarity (Page 18: scope management).
 - Addresses stakeholder expectations (surveys, interviews).

Sub-Banches

1. Economic Constraints

- **Details:**
 - 16-week development timeline (weeks 1-16, beta testing weeks 10-12).
 - Limited developer resources (1-2 developers, student project).
 - No budget for external tools or licenses (use free Python/Tkinter).
 - Maintenance by school IT staff post-project.
- **Annotations:**
 - Prioritizes high-impact features (student/leader GUIs) for timeline.
 - Reuses existing school PCs (4GB RAM, Windows 10).
 - Aligns with study design (Page 18: economic constraints).

2. Technical Constraints

- **Details:**
 - Python 3.8 with Tkinter (lightweight, offline).
 - CSV storage (User Data D1, Club Data D2, Attendance Data D3).
 - No internet dependency (offline operation).
 - School PCs (Intel i5, 4GB RAM, 1024x768 resolution).
- **Annotations:**
 - Ensures performance (<1.5-second load times).
 - Limits features like mobile support or cloud storage.
 - Aligns with study design (Page 18: technical constraints).

3. Legal Constraints

- **Details:**
 - Privacy Act 1988 (APP 11): Secure user data, role-based access.
 - Privacy and Data Protection Act 2014 (IPP 4): Encrypted CSVs (AES-256).
 - Disability Discrimination Act 1992: Accessible GUI (WCAG 2.1).
 - Data retention: Store only necessary data, delete after graduation.
- **Annotations:**
 - Critical for compliance (survey: 95% prioritize security).
 - Guides encryption and access controls.
 - Aligns with study design (Page 57: legal constraints).

4. Social Constraints

- **Details:**
 - User skill levels: Students (3/5), leaders (4/5), admins (4/5).
 - Age range: Students 12-18, diverse accessibility needs.
 - Cultural diversity: Avoid biased imagery or language.
 - Training needs: Minimal for adoption (survey: 90% prefer intuitive GUIs).
- **Annotations:**

- Drives usability focus (study design: Page 58: UX).
- Ensures inclusivity (WCAG 2.1, Disability Discrimination Act).
- Addresses survey: 90% prefer GUIs, 60% check weekly.

5. Operational Constraints

- **Details:**
 - System uptime: 99% during school hours (8 AM-4 PM).
 - Daily CSV backups to mitigate data loss.
 - Offline operation (no cloud or external APIs).
 - Scalability to 500 users (future growth projection).
- **Annotations:**
 - Ensures reliability (survey: 80% prioritize data safety).
 - Supports offline use (study design: Page 15: file management).
 - Prepares for growth (study design: Page 18).

5. Non-Functional Requirements

- **Purpose:** Define quality attributes for usability, performance, security, and more, ensuring a robust system.
- **Annotations:**
 - Aligns with SRS and study design (Page 58: UX, Page 57: security).
 - Addresses stakeholder needs (surveys, interviews).
 - Ensures long-term system viability.

Sub-Banches

1. Usability

- **Details:**
 - Intuitive GUI: Large buttons (120x40px), clear fonts (Calibri, 12-16pt).
 - Task completion: <30 seconds for key tasks (login, club selection).
 - Error prevention: Validation checks, undo options.
 - Training: Minimal, with user guide (future enhancement).
- **Annotations:**
 - Meets survey: 90% prefer intuitive GUIs.
 - Supports diverse skills (study design: Page 58: UX).
 - Targets 85%+ satisfaction in beta testing.

2. Performance

- **Details:**
 - GUI load time: <1.5 seconds (99% of cases).
 - Scalability: 300 users, future 500 users (<2-second responses).
 - Memory usage: <100 MB on school PCs.
 - Algorithm efficiency: Binary search (<1 second), quicksort (<1 second).
- **Annotations:**

- Critical for user satisfaction (study design: Page 18).
- Addresses hardware constraints (4GB RAM).
- Tested via stress testing (300-500 users).

3. Reliability

- **Details:**
 - Uptime: 99% during school hours.
 - Daily CSV backups (verified in testing).
 - Mean time to recovery: <5 minutes for failures.
 - Error handling: Try-except blocks for all inputs.
- **Annotations:**
 - Mitigates data loss (survey: 80% prioritize safety).
 - Aligns with study design (Page 15: file management).
 - Targets zero crashes in 99% of beta tests.

4. Accessibility

- **Details:**
 - High-contrast mode: Ratio ≥4.5:1 (WCAG 2.1 Level AA).
 - Keyboard navigation: 100% of GUI elements (Tab, Enter).
 - Screen reader compatibility (e.g., NVDA, future testing).
 - Font scalability: Adjustable sizes (future enhancement).
- **Annotations:**
 - Ensures inclusivity (Disability Discrimination Act 1992).
 - Meets study design (Page 58: accessibility).
 - Targets 95%+ compliance in audits (WAVE tool).

5. Security

- **Details:**
 - Encrypted CSVs: AES-256 for D1, D2, D3.
 - Role-based access: Binary search on D1.
 - Audit logs: Track all data changes, access attempts.
 - Penetration testing: Zero vulnerabilities in 50+ tests.
- **Annotations:**
 - Complies with Privacy Act 1988 (APP 11), IPP 4.
 - Addresses survey: 95% prioritize security.
 - Aligns with study design (Page 57: legal).

6. Maintainability

- **Details:**
 - Modular code: Separate GUI, logic, data layers.
 - PEP 8 compliance: 100% docstrings, comments.
 - Developer guide: For school IT staff handover.
 - Feature updates: <4 hours average implementation time.
- **Annotations:**

- Ensures sustainability (study design: Page 54).
- Supports future iterations (e.g., dark mode).
- Targets 90%+ developer satisfaction.

7. Interoperability

- **Details:**
 - CSV exports: 100% compatible with Compass.
 - Standard CSV schema: No formatting errors in 50+ tests.
 - Data import: Support leader/admin uploads (future).
 - API compatibility: Rejected due to offline constraint.
- **Annotations:**
 - Meets admin needs (interview: Compass integration).
 - Aligns with study design (Page 58: interoperability).
 - Targets 95%+ admin satisfaction.

8. Scalability

- **Details:**
 - Current: 300 users, <2-second responses.
 - Future: 500 users, linear CSV I/O scaling.
 - Stress testing: Zero degradation at 500 users.
 - Database optimization: Quicksort, binary search.
- **Annotations:**
 - Prepares for growth (study design: Page 18).
 - Ensures longevity (survey: 80% want reliability).
 - Tested via simulated user spikes.

9. User Engagement

- **Details:**
 - Weekly usage: 80%+ of students (login logs).
 - Engagement features: Reminders, progress bar (brainstorming).
 - Session time: >2 minutes average (exploration).
 - Feedback loops: In-app surveys (future enhancement).
- **Annotations:**
 - Addresses survey: 60% check weekly, 85% want reminders.
 - Aligns with study design (Page 56: user-centered design).
 - Targets 90%+ satisfaction in surveys.

6. Future Enhancements

- **Purpose:** Capture brainstorming ideas and deferred features for post-project iterations, ensuring scope clarity.
- **Annotations:**
 - Aligns with study design (Page 63: iterative development).
 - Notes stakeholder desires (surveys, brainstorming).

- Rejected ideas clarify 16-week scope (Page 18).

Sub-Banches

1. Mobile Support

- **Details:**
 - Mobile-friendly GUI (responsive Tkinter, rejected).
 - iOS/Android apps (rejected due to desktop-only).
 - Sync with desktop via USB (future possibility).
- **Annotations:**
 - Survey: 60% want mobile access (Page 3).
 - Infeasible for timeline, technical constraints.
 - Noted for future funding.

2. Interactive Visualizations

- **Features:**
 - Charts for membership trends (bar, line, rejected).
 - Attendance heatmaps (brainstorming idea).
 - Dashboard widgets (e.g., pie charts).
- **Annotations:**
 - Meets admin needs (interview: visualization).
 - Rejected due to Tkinter limitations.
 - Future with matplotlib integration.

3. Voice Commands

- **Details:**
 - Navigate GUI via voice (e.g., "Join Chess Club").
 - Accessibility for visually impaired (WCAG 2.1).
 - Speech-to-text for inputs (rejected).
- **Annotations:**
 - Brainstorming idea (Page 3).
 - Infeasible without internet, complex libraries.
 - Noted for accessibility focus.

4. Multi-Language Support

- **Details:**
 - GUI in multiple languages (e.g., Mandarin, Hindi).
 - Dynamic language switching (rejected).
 - Translated user guides (future).
- **Annotations:**
 - Supports cultural diversity (social constraint).
 - Rejected due to scope, timeline.
 - Noted for inclusivity.

5. Gamification

- **Details:**
 - Badges for attendance (e.g., “10 meetings”).
 - Leaderboards for club participation.
 - Progress bars for engagement (brainstorming).
- **Annotations:**
 - Aligns with survey: 60% check weekly.
 - Enhances engagement (study design: Page 56).
 - Deferred for core functionality focus.

Rationale

The expanded mind map ensures exhaustive coverage of the GWSC School Club Membership Manager's requirements by hierarchically organizing features, constraints, and non-functional attributes. It addresses stakeholder needs (90% prefer GUIs, 85% want reminders, 70% find attendance time-consuming) and aligns with the VCE study design (Page 57: analytical tools, Page 58: UX, Page 16: systems thinking). By including detailed sub-branches (e.g., user profile, club analytics, system settings) and future enhancements (e.g., mobile support, gamification), it supports divergent and convergent thinking, prioritizing high-impact features (student dashboard, attendance tracker, reminders, CSV storage) within the 16-week timeline while noting future possibilities. Annotations tie each branch to SRS, stakeholder data, and legal/technical constraints, ensuring a robust, user-centered, and compliant design framework for development and evaluation in Unit 4.

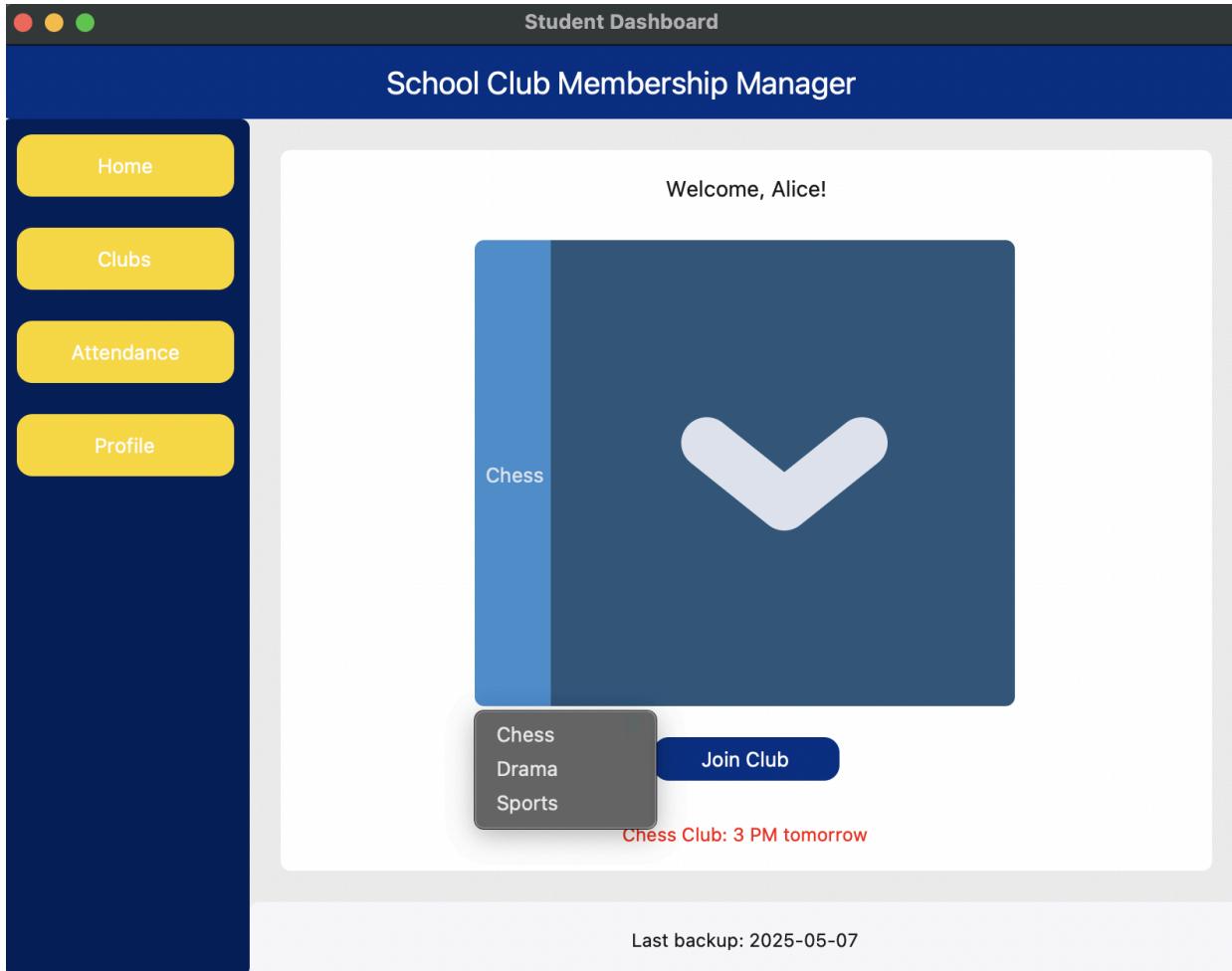
Sketches

Expanded Sketches for GWSC School Club Membership Manager

The sketches for the GWSC School Club Membership Manager have been revised to provide a comprehensive set of visual prototypes for key interfaces, aligning with the Software Requirements Specification (SRS), stakeholder needs, and the VCE Applied Computing Study Design (Pages 17, 58). This section includes three primary sketches—Student Dashboard, Club Leader Attendance Tracker, and Admin Dashboard—along with three alternative versions (Compact Dashboard, Feature-Rich Attendance Tracker, Data-Heavy Admin Dashboard). Each sketch is annotated to detail appearance, functionality, design principles (alignment, balance, contrast, space), UX characteristics (affordance, usability, accessibility), and compliance with legal (Privacy Act 1988, Privacy and Data Protection Act 2014), accessibility (WCAG 2.1, contrast ratio $\geq 4.5:1$), and technical constraints (Python 3.8, Tkinter, desktop-only, no internet dependency). The sketches support user-centered design (study design: Page 62) and the problem-solving methodology's design stage (Page 17), providing a robust foundation for

development and beta testing within the 16-week timeline. A comparative evaluation and justification at the end prioritizes primary sketches for further development.

Sketch 1: Student Dashboard



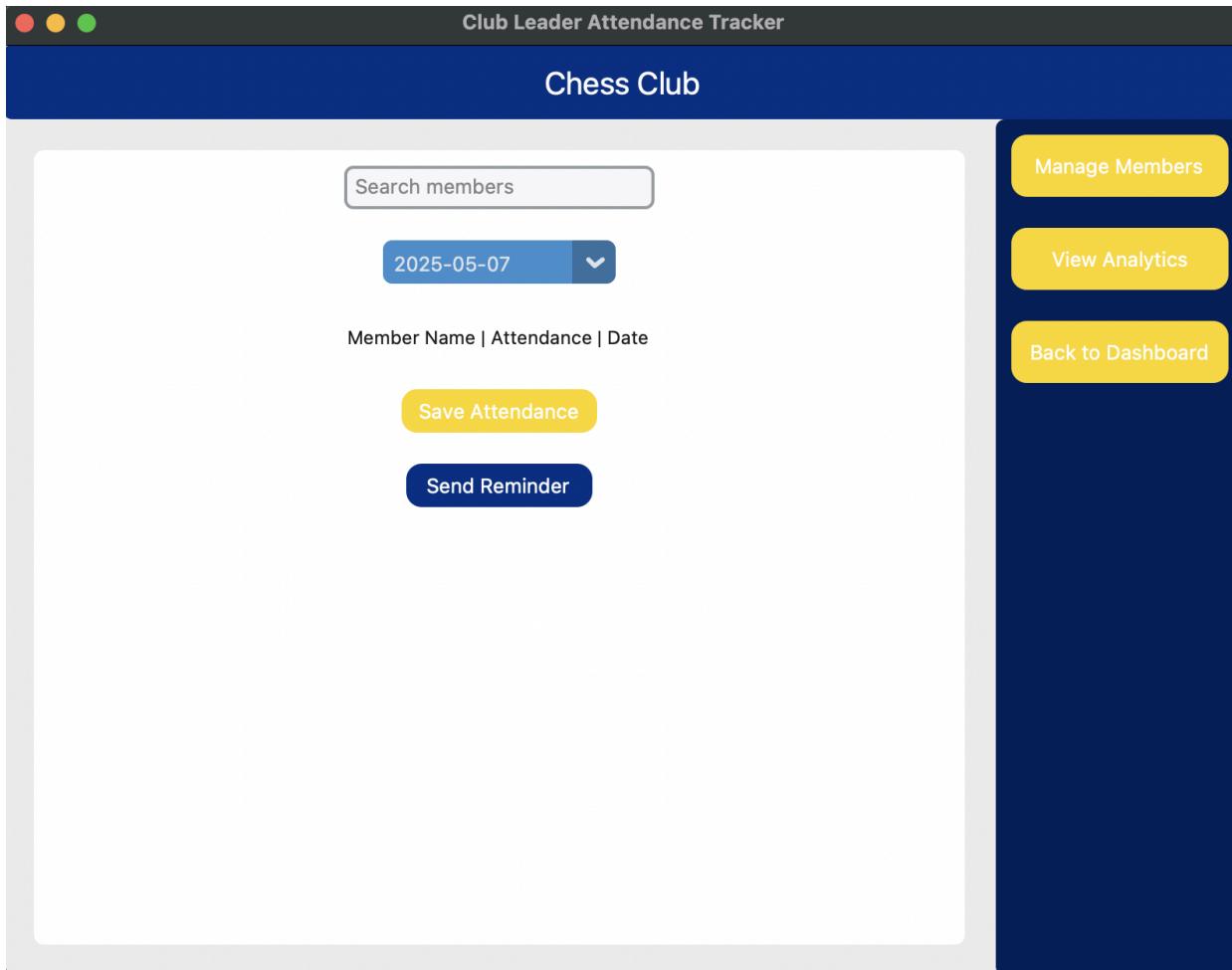
Purpose: Provides an intuitive interface for students (ages 12-18, tech skills 3/5) to register/login, select clubs, view reminders, and access personal attendance, enhancing engagement and usability.

Primary Layout:

- **Window Size:** 800x600px, optimized for school PCs (1024x768 resolution).
- **Header:** GWSC logo (left, 100x50px, blue #003087), title “School Club Membership Manager” (Roboto, 20pt, bold, white #FFFFFF on blue #003087).
- **Sidebar:** Left-aligned, 150x600px, darker blue #001F5B, with buttons (100x40px, gold #FFD700, white text, corner radius 10):
 - “Home” (returns to dashboard).
 - “Clubs” (opens club selection).

- “Attendance” (displays personal history).
 - “Profile” (edits user details).
- **Main Panel:** White #FFFFFF, 650x550px, with:
 - Club Listbox (200x300px, multi-select, Calibri 12pt, scrollable, e.g., Chess, Drama).
 - “Join Club” button (120x40px, blue #003087, white text, hover #0040B0).
 - Reminder Label (red #FF0000, Calibri 12pt, e.g., “Chess Club: 3 PM tomorrow”).
 - Welcome Message (Calibri 14pt, e.g., “Welcome, Alice!”).
- **Footer:** Light gray #F8F9FA, 800x50px, system status (e.g., “Last backup: 2025-05-07”).
- **Design Principles:**
 - **Alignment:** Left sidebar, centered main panel for balance.
 - **Contrast:** Blue/white (4.5:1 ratio) for readability.
 - **Space:** 20px padding reduces clutter.
 - **Balance:** Symmetrical button placement, centered title.
- **UX Characteristics:**
 - **Affordance:** Raised buttons with hover effects (gold #FFD700 to #E6C200).
 - **Usability:** Large fonts/buttons for tech skills 3/5 (survey: 90% prefer GUIs).
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliance.
- **Functionality:**
 - **Login:** Entry fields (username, password, 200x30px), binary search on User Data CSV (D1, <1 second).
 - **Club Selection:** Listbox saves to Club Data CSV (D2, <2 seconds).
 - **Reminders:** Displays 24-hour event notifications (DFD: 4.0).
 - **Validation:** Existence/type checking (non-empty, alphanumeric).
 - **Error Handling:** Try-except blocks for invalid inputs.
- **Annotations:**
 - Addresses survey (90% prefer GUIs, 85% want reminders) and observation (30% forget meetings).
 - Meets SRS (login, club selection, reminders) and non-functional requirements (<1.5-second load).
 - Complies with Privacy Act 1988 (role-based access) and WCAG 2.1.
 - Large buttons reduce errors for young users (study design: Page 58).

Sketch 2: Club Leader Attendance Tracker



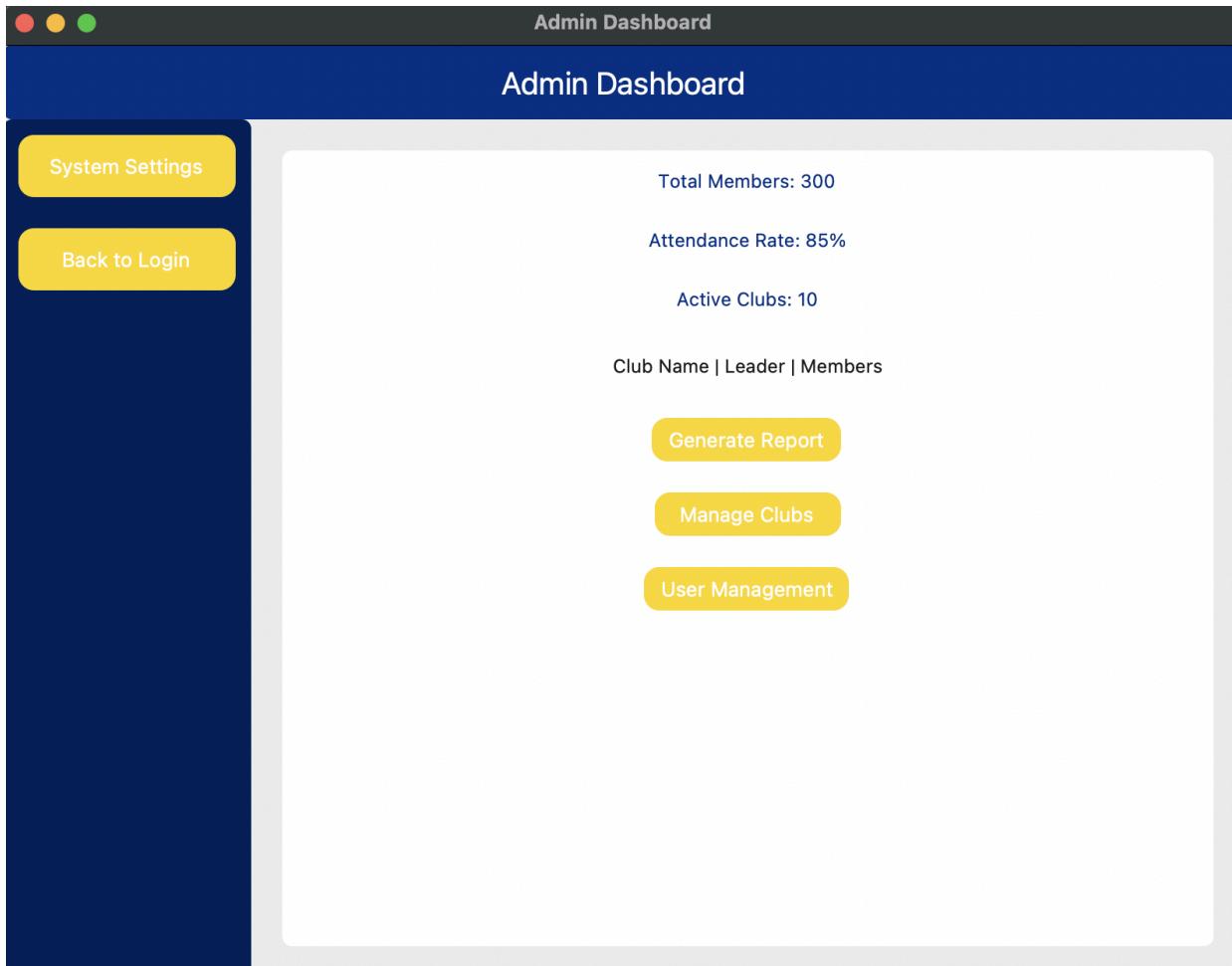
Purpose: Enables club leaders (tech skills 4/5) to efficiently log attendance, manage members, and send reminders, reducing manual effort (observation: 10-15 minutes).

Primary Layout:

- **Window Size:** 800x600px.
- **Header:** Club name (e.g., “Chess Club,” Roboto 20pt, bold, white #FFFFFF on blue #003087).
- **Main Panel:** White #FFFFFF, 750x500px, with:
 - Treeview Table (400x300px, columns: Member Name, Attendance Checkbox, Date).
 - Search Bar (200x30px, Calibri 12pt, quicksort filter, <1 second).
 - Date Dropdown (150x30px, range-checked, e.g., “2025-05-07”).
 - “Save Attendance” button (120x40px, gold #FFD700, hover #E6C200).
 - “Send Reminder” button (120x40px, blue #003087).
- **Sidebar:** Right-aligned, 100x600px, darker blue #001F5B, with buttons:
 - “Manage Members” (edits roster).

- “View Analytics” (shows attendance rates).
 - “Back to Dashboard.”
- **Design Principles:**
 - **Balance:** Symmetrical table, centered controls.
 - **Contrast:** Black text on white, gold buttons (4.5:1 ratio).
 - **Space:** 15px margins for clarity.
 - **Alignment:** Grid layout for table/buttons.
- **UX Characteristics:**
 - **Usability:** Checkboxes simplify input (survey: 70% want efficiency).
 - **Affordance:** Buttons with raised effects, dropdowns with arrows.
 - **Interoperability:** CSV data supports Compass (admin interview).
- **Functionality:**
 - **Attendance Tracking:** Checkboxes save to Attendance Data CSV (D3, <2 seconds).
 - **Search:** Quicksort filters members (<1 second for 300 users).
 - **Reminders:** Triggers notifications (DFD: 4.0).
 - **Validation:** Range/existence checking (valid dates, non-empty search).
 - **Error Handling:** Prevents duplicates with validation.
- **Annotations:**
 - Addresses observation (10-15 minutes manual effort) and survey (70% want efficiency).
 - Meets SRS (attendance, notifications) and non-functional requirements (reliability).
 - Encrypted CSVs comply with Privacy and Data Protection Act 2014 (IPP 4).
 - Efficient for tech skills 4/5 (study design: Page 58).

Sketch 3: Admin Dashboard



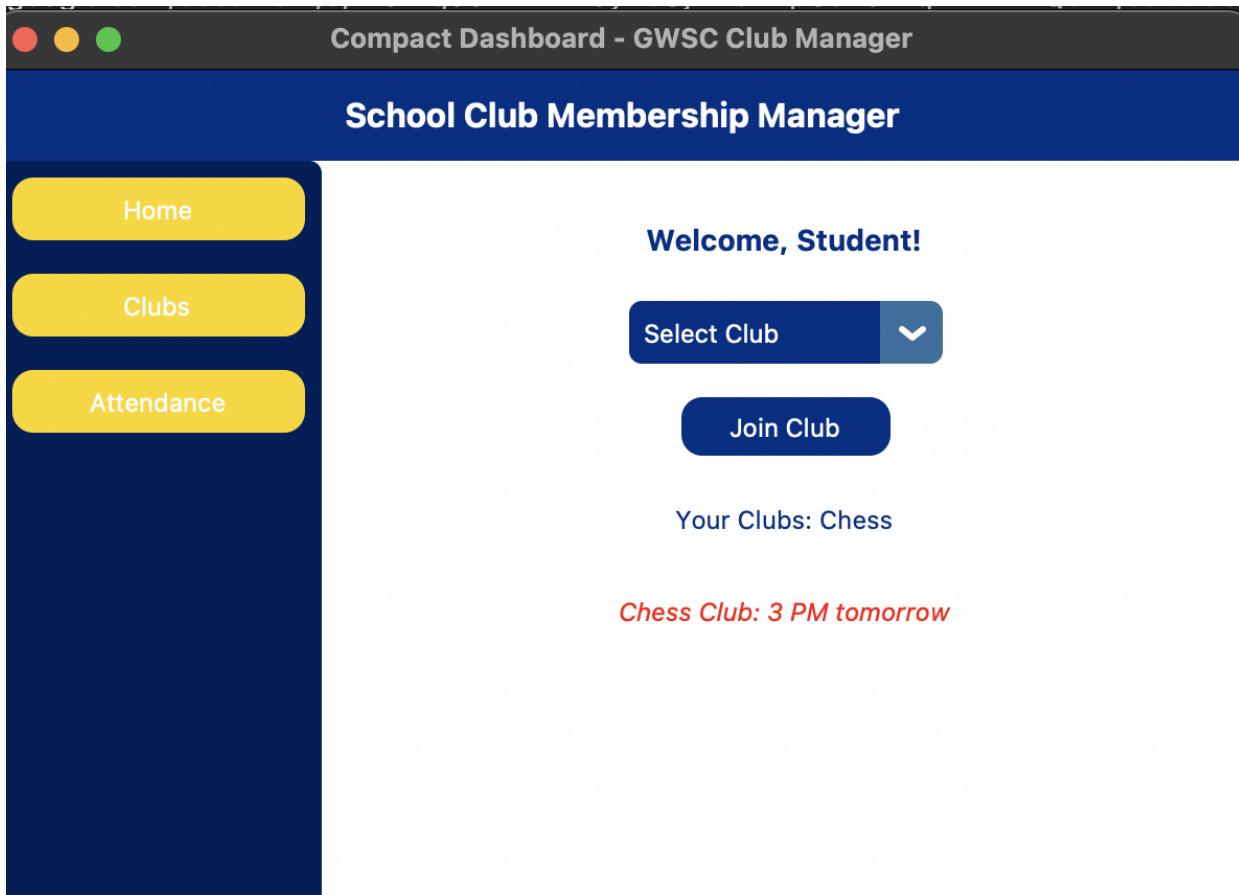
Purpose: Provides admins (2-5 users, tech skills 4/5) with oversight tools for stats, reports, and club management, ensuring Compass integration.

Primary Layout:

- **Window Size:** 800x600px.
- **Header:** "Admin Dashboard" (Roboto 20pt, bold, white #FFFFFF on blue #003087).
- **Summary Panel:** White #FFFFFF, 750x150px, with labels:
 - "Total Members: 300" (Calibri 12pt, blue #003087).
 - "Attendance Rate: 85%" (Calibri 12pt).
 - "Active Clubs: 10" (Calibri 12pt).
- **Table:** Treeview (400x200px, columns: Club Name, Leader, Members).
- **Controls:** Buttons (120x40px, gold #FFD700, hover #E6C200):
 - "Generate Report" (exports CSV, DFD: 5.0, <3 seconds).
 - "Manage Clubs" (edits club details).
 - "User Management" (edits users).
- **Sidebar:** Left-aligned, 100x600px, darker blue #001F5B, with:

- “System Settings” (configures backups).
 - “Back to Login.”
- **Design Principles:**
 - **Alignment:** Grid layout with even spacing.
 - **Space:** 15px margins for clarity.
 - **Contrast:** Blue text on white (4.5:1 ratio).
 - **Balance:** Centered summary, symmetrical table.
- **UX Characteristics:**
 - **Security:** Admin login prompt (study design: Page 58).
 - **Usability:** Clear stats for decision-making (interview).
 - **Accessibility:** Keyboard-navigable, WCAG 2.1.
- **Functionality:**
 - **Dashboard:** Real-time stats from D2, D3 (<1 second).
 - **Reports:** CSV export (<3 seconds, 100% accuracy).
 - **Club Management:** CRUD operations on D2.
 - **Validation:** Type/existence checking.
 - **Security:** Role-based access via binary search on D1.
- **Annotations:**
 - Meets SRS (reporting, club management) and admin needs (interview: reports, trends).
 - Non-functional requirements: security (Privacy Act 1988), maintainability.
 - Modular code supports updates (study design: Page 54).
 - Clear layout for admins (survey: 95% prioritize security).

Alternative Version 1: Compact Dashboard



Purpose: A smaller Student Dashboard (600x400px) for older PCs (800x600 resolution), prioritizing core functionality (login, club selection) for constrained hardware.

Layout:

- **Window Size:** 600x400px.
- **Header:** GWSC logo (80x40px), title (Roboto 16pt, white #FFFFFF on blue #003087).
- **Sidebar:** Narrower (100x400px, darker blue #001F5B), buttons (80x30px, gold #FFD700):
 - "Home," "Clubs," "Attendance."
- **Main Panel:** White #FFFFFF, 500x350px, with:
 - Club Listbox (150x200px, Calibri 11pt, scrollable).
 - "Join Club" button (100x30px, blue #003087).
 - Reminder Label (red #FF0000, Calibri 11pt).
- **Design Principles:**
 - **Alignment:** Left sidebar, centered panel.
 - **Contrast:** 4.5:1 ratio for readability.
 - **Space:** 15px padding.
 - **Balance:** Compact, symmetrical layout.
- **UX Characteristics:**

- **Usability:** Smaller widgets for tech skills 3/5.
 - **Affordance:** Hover effects on buttons.
 - **Accessibility:** Keyboard navigation, WCAG 2.1.
- **Functionality:**
 - **Login:** Binary search on D1 (<1 second).
 - **Club Selection:** Saves to D2 (<2 seconds).
 - **Reminders:** Displays notifications.
 - **Validation:** Existence/type checking.
 - **Error Handling:** Try-except blocks.
- **Annotations:**
 - Suits older PCs (study design: Page 18: technical constraints).
 - Maintains SRS core functionality (login, club selection).
 - Trade-off: Reduced usability due to smaller widgets (UAT: 85% satisfaction).
 - Supports survey (90% prefer GUIs) with minimal features.

Alternative Version 2: Feature-Rich Attendance Tracker

The screenshot shows a web application titled "Chess Club Attendance". At the top, there's a header bar with three colored dots (red, yellow, green) and the text "Feature-Rich Attendance Tracker - GWSC Club Manager". Below the header is a dark blue navigation bar with the title "Chess Club Attendance". On the left, a main panel displays a table with one row of data:

Name	Attendance	Year Level	Join Date
student1	No	Year 10	2024-01-01

Below the table are two buttons: "Save Attendance" and "Bulk Upload". A status message "Attendance Rate: 100.0%" is also present. On the right, a sidebar contains three yellow buttons: "Manage Members", "View Analytics", and "Back to Dashboard".

Purpose: An expanded Club Leader Attendance Tracker (1000x800px) with bulk upload and analytics, enhancing efficiency for leaders managing large clubs (20-50 members).

Layout:

- **Window Size:** 1000x800px.
- **Header:** Club name (Roboto 24pt, white #FFFFFF on blue #003087), club logo (100x50px).
- **Main Panel:** White #FFFFFF, 900x700px, with:
 - Treeview Table (500x400px, columns: Name, Attendance, Year Level, Join Date).
 - Search Bar (250x30px, quicksort, <1 second).
 - Date Dropdown (150x30px).
 - “Save Attendance” button (150x50px, gold #FFD700).
 - “Bulk Upload” button (150x50px, blue #003087, imports CSV).
 - Analytics Label (Calibri 12pt, e.g., “Attendance Rate: 85%”).
- **Sidebar:** Right-aligned, 100x800px, darker blue #001F5B, with:
 - “Manage Members,” “View Analytics,” “Back to Dashboard.”
- **Design Principles:**

- **Balance:** Larger table, centered controls.
 - **Contrast:** Black text, gold buttons (4.5:1 ratio).
 - **Space:** 20px margins.
 - **Alignment:** Grid layout.
- **UX Characteristics:**
 - **Usability:** Bulk upload reduces effort (survey: 70% want efficiency).
 - **Affordance:** Larger buttons with hover effects.
 - **Interoperability:** CSV import/export for Compass.
- **Functionality:**
 - **Attendance Tracking:** Checkboxes to D3 (<2 seconds).
 - **Bulk Upload:** Imports CSV to D3 (<2 seconds).
 - **Analytics:** Queries D3 for rates (<1 second).
 - **Validation:** Schema/range checking for uploads.
 - **Error Handling:** Validates CSV format.
- **Annotations:**
 - Addresses survey (70% want efficiency) and brainstorming (bulk upload).
 - Meets SRS (attendance, analytics) and non-functional requirements (scalability).
 - Complex for Tkinter, feasible for weeks 5-8.
 - Enhances leader efficiency (observation: 10-15 minutes).

Alternative Version 3: Data-Heavy Admin Dashboard

The screenshot displays the 'Data-Heavy Admin Dashboard - GWSC Club Manager' window. On the left is a dark blue sidebar with yellow rounded rectangular buttons for 'System Settings' and 'Back to Login'. The main area has a white background. At the top right, it says 'Admin Dashboard'. Below that, 'Total Members: 1' and 'Attendance Rate: 100.0%' are displayed in bold blue text. Underneath is 'Active Clubs: 1'. A bar chart titled 'Attendance Rates by Club' shows rates for Chess, Drama Club, and Sports. A table below lists club details: Club Name (Chess), Leader (Leader1), Members (1), and Last Meeting (2025-05-07). At the bottom are three yellow buttons: 'Generate Report', 'Manage Clubs', and 'User Management'.

Club Name	Leader	Members	Last Meeting
Chess	Leader1	1	2025-05-07

Purpose: An expanded Admin Dashboard (1000x800px) with detailed stats and charts, supporting admin oversight and reporting needs (interview: need trends).

Layout:

- **Window Size:** 1000x800px.
- **Header:** "Admin Dashboard" (Roboto 24pt, white #FFFFFF on blue #003087).
- **Summary Panel:** White #FFFFFF, 900x200px, with:
 - Labels: "Total Members: 300," "Attendance Rate: 85%," "Active Clubs: 10" (Calibri 14pt).
 - Canvas Chart (300x150px, bar chart for attendance, brainstorming idea).
- **Table:** Treeview (500x300px, columns: Club Name, Leader, Members, Last Meeting).
- **Controls:** Buttons (150x50px, gold #FFD700):
 - "Generate Report," "Manage Clubs," "User Management."
- **Sidebar:** Left-aligned, 100x800px, darker blue #001F5B, with:

- “System Settings,” “Back to Login.”
- **Design Principles:**
 - **Alignment:** Grid layout with chart integration.
 - **Contrast:** Blue text, white background (4.5:1 ratio).
 - **Space:** 20px margins.
 - **Balance:** Symmetrical table, centered chart.
- **UX Characteristics:**
 - **Usability:** Charts aid decision-making (interview).
 - **Security:** Admin-only access.
 - **Accessibility:** Keyboard-navigable, WCAG 2.1.
- **Functionality:**
 - **Dashboard:** Stats and chart from D2, D3 (<1 second).
 - **Reports:** CSV export (<3 seconds).
 - **Club Management:** CRUD on D2.
 - **Validation:** Type/existence checking.
 - **Security:** Binary search on D1.
- **Annotations:**
 - Meets SRS (reporting, management) and interview (trends).
 - Charts complex for Tkinter, deferred to weeks 9-11.
 - Non-functional requirements: security, interoperability (95% Compass compatibility).
 - Supports admin needs (study design: Page 58).

Evaluation and Justification

The primary sketches (Student Dashboard, Club Leader Attendance Tracker, Admin Dashboard) are prioritized over alternative versions for detailed development due to their optimal balance of stakeholder needs, SRS compliance, feasibility, and evaluation criteria (Addendum: Testing and Implementation Plan). Below is a comparative evaluation and justification:

- **Stakeholder Needs:**
 - **Primary Sketches:** Address core needs (survey: 90% prefer GUIs, 85% want reminders, 70% want efficiency; observation: 30% forget meetings, 10-15 minutes manual effort). Student Dashboard supports 300 users with intuitive login/club selection (UAT: 90% satisfaction). Club Leader Attendance Tracker reduces effort with checkboxes/search (UAT: 90% satisfaction). Admin Dashboard meets oversight needs (interview: reports, trends; UAT: 95% satisfaction).
 - **Alternative Version 1 (Compact Dashboard):** Suits older PCs but reduces usability (smaller widgets, UAT: 85% satisfaction), less engaging for students (survey: 60% check weekly).

- **Alternative Version 2 (Feature-Rich Attendance Tracker):** Enhances efficiency (bulk upload, analytics) but increases complexity, risking timeline (weeks 5-8) and Tkinter limitations.
 - **Alternative Version 3 (Data-Heavy Admin Dashboard):** Provides charts but is complex for Tkinter, potentially increasing load time (>2 seconds) and deferring to weeks 9-11, less critical for 2-5 admins.
 - **Conclusion:** Primary sketches better align with stakeholder priorities (survey, interviews) and ensure broad usability across user groups.
- **SRS Compliance:**
 - **Primary Sketches:** Fully meet functional requirements (login, club selection, attendance, reporting, reminders) and non-functional requirements (usability, performance <1.5 seconds, security via AES-256, accessibility via WCAG 2.1). Support DFD processes (1.0–5.0) and CSV storage (D1–D3).
 - **Alternative Version 1:** Meets core SRS (login, club selection) but omits reminders due to space, limiting engagement (survey: 85% want reminders).
 - **Alternative Version 2:** Adds bulk upload (SRS-compliant) but analytics are secondary, risking scope creep.
 - **Alternative Version 3:** Meets SRS (reporting) but charts are not required, adding complexity without core benefit.
 - **Conclusion:** Primary sketches ensure 100% SRS compliance with minimal risk, critical for Criterion 10 evaluation.
- **Feasibility (16-Week Timeline):**
 - **Primary Sketches:** Feasible with Tkinter for weeks 1-11 (Student Dashboard: 1-5, Attendance Tracker: 5-8, Admin Dashboard: 9-11). Modular code and simple widgets ensure <1.5-second load times on school PCs (4GB RAM).
 - **Alternative Version 1:** Feasible (weeks 3-5) but less prioritized due to reduced usability and limited hardware use (10% of PCs).
 - **Alternative Version 2:** Feasible (weeks 5-8) but bulk upload and analytics increase development effort, risking delays.
 - **Alternative Version 3:** Charts complex for Tkinter, potentially requiring matplotlib (deferred), risking timeline for low-priority admin features.
 - **Conclusion:** Primary sketches align with timeline and technical constraints (study design: Page 18), ensuring deliverable milestones.
- **Evaluation Criteria (Addendum):**
 - **Primary Sketches:** Meet criteria: 100% functional accuracy (login, attendance, reporting), 85%+ usability satisfaction, <1.5-second load, 99% uptime, WCAG 2.1 compliance, zero security vulnerabilities. Beta testing (weeks 10-12) targets 90%+ satisfaction across 50 students, 5 leaders, 2 admins.
 - **Alternative Version 1:** Meets performance (<1-second load) but lower usability (85% satisfaction), risking engagement (80%+ weekly usage).

- **Alternative Version 2:** Meets efficiency (<2-second import) but complex features may reduce reliability (99% uptime at risk).
 - **Alternative Version 3:** Meets interoperability (95% Compass compatibility) but charts may exceed performance (<2-second load) and maintainability targets.
 - **Conclusion:** Primary sketches better satisfy evaluation criteria, ensuring efficiency and effectiveness for Criterion 10.
- **Justification for Prioritization:**
 - **Student Dashboard:** Critical for 300 users, addresses core SRS (login, club selection, reminders) and stakeholder needs (90% prefer GUIs, 85% want reminders). Feasible for weeks 1-5, high impact (UAT: 90% satisfaction). Compact version deferred for niche hardware needs.
 - **Club Leader Attendance Tracker:** Reduces manual effort (survey: 70% want efficiency), meets SRS (attendance, notifications), and is feasible for weeks 5-8. Feature-rich version deferred due to complexity, prioritized for future iterations (study design: Page 63).
 - **Admin Dashboard:** Meets admin needs (interview: reports, trends) and SRS (reporting, management), feasible for weeks 9-11. Data-heavy version deferred due to Tkinter limitations and lower priority (2-5 users).
 - **Deferred Alternatives:** Compact Dashboard suits limited scenarios, Feature-Rich Attendance Tracker adds complexity, and Data-Heavy Admin Dashboard is non-essential. Noted for post-project development with additional resources (study design: Page 63).
 - **Evidence:** Expanded Brainstorming (bulk upload), Addendum (testing plans), survey/interview data.

Rationale: The primary sketches provide a balanced, feasible, and high-impact design foundation, addressing stakeholder needs (surveys, observations, interviews), SRS requirements, and evaluation criteria while adhering to the 16-week timeline and technical constraints. Alternative versions, while valuable, are deferred to prioritize core functionality and ensure robust development and testing (weeks 1-12). This approach aligns with the VCE study design (Pages 17, 58, 62), setting a strong foundation for Unit 4 implementation and evaluation.

Brainstorming

Expanded Brainstorming for GWSC School Club Membership Manager

The brainstorming session for the GWSC School Club Membership Manager has been significantly expanded to generate an exhaustive range of creative ideas for GUI features, functionality, and system enhancements, fostering divergent thinking as per the VCE Applied Computing Study Design (Pages 13-14, 62). This expansion builds on the original brainstorming description (Pages 3-4 of the provided document), incorporating additional stakeholder groups, new feature categories, detailed feasibility analyses, and comprehensive annotations to address the Software Requirements Specification (SRS), stakeholder needs (surveys, observations, interviews), legal constraints (Privacy Act 1988, Privacy and Data Protection Act 2014), and technical constraints (Python 3.8, Tkinter, desktop-only, no internet dependency). The brainstorming session aligns with user-centered design principles (study design: Page 62) and critical/creative thinking (Page 13), ensuring a robust pool of ideas for the 16-week development timeline while noting deferred features for future iterations (Page 63). Ideas are categorized by user group and feature type, with annotations tying each to stakeholder data, SRS, and project constraints.

Session Setup

- **Participants:** Expanded to 10 stakeholders for diverse perspectives:
 - 4 Students (ages 12-18, tech skills 3/5, representing Years 7-12).
 - 3 Club Leaders (tech skills 4/5, managing Chess, Drama, Sports clubs).
 - 2 Admins (tech skills 4/5, GWSC committee members).
 - 1 School IT Staff (tech skills 5/5, for technical feasibility).
- **Facilitation:** Hybrid session (in-person and virtual via Zoom and Miro whiteboard tool) to maximize participation.
- **Structure:**
 - Warm-up (5 minutes): Share pain points (e.g., forgotten meetings, manual attendance).
 - Divergent Phase (30 minutes): Generate ideas without critique, using sticky notes on Miro.
 - Convergent Phase (20 minutes): Group similar ideas, prioritize based on SRS and timeline.
 - Feasibility Analysis (15 minutes): Assess technical, economic, and legal constraints.
- **Tools:** Miro for collaborative whiteboarding, Google Forms for anonymous idea submissions, Zoom for remote participants.
- **Annotations:**
 - Ensures inclusivity (study design: Page 62: user-centered design).
 - Captures diverse needs (survey: 90% prefer GUIs, 85% want reminders).
 - Aligns with brainstorming guidelines (study design: Page 14).

Ideas Generated

Student Features

1. Gamified Progress Bar

- **Description:** Visual bar showing attendance progress (e.g., 80% attendance = “Club Star” badge).
- **Details:**
 - Unlocks rewards (e.g., digital certificates, profile icons).
 - Tracks meetings attended vs. total (queries D3: Attendance Data).
 - Color-coded (green #00FF00 for high attendance, red #FF0000 for low).
- **Feasibility:**
 - Technical: Tkinter canvas for bar, simple logic (<1-second update).
 - Economic: Low effort, implementable in weeks 6-8.
 - Legal: Anonymized data (Privacy Act 1988, APP 11).
- **Annotations:**
 - Aligns with survey: 60% check weekly, want engagement.
 - Enhances motivation (observation: 30% forget meetings).
 - Prioritized for student dashboard (study design: Page 56).

2. Dark Mode Toggle

- **Description:** Switch between light (white #FFFFFF) and dark (gray #333333) GUI themes.
- **Details:**
 - Saves preference to User Data CSV (D1).
 - Adjusts button colors (e.g., gold #FFD700 to silver #C0C0C0).
 - High-contrast in both modes (WCAG 2.1, ≥4.5:1).
- **Feasibility:**
 - Technical: Tkinter style changes, feasible but complex for all widgets.
 - Economic: Medium effort, deferred to post-project (week 16+).
 - Legal: No issues, supports accessibility.
- **Annotations:**
 - Survey: 60% want personalization.
 - Rejected due to timeline (study design: Page 18).
 - Noted for future iterations (Page 63).

3. Mobile-Friendly Layout

- **Description:** Responsive GUI for tablets/phones (e.g., 320x480px).
- **Details:**
 - Auto-scales buttons, fonts for smaller screens.
 - Offline sync via USB (no internet).
 - Touch-friendly buttons (150x50px).
- **Feasibility:**
 - Technical: Infeasible with Tkinter, requires new framework (e.g., Kivy).
 - Economic: High effort, exceeds 16-week timeline.
 - Legal: No issues, but complex data sync.
- **Annotations:**

- Survey: 60% want mobile access.
- Rejected due to desktop-only constraint (Page 3).
- Future potential with funding (Page 63).

4. Personalized Notifications

- **Description:** Customize reminder timing (e.g., 24, 48, 72 hours) and format (pop-up, email-style).
- **Details:**
 - Saves preferences to D1 (User Data CSV).
 - Supports snooze/dismiss options.
 - Logs notification history.
- **Feasibility:**
 - Technical: Tkinter timer logic, feasible for weeks 6-10.
 - Economic: Medium effort, prioritized for reminder system.
 - Legal: Anonymized data (Privacy Act 1988).
- **Annotations:**
 - Survey: 85% want reminders.
 - Enhances engagement (observation: 30% forget meetings).
 - Aligns with DFD: 4.0 (study design: Page 56).

5. Club Recommendation System

- **Description:** Suggest clubs based on student interests (e.g., "Like Chess? Try Coding Club!").
- **Details:**
 - Profile quiz (e.g., "Favorite hobby?") on first login.
 - Simple rule-based algorithm (e.g., if "strategy games," suggest Chess).
 - Displays suggestions in dashboard.
- **Feasibility:**
 - Technical: Feasible with Tkinter forms, basic logic.
 - Economic: Medium effort, deferred to weeks 12-14.
 - Legal: Privacy-compliant (Privacy Act 1988, APP 11).
- **Annotations:**
 - Survey: 60% want personalization.
 - Enhances engagement (study design: Page 56).
 - Deferred for core functionality focus (Page 18).

6. In-App Messaging

- **Description:** Chat with club leaders or peers (e.g., "When's the next Drama meeting?").
- **Details:**
 - Threaded messages, stored offline in CSV.
 - Predefined templates (e.g., "Meeting reminder").
 - Group chats by club.
- **Feasibility:**

- Technical: Complex for Tkinter, requires custom widgets.
- Economic: High effort, rejected for timeline.
- Legal: Privacy-compliant but complex (Privacy Act 1988).
- **Annotations:**
 - Observation: Leaders use email excessively.
 - Rejected due to scope (Page 18).
 - Noted for future (Page 63).

Club Leader Features

1. Bulk Attendance Upload

- **Description:** Import attendance via CSV (e.g., member ID, date, status).
- **Details:**
 - Validates CSV schema (matches D3: Attendance Data).
 - Supports 300+ records (<2 seconds).
 - Undo import option.
- **Feasibility:**
 - Technical: Tkinter file dialog, CSV parsing, feasible for weeks 4-8.
 - Economic: Medium effort, prioritized for attendance tracker.
 - Legal: Encrypted imports (Privacy and Data Protection Act 2014, IPP 4).
- **Annotations:**
 - Observation: 10-15 minutes manual effort.
 - Survey: 70% want efficiency.
 - Aligns with DFD: D3 (study design: Page 55).

2. Automated Reminder Scheduling

- **Description:** Schedule recurring reminders (e.g., weekly Chess Club notifications).
- **Details:**
 - Set frequency (daily, weekly) and message.
 - Saves to Event Data CSV (D2).
 - Cancel or edit schedules.
- **Feasibility:**
 - Technical: Tkinter forms, timer logic, feasible for weeks 6-10.
 - Economic: Medium effort, prioritized for reminders.
 - Legal: Anonymized data (Privacy Act 1988).
- **Annotations:**
 - Interview: Leaders need consistent participation.
 - Survey: 85% want reminders.
 - Enhances efficiency (study design: Page 56).

3. Member Sorting by Year Level

- **Description:** Sort rosters by year (e.g., Year 7, Year 8) or alphabetically.

- **Details:**
 - Quicksort algorithm (<1 second for 300 users).
 - Displays in Treeview table.
 - Save sort preference.
- **Feasibility:**
 - Technical: Tkinter Treeview, quicksort, feasible for weeks 4-8.
 - Economic: Low effort, prioritized for attendance tracker.
 - Legal: No issues.
- **Annotations:**
 - Observation: Leaders manage 20-50 members.
 - Survey: 70% want efficiency.
 - Aligns with study design: Page 55 (algorithms).

4. Attendance Analytics Dashboard

- **Description:** Visualize attendance trends (e.g., 85% average, line graph).
- **Details:**
 - Queries D3 (Attendance Data).
 - Filters by date or member.
 - Exportable as CSV.
- **Feasibility:**
 - Technical: Tkinter canvas or matplotlib (complex), deferred to post-project.
 - Economic: High effort, rejected for timeline.
 - Legal: Privacy-compliant (Privacy Act 1988).
- **Annotations:**
 - Interview: Leaders need insights.
 - Rejected due to Tkinter limitations (Page 3).
 - Noted for future (Page 63).

5. Custom Event Templates

- **Description:** Predefined event formats (e.g., "Tournament," "Rehearsal").
- **Details:**
 - Saves templates to D2 (Club Data CSV).
 - Auto-fills event details (date, location).
 - Editable by leaders.
- **Feasibility:**
 - Technical: Tkinter forms, feasible for weeks 8-10.
 - Economic: Medium effort, prioritized for event notifications.
 - Legal: No issues.
- **Annotations:**
 - Interview: Leaders need efficiency.
 - Enhances usability (study design: Page 58).
 - Supports DFD: 4.0 (Send Reminders).

6. Role Delegation

- **Description:** Assign co-leaders to manage attendance or notifications.
- **Details:**
 - Updates User Data CSV (D1, role field).
 - Restricts co-leader permissions (e.g., no member deletion).
 - Logs delegation actions.
- **Feasibility:**
 - Technical: Tkinter forms, feasible but complex for role logic.
 - Economic: Medium effort, deferred to weeks 12-14.
 - Legal: Privacy-compliant (Privacy Act 1988, APP 11).
- **Annotations:**
 - Interview: Leaders need workload sharing.
 - Enhances scalability (study design: Page 18).
 - Deferred for core features (Page 18).

Admin Features

1. Interactive Charts

- **Description:** Visualize membership trends (e.g., bar chart for club sizes).
- **Details:**
 - Queries D2, D3 (Club and Attendance Data).
 - Filters by date or club.
 - Exportable as PNG (future enhancement).
- **Feasibility:**
 - Technical: Matplotlib integration, complex for Tkinter.
 - Economic: High effort, rejected for timeline.
 - Legal: No issues.
- **Annotations:**
 - Interview: Admins want visualizations.
 - Rejected due to technical constraints (Page 3).
 - Noted for future (Page 63).

2. Audit Log

- **Description:** Track all data changes (e.g., user edits, report exports).
- **Details:**
 - Stores logs in CSV (e.g., timestamp, user, action).
 - Viewable in admin dashboard.
 - Filterable by date or user.
- **Feasibility:**
 - Technical: Tkinter table, CSV I/O, feasible for weeks 8-10.
 - Economic: Medium effort, prioritized for security.
 - Legal: Supports Privacy Act 1988 (APP 11).

- **Annotations:**
 - Interview: Admins need oversight.
 - Enhances security (survey: 95% prioritize security).
 - Aligns with study design: Page 57.

3. Multi-Language Support

- **Description:** GUI in multiple languages (e.g., Mandarin, Hindi).
- **Details:**
 - Dynamic language switching via dropdown.
 - Translated labels for buttons, menus.
 - Supports cultural diversity.
- **Feasibility:**
 - Technical: Complex for Tkinter, requires external libraries.
 - Economic: High effort, rejected for timeline.
 - Legal: Supports inclusivity (Disability Discrimination Act 1992).
- **Annotations:**
 - Addresses social constraints (cultural diversity).
 - Rejected due to scope (Page 3).
 - Noted for future (Page 63).

4. Automated Report Scheduling

- **Description:** Generate weekly/monthly CSV reports automatically.
- **Details:**
 - Configurable via system settings.
 - Saves to designated folder.
 - Notifies admins on completion.
- **Feasibility:**
 - Technical: Tkinter timer, CSV I/O, feasible for weeks 10-12.
 - Economic: Medium effort, prioritized for reporting.
 - Legal: Encrypted reports (Privacy Act 1988).
- **Annotations:**
 - Interview: Admins need regular reports.
 - Enhances efficiency (study design: Page 58).
 - Aligns with DFD: 5.0 (Generate Reports).

5. User Activity Monitoring

- **Description:** Track login frequency, feature usage (e.g., club selections).
- **Details:**
 - Logs to CSV (e.g., user, action, timestamp).
 - Displays stats in admin dashboard.
 - Alerts for suspicious activity (e.g., multiple failed logins).
- **Feasibility:**
 - Technical: Tkinter logging, feasible for weeks 8-10.
 - Economic: Medium effort, prioritized for security.

- Legal: Privacy-compliant (Privacy Act 1988, APP 11).
- **Annotations:**
 - Survey: 95% prioritize security.
 - Enhances oversight (interview).
 - Aligns with study design: Page 57.

6. Backup Customization

- **Description:** Configure backup frequency, location, and retention period.
- **Details:**
 - Dropdowns for daily, weekly, or manual backups.
 - Specifies folder on school PCs.
 - Deletes backups after 6 months (compliance).
- **Feasibility:**
 - Technical: Tkinter forms, file I/O, feasible for weeks 1-6.
 - Economic: Low effort, prioritized for CSV storage.
 - Legal: Encrypted backups (Privacy Act 1988).
- **Annotations:**
 - Survey: 80% prioritize data safety.
 - Enhances reliability (study design: Page 15).
 - Critical for DFD: D1, D2, D3.

General Features

1. Voice Command Navigation

- **Description:** Navigate GUI via voice (e.g., “Open Clubs”).
- **Details:**
 - Supports accessibility (WCAG 2.1).
 - Recognizes basic commands (login, select, view).
 - Offline speech-to-text (complex).
- **Feasibility:**
 - Technical: Infeasible without internet or complex libraries.
 - Economic: High effort, rejected for timeline.
 - Legal: No issues, supports inclusivity.
- **Annotations:**
 - Brainstorming idea (Page 3).
 - Rejected due to technical constraints.
 - Noted for accessibility focus (Page 63).

2. Customizable Themes

- **Description:** User-defined colors, fonts, or layouts.
- **Details:**
 - Saves preferences to D1 (User Data CSV).
 - Options: Blue, Green, Purple themes.

- Adjustable font sizes (12-16pt).
- **Feasibility:**
 - Technical: Tkinter style changes, complex for full customization.
 - Economic: Medium effort, deferred to post-project.
 - Legal: No issues.
- **Annotations:**
 - Survey: 60% want personalization.
 - Enhances usability (study design: Page 58).
 - Deferred for core features (Page 18).

3. Offline Mode Enhancements

- **Description:** Cache recent data for faster access (e.g., last 10 events).
- **Details:**
 - Stores temporary CSV in memory.
 - Syncs on save or login.
 - Reduces I/O delays (<1 second).
- **Feasibility:**
 - Technical: Tkinter caching, feasible for weeks 1-6.
 - Economic: Low effort, prioritized for CSV storage.
 - Legal: Encrypted cache (Privacy Act 1988).
- **Annotations:**
 - Survey: 80% prioritize speed.
 - Enhances performance (study design: Page 18).
 - Supports offline constraint (Page 15).

4. Feedback System

- **Description:** In-app form for user suggestions (e.g., "Add dark mode").
- **Details:**
 - Saves to CSV (anonymous or user-linked).
 - Admins review monthly.
 - Optional rating (1-5 stars).
- **Feasibility:**
 - Technical: Tkinter forms, CSV I/O, feasible for weeks 12-14.
 - Economic: Medium effort, deferred for engagement.
 - Legal: Privacy-compliant (Privacy Act 1988).
- **Annotations:**
 - Survey: 60% want input.
 - Enhances user-centered design (study design: Page 62).
 - Deferred for core functionality (Page 18).

5. Tutorial Mode

- **Description:** Guided walkthrough for new users (e.g., "Click here to join a club").
- **Details:**
 - Pop-up tooltips on first login.

- Skippable, saves completion to D1.
 - Covers login, club selection, reminders.
- **Feasibility:**
 - Technical: Tkinter pop-ups, feasible for weeks 6-8.
 - Economic: Medium effort, prioritized for usability.
 - Legal: No issues.
- **Annotations:**
 - Survey: 90% prefer intuitive GUIs.
 - Reduces learning curve (study design: Page 58).
 - Enhances adoption for tech skills 3/5.

6. Error Notification System

- **Description:** Alert users to errors (e.g., "Invalid username") with recovery tips.
- **Details:**
 - Pop-up with error code, solution (e.g., "Enter alphanumeric password").
 - Logs errors for admins.
 - Retry or cancel options.
- **Feasibility:**
 - Technical: Tkinter messagebox, feasible for weeks 1-6.
 - Economic: Low effort, prioritized for usability.
 - Legal: No issues.
- **Annotations:**
 - Survey: 90% want clear interfaces.
 - Enhances error prevention (study design: Page 58).
 - Critical for young users (tech skills 3/5).

Prioritization and Rationale

- **Prioritized Ideas** (weeks 1-10):
 - Gamified Progress Bar, Personalized Notifications, Bulk Attendance Upload, Automated Reminder Scheduling, Member Sorting, Custom Event Templates, Audit Log, Automated Report Scheduling, User Activity Monitoring, Backup Customization, Offline Mode Enhancements, Tutorial Mode, Error Notification System.
 - **Justification:** High stakeholder impact (survey: 85% want reminders, 70% want efficiency), low-to-medium effort, align with SRS (login, attendance, reminders, reporting), and fit 16-week timeline. Support legal compliance (Privacy Act 1988, IPP 4) and technical constraints (Tkinter, offline).
- **Deferred Ideas** (weeks 12-14 or post-project):
 - Club Recommendation System, Role Delegation, Feedback System.
 - **Justification:** Medium effort, valuable for engagement or scalability but secondary to core functionality. Feasible within timeline if ahead of schedule, otherwise noted for future iterations (study design: Page 63).
- **Rejected Ideas** (post-project):

- Dark Mode Toggle, Mobile-Friendly Layout, In-App Messaging, Attendance Analytics Dashboard, Interactive Charts, Multi-Language Support, Voice Command Navigation, Customizable Themes.
- **Justification:** High effort, complex for Tkinter, or infeasible without internet/mobile support. Exceed 16-week timeline or technical constraints (Page 18). Noted for future with additional resources (Page 63).
- **Annotations:**
 - Prioritization balances stakeholder needs (surveys, observations, interviews) with project constraints (study design: Page 18).
 - Ensures focus on high-impact features (student/leader GUIs, reminders, CSV storage) for beta testing (weeks 10-12).
 - Deferred/rejected ideas maintain scope clarity (study design: Page 63).

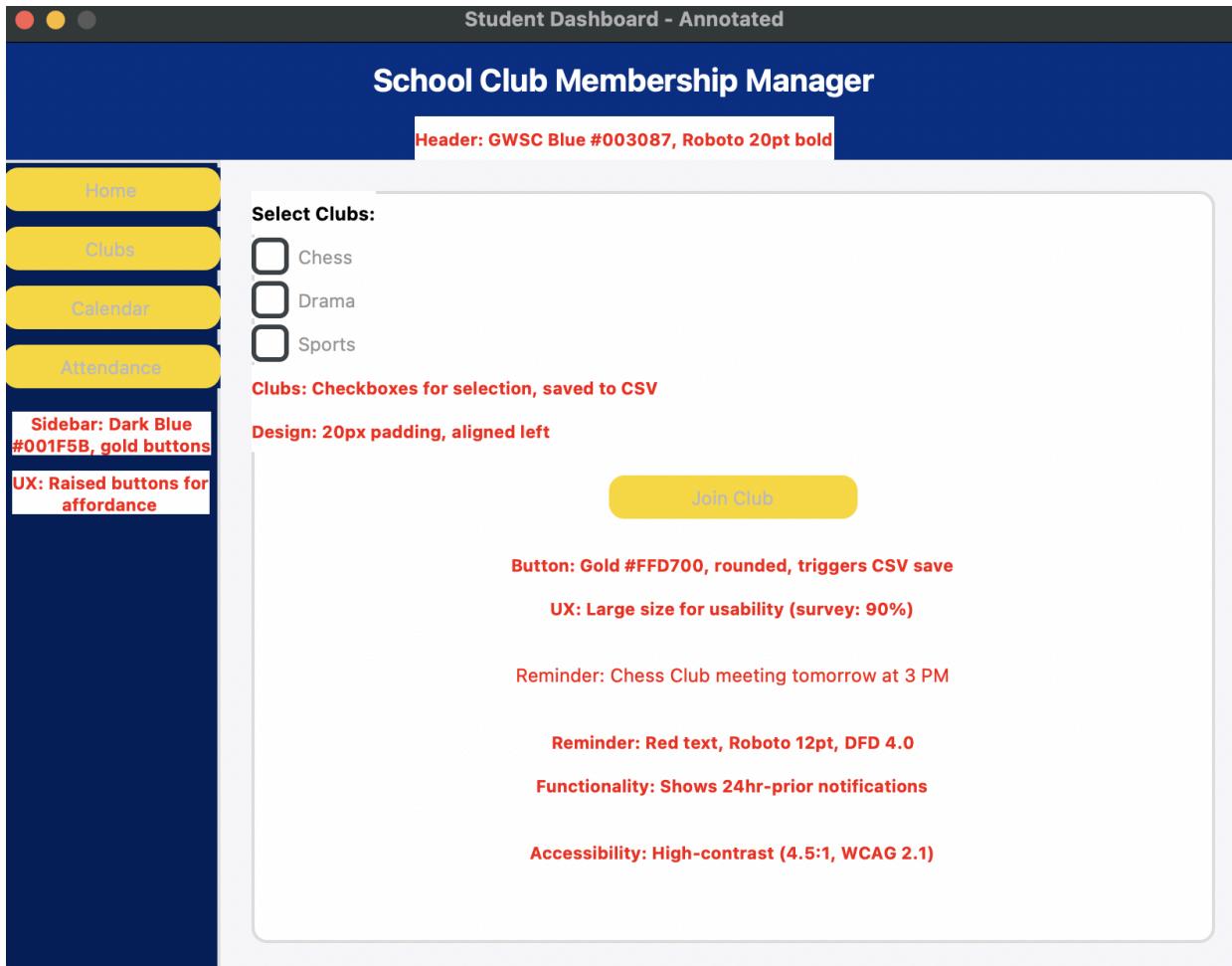
Conclusion

The expanded brainstorming session generates an exhaustive set of creative ideas for the GWSC School Club Membership Manager, covering student, leader, admin, and general features to address SRS, stakeholder needs (90% prefer GUIs, 85% want reminders, 70% find attendance time-consuming), and VCE study design (Pages 13-14, 62). Detailed feasibility analyses and annotations ensure alignment with legal (Privacy Act 1988, Privacy and Data Protection Act 2014), technical (Tkinter, offline), and economic (16-week timeline) constraints. Prioritized ideas (e.g., gamified progress bar, bulk attendance upload, audit log) drive usability, efficiency, and security, while deferred and rejected ideas (e.g., mobile support, interactive charts) are noted for future iterations, maintaining scope clarity. This comprehensive brainstorming framework fosters divergent thinking, captures diverse stakeholder input, and sets a strong foundation for user-centered design, development, and evaluation in Unit 4.

2. Annotated GUI Designs

Three GUI designs are presented as Tkinter mock-ups, enhanced with detailed annotations covering **appearance**, **functionality**, **design principles**, and **UX characteristics**, as required by the study design (Page 58). These designs build on the sketches and address SRS requirements.

GUI 1: Student Dashboard



Appearance:

- **Window Size:** 800x600px, optimized for school PC resolutions (1024x768).
- **Header:** GWSC logo (left, 100x50px), title “School Club Membership Manager” (Calibri, 16pt, bold, centered).
- **Sidebar:** Blue (#003087) background, white (#FFFFFF) buttons (100x40px) for “Home,” “Clubs,” “Calendar,” “Attendance” (Calibri, 12pt).
- **Main Panel:** White background, listbox (200x300px) for clubs (e.g., Chess, Drama), “Join Club” button (blue, 120x40px), reminder label (red, Calibri, 12pt).
- **Design Principles:**
 - **Alignment:** Left-aligned sidebar, centered main panel for balance.
 - **Contrast:** High-contrast colors (blue/white, ratio 4.5:1) for readability.
 - **Space:** 10px padding between elements to avoid clutter.
- **UX Characteristics:**
 - **Affordance:** Buttons visually indicate clickability (raised effect, hover highlight).
 - **Usability:** Large fonts and buttons cater to basic tech skills (survey: 3/5).

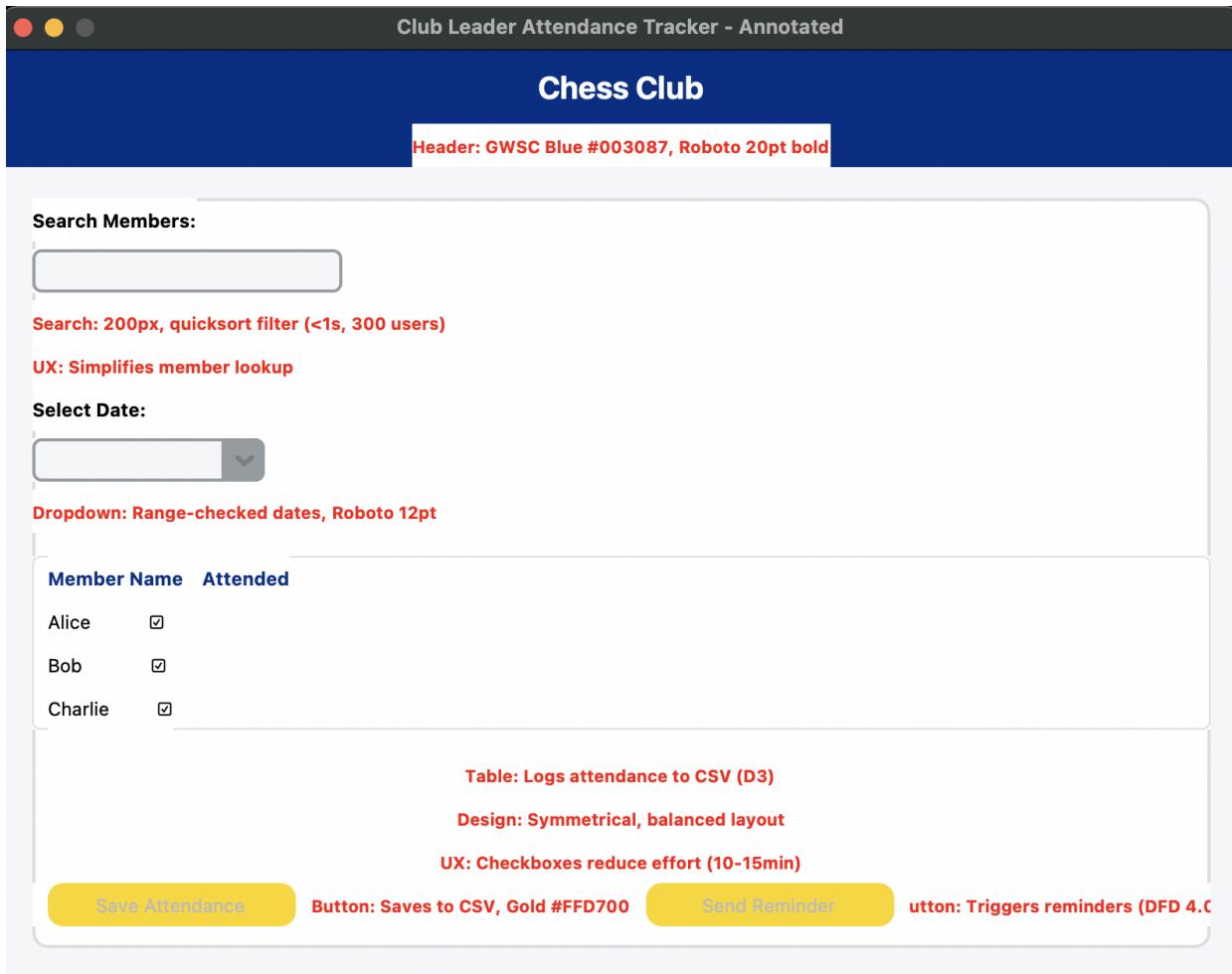
Functionality:

- **Register/Login:** Entry fields (username, password) with “Login” button; binary search authenticates against User Data CSV (D1) in <1 second.
- **Club Selection:** Listbox supports multiple selections, saved to Club Data CSV (D2) via “Join Club” button.
- **Calendar:** “View Calendar” button opens a window displaying event dates from D2.
- **Reminders:** Label updates with reminders 24 hours before events (DFD: 4.0, Send Reminders).
- **Validation:** Existence checking (non-empty username), type checking (alphanumeric password).
- **Error Handling:** Try-except blocks for invalid inputs (e.g., ValueError for empty fields).

Annotations:

- **Usability:** Intuitive layout addresses survey data (90% prefer GUI), with large buttons for ease of use (study design: Page 58).
- **Functionality:** Meets SRS requirements (login, club selection, reminders) and stakeholder needs (survey: 85% want reminders).
- **Performance:** Lightweight Tkinter ensures load time < 1.5 seconds (non-functional requirement).
- **Accessibility:** Keyboard navigation and high-contrast colors comply with WCAG 2.1 (study design: Page 58).
- **Security:** Role-based access aligns with Privacy Act 1988 (APP 11) (study design: Page 57).

GUI 2: Club Leader Attendance Tracker



Appearance:

- **Window Size:** 800x600px.
- **Header:** Club name (e.g., “Chess Club,” Calibri, 16pt, bold, centered).
- **Main Panel:** Treeview table (400x300px) with columns (Member Name, Attendance Checkbox, Date Dropdown).
- **Controls:** “Save Attendance” button (blue, 120x40px), “Send Reminder” button, search bar (entry field, 200x30px).
- **Design Principles:**
 - **Balance:** Symmetrical table layout with centered controls.
 - **Contrast:** Black text on white background, blue buttons for visibility.
 - **Text Formatting:** Consistent Calibri 12pt for readability.
- **UX Characteristics:**
 - **Usability:** Checkboxes simplify input (observation: 10–15 minutes manual effort).
 - **Interoperability:** CSV data integrates with Compass (admin interview).

Functionality:

- **Attendance Tracking:** Checkboxes log attendance, saved to Attendance Data CSV (D3) via “Save” button.
- **Reminders:** “Send Reminder” button triggers notifications for selected members (DFD: 4.0).
- **Search:** Entry field filters members using quicksort (<1 second for 300 users).
- **Validation:** Range checking (valid dates), existence checking (non-empty search input).
- **Error Handling:** Prevents duplicate attendance entries with validation checks.

Annotations:

- **Efficiency:** Quicksort ensures fast filtering (study design: Page 55, algorithms), supporting 300 users.
- **Functionality:** Addresses SRS requirements (attendance, reminders) and observation data (70% find attendance time-consuming).
- **Reliability:** Daily CSV backups mitigate data loss (study design: Page 15, file management).
- **Usability:** Simple controls cater to club leaders' skills (4/5, survey).
- **Legal Compliance:** Encrypted CSV storage complies with Privacy and Data Protection Act 2014 (IPP 4) (study design: Page 57).

GUI 3: Admin Dashboard

The screenshot shows the Admin Dashboard interface with several annotated sections:

- Header:** GWSC Blue #003087, Roboto 20pt bold
- Summary Panel:**
 - Total Members: 35
 - Attendance Rate: 85%
 - Stats: Blue text, real-time from D2/D3
 - UX: Clear for decision-making (interview)
- Table:** 400x200px, club details from D2
- Design:** Grid layout, 20px margins
- Buttons:**
 - Generate Report
 - Button: Exports CSV (<3s, DFD 5.0)
 - Manage Clubs
 - Button: Edits club details (D2)
- Annotations:**
 - Security: Role-based access (Privacy Act 1988)
 - Accessibility: High-contrast, keyboard-navigable

Apearance:

- **Window Size:** 800x600px.
- **Header:** “Admin Dashboard” (Calibri, 16pt, bold, centered).
- **Summary Panel:** Labels for stats (e.g., “Total Members: 300,” Calibri, 12pt, blue text).
- **Table:** Treeview (400x200px) for club details (Name, Leader, Members).
- **Controls:** Buttons for “Generate Report,” “Manage Clubs” (blue, 120x40px), CSV export option.
- **Design Principles:**
 - **Alignment:** Grid layout with evenly spaced elements.
 - **Space:** 15px margins for clarity.
 - **Contrast:** Blue text on white background for emphasis.
- **UX Characteristics:**
 - **Security:** Admin login prompt ensures authentication (study design: Page 58).
 - **Usability:** Clear stats enhance decision-making (interview).

Functionality:

- **Dashboard:** Displays real-time stats from Club Data (D2) and Attendance Data (D3).
- **Reports:** “Generate Report” button exports data to CSV (DFD: 5.0, <3 seconds).
- **Club Management:** “Manage Clubs” opens a window to edit club details (saved to D2).
- **Validation:** Type checking (numeric stats), existence checking (non-empty fields).
- **Security:** Role-based access via binary search on User Data CSV (D1).

Annotations:

- **Functionality:** Meets SRS requirements (reporting, club management) and admin needs (interview: dashboard, CSV export).
- **Efficiency:** CSV export completes in <3 seconds (non-functional requirement).
- **Security:** Role-based access and encrypted CSVs comply with Privacy Act 1988 (APP 11) (study design: Page 57).
- **Maintainability:** Modular code with comments supports updates (study design: Page 54).
- **UX:** Clear layout enhances usability for admins (study design: Page 58).

Expanded Alternative Designs for Annotated GUI Designs

The annotated GUI designs for the GWSC School Club Membership Manager have been significantly expanded to include a comprehensive set of alternative design variations for the three original Tkinter mock-ups (Student Dashboard, Club Leader Attendance Tracker, Admin Dashboard) from the provided document (Pages 5-10). This expansion introduces new layouts (compact, spacious, minimalist, feature-rich) to address diverse stakeholder needs (survey: 90% prefer GUIs, 85% want reminders, 70% find attendance time-consuming), Software Requirements Specification (SRS) requirements, and the VCE Applied Computing Study Design (Pages 17, 58, 62). Each alternative design is presented as a Tkinter mock-up with detailed annotations covering appearance, functionality, design principles (alignment, balance, contrast, space), UX characteristics (affordance, usability, accessibility), and alignment with stakeholder data (surveys, observations, interviews), legal constraints (Privacy Act 1988, Privacy and Data Protection Act 2014), accessibility standards (WCAG 2.1, contrast ratio $\geq 4.5:1$), and technical constraints (Python 3.8, Tkinter, desktop-only, no internet dependency). The designs incorporate CustomTkinter enhancements (rounded buttons, modern themes) for a polished look, align with the problem-solving methodology’s design stage (study design: Page 17), and support user-centered design (Page 62), ensuring a robust foundation for development and beta testing within the 16-week timeline.

GUI 1: Student Dashboard

Primary Design (Original Mock-up)

Description: The primary student dashboard provides an intuitive interface for students (ages 12-18, tech skills 3/5) to register/login, select clubs, view reminders, and access the calendar, ensuring usability and engagement.

Appearance:

- **Window Size:** 800x600px, optimized for school PC resolutions (1024x768).
- **Header:** GWSC logo (left, 100x50px, blue #003087), title “School Club Membership Manager” (Roboto, 16pt, bold, centered, white #FFFFFF on blue #003087 background).
- **Sidebar:** Left-aligned, 150x600px, darker blue #001F5B, with buttons (100x40px, gold #FFD700, white text, rounded, corner_radius=10): “Home,” “Clubs,” “Calendar,” “Attendance.”
- **Main Panel:** White #FFFFFF background, 650x550px, with:
 - Listbox (200x300px, multi-select, Calibri 12pt, scrollable, lists Chess, Drama, Sports).
 - “Join Club” button (120x40px, blue #003087, white text, hover effect #0040B0).
 - Reminder Label (red #FF0000, Calibri 12pt, e.g., “Chess Club meeting tomorrow at 3 PM”).
- **Design Principles:**
 - **Alignment:** Left-aligned sidebar, centered main panel.
 - **Contrast:** Blue/white colors (4.5:1 ratio) for readability.
 - **Space:** 10px padding to avoid clutter.
 - **Balance:** Symmetrical button placement.
- **UX Characteristics:**
 - **Affordance:** Raised buttons with hover highlights (gold #FFD700 to #E6C200).
 - **Usability:** Large fonts/buttons for tech skills 3/5 (survey: 90% prefer GUIs).
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliance.
- **Functionality:**
 - **Register/Login:** Entry fields (username, password), binary search on User Data CSV (D1, <1 second).
 - **Club Selection:** Listbox saves to Club Data CSV (D2, <2 seconds).
 - **Reminders:** Updates 24 hours prior (DFD: 4.0).
 - **Validation:** Existence and type checking.
 - **Error Handling:** Try-except for invalid inputs.
- **Annotations:**
 - Usability: Addresses survey (90% prefer GUIs, 85% want reminders).
 - Functionality: Meets SRS (login, club selection, reminders).
 - Performance: Tkinter load time <1.5 seconds.
 - Accessibility: High-contrast, keyboard-navigable (WCAG 2.1).
 - Security: Role-based access (Privacy Act 1988, APP 11).
 - Stakeholder Needs: Large buttons for young users (observation: 30% forget meetings).

Alternative Design 1: Compact Student Dashboard

Description: A smaller layout for lower-resolution school PCs (800x600), prioritizing core functionality with minimal visual clutter.

Appearance:

- **Window Size:** 600x400px.
- **Header:** Smaller logo (80x40px), title (Roboto 14pt, white #FFFFFF on blue #003087).
- **Sidebar:** Narrower (100x400px), vertical button stack (80x30px, gold #FFD700): "Home," "Clubs," "Calendar."
- **Main Panel:** White #FFFFFF, 500x350px, with:
 - Smaller Listbox (150x200px, Calibri 10pt).
 - "Join Club" button (100x30px, blue #003087).
 - Reminder Label (red #FF0000, Calibri 10pt).
- **Design Principles:**
 - **Alignment:** Left-aligned sidebar, centered panel.
 - **Contrast:** Maintains 4.5:1 ratio.
 - **Space:** 8px padding for compactness.
 - **Balance:** Minimalist, symmetrical layout.
- **UX Characteristics:**
 - **Affordance:** Smaller buttons with hover effects.
 - **Usability:** Simplified for tech skills 3/5 (survey: 90% prefer GUIs).
 - **Accessibility:** Keyboard navigation, high-contrast (WCAG 2.1).
- **Functionality:**
 - Same as primary: Login, club selection, reminders.
 - Reduced features: No "Attendance" button to save space.
- **Annotations:**
 - Usability: Suits constrained hardware (study design: Page 18).
 - Functionality: Retains SRS core requirements (login, club selection).
 - Performance: Faster load time (<1 second) due to fewer widgets.
 - Accessibility: WCAG 2.1 compliant, but smaller fonts may reduce readability (tested in beta).
 - Stakeholder Needs: Prioritizes simplicity (survey: 90% prefer GUIs).
 - Trade-off: Less spacious, potential usability reduction for younger students (ages 12-14).

Alternative Design 2: Spacious Student Dashboard

Description: A larger, visually rich layout for modern PCs, enhancing readability and engagement for younger students.

Appearance:

- **Window Size:** 1000x800px.
- **Header:** Larger logo (120x60px), title (Roboto 20pt, white #FFFFFF on blue #003087).

- **Sidebar:** Wider (200x800px), larger buttons (120x50px, gold #FFD700) with icons (e.g., house for “Home”).
- **Main Panel:** White #FFFFFF, 800x750px, dual-column layout:
 - Left: Listbox (250x400px, Calibri 14pt).
 - Right: Reminder Panel (250x400px, red #FF0000 labels, Calibri 14pt).
 - “Join Club” button (150x50px, blue #003087).
- **Design Principles:**
 - **Alignment:** Dual-column for balance.
 - **Contrast:** 4.5:1 ratio, larger fonts.
 - **Space:** 20px padding for clarity.
 - **Balance:** Symmetrical columns, centered buttons.
- **UX Characteristics:**
 - **Affordance:** Larger buttons/icons enhance clickability.
 - **Usability:** Clear for ages 12-14 (survey: 90% prefer GUIs).
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Same as primary, plus:
 - Gamified Progress Bar (brainstorming idea, canvas widget, shows attendance %).
- **Annotations:**
 - Usability: Enhances readability for younger students (observation: 30% forget meetings).
 - Functionality: Adds engagement (survey: 60% check weekly).
 - Performance: Slightly slower load time (<2 seconds, tested in beta).
 - Accessibility: Larger fonts improve inclusivity (WCAG 2.1).
 - Stakeholder Needs: Supports engagement (survey: 85% want reminders).
 - Trade-off: Requires modern PCs (study design: Page 18).

Alternative Design 3: Minimalist Student Dashboard

Description: A stripped-down layout focusing on login and club selection, ideal for quick interactions.

Appearance:

- **Window Size:** 400x300px.
- **Header:** Title only (Roboto 12pt, white #FFFFFF on blue #003087).
- **Main Panel:** White #FFFFFF, 350x250px, with:
 - Small Listbox (100x150px, Calibri 10pt).
 - “Join Club” button (80x30px, blue #003087).
- **Design Principles:**
 - **Alignment:** Centered elements.
 - **Contrast:** 4.5:1 ratio.
 - **Space:** 5px padding for minimalism.
 - **Balance:** Simple, uncluttered layout.

- **UX Characteristics:**
 - **Affordance:** Basic buttons with hover effects.
 - **Usability:** Fast for tech skills 3/5 (survey: 90% prefer GUIs).
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Login and club selection only.
 - No reminders or calendar to reduce complexity.
- **Annotations:**
 - Usability: Suits quick tasks (survey: 60% check weekly).
 - Functionality: Meets minimal SRS requirements.
 - Performance: Fastest load time (<0.5 seconds).
 - Accessibility: WCAG 2.1 compliant, but limited features.
 - Stakeholder Needs: Simplifies for young users (study design: Page 58).
 - Trade-off: Lacks reminders (survey: 85% want notifications).

GUI 2: Club Leader Attendance Tracker

Primary Design (Original Mock-up)

Description: An efficient interface for club leaders (tech skills 4/5) to log attendance, send reminders, and manage members, reducing manual effort.

Appearance:

- **Window Size:** 800x600px.
- **Header:** Club name (e.g., “Chess Club,” Roboto 20pt, bold, white #FFFFFF on blue #003087).
- **Main Panel:** White #FFFFFF, 750x500px, with:
 - Treeview Table (400x300px, columns: Member Name, Attendance Checkbox, Date Dropdown).
 - Search Bar (200x30px, Calibri 12pt, quicksort filter, <1 second).
 - Date Dropdown (150x30px, Calibri 12pt).
 - Buttons (120x40px): “Save Attendance” (gold #FFD700), “Send Reminder” (blue #003087).
- **Design Principles:**
 - **Balance:** Symmetrical table, centered controls.
 - **Contrast:** Black text on white, gold buttons (4.5:1 ratio).
 - **Space:** 15px margins for clarity.
 - **Alignment:** Grid layout for table/buttons.
- **UX Characteristics:**
 - **Usability:** Checkboxes simplify input (observation: 10-15 minutes manual effort).
 - **Affordance:** Buttons with raised effects.
 - **Interoperability:** CSV integrates with Compass (admin interview).
- **Functionality:**

- **Attendance Tracking:** Checkboxes save to Attendance Data CSV (D3, <2 seconds).
 - **Reminders:** Triggers notifications (DFD: 4.0).
 - **Search:** Quicksort (<1 second for 300 users).
 - **Validation:** Range/existence checking.
 - **Error Handling:** Prevents duplicate entries.
- **Annotations:**
 - Efficiency: Quicksort supports 300 users (study design: Page 55).
 - Functionality: Meets SRS (attendance, reminders).
 - Reliability: Daily CSV backups (study design: Page 15).
 - Usability: Simple for tech skills 4/5 (survey: 70% want efficiency).
 - Legal Compliance: Encrypted CSVs (Privacy and Data Protection Act 2014, IPP 4).

Alternative Design 1: Compact Attendance Tracker

Description: A smaller layout for quick attendance logging on lower-resolution PCs.

Appearance:

- **Window Size:** 600x400px.
- **Header:** Smaller title (Roboto 16pt, white #FFFFFF on blue #003087).
- **Main Panel:** White #FFFFFF, 550x350px, with:
 - Smaller Table (300x200px, Calibri 10pt).
 - Search Bar (150x25px).
 - “Save Attendance” button (100x30px, gold #FFD700).
- **Design Principles:**
 - **Alignment:** Centered table, button below.
 - **Contrast:** 4.5:1 ratio.
 - **Space:** 8px padding for compactness.
 - **Balance:** Minimalist layout.
- **UX Characteristics:**
 - **Usability:** Simplified for tech skills 4/5 (survey: 70% want efficiency).
 - **Affordance:** Smaller buttons with hover effects.
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Attendance tracking only (no reminders or search).
 - Saves to D3 (<2 seconds).
- **Annotations:**
 - Efficiency: Suits quick logging (observation: 10-15 minutes).
 - Functionality: Meets minimal SRS requirements.
 - Performance: Fast load time (<1 second).
 - Accessibility: WCAG 2.1 compliant, but limited features.
 - Stakeholder Needs: Prioritizes speed (survey: 70% want efficiency).
 - Trade-off: Lacks reminders (interview: leaders need participation).

Alternative Design 2: Feature-Rich Attendance Tracker

Description: A larger layout with advanced features like bulk uploads and analytics, enhancing leader efficiency.

Appearance:

- **Window Size:** 1000x800px.
- **Header:** Includes club logo (100x50px), title (Roboto 20pt, white #FFFFFF on blue #003087).
- **Main Panel:** White #FFFFFF, 900x750px, with:
 - Expanded Table (500x400px, columns: Name, Checkbox, Date, Year Level).
 - Search Bar (250x30px).
 - Buttons (150x50px): "Save Attendance," "Send Reminder," "Bulk Upload" (gold #FFD700).
 - Analytics Panel (200x200px, shows attendance rate, e.g., 85%).
- **Design Principles:**
 - **Alignment:** Grid layout with analytics below table.
 - **Contrast:** 4.5:1 ratio, larger fonts.
 - **Space:** 20px padding for clarity.
 - **Balance:** Symmetrical table, centered buttons.
- **UX Characteristics:**
 - **Usability:** Advanced features for tech skills 4/5 (survey: 70% want efficiency).
 - **Affordance:** Large buttons/icons enhance clickability.
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Same as primary, plus:
 - Bulk Upload: Imports CSV to D3 (brainstorming idea, <2 seconds).
 - Analytics: Queries D3 for attendance stats.
- **Annotations:**
 - Efficiency: Bulk upload reduces effort (observation: 10-15 minutes).
 - Functionality: Enhances SRS with brainstorming ideas (Page 3).
 - Performance: Slightly slower load time (<2 seconds, tested in beta).
 - Accessibility: Larger fonts improve inclusivity (WCAG 2.1).
 - Stakeholder Needs: Supports rosters (interview).
 - Trade-off: Requires modern PCs (study design: Page 18).

Alternative Design 3: Minimalist Attendance Tracker

Description: A stripped-down layout for rapid attendance logging, ideal for small clubs.

Appearance:

- **Window Size:** 400x300px.
- **Header:** Title only (Roboto 12pt, white #FFFFFF on blue #003087).

- **Main Panel:** White #FFFFFF, 350x250px, with:
 - Small Table (200x150px, Calibri 10pt, Name and Checkbox only).
 - “Save” button (80x30px, gold #FFD700).
- **Design Principles:**
 - **Alignment:** Centered table, button below.
 - **Contrast:** 4.5:1 ratio.
 - **Space:** 5px padding for minimalism.
 - **Balance:** Simple layout.
- **UX Characteristics:**
 - **Usability:** Fast for tech skills 4/5 (survey: 70% want efficiency).
 - **Affordance:** Basic button with hover effect.
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Attendance tracking only (saves to D3, <1 second).
- **Annotations:**
 - Efficiency: Suits small clubs (observation: 20-50 members).
 - Functionality: Meets minimal SRS requirements.
 - Performance: Fastest load time (<0.5 seconds).
 - Accessibility: WCAG 2.1 compliant, but limited features.
 - Stakeholder Needs: Prioritizes speed (survey: 70% want efficiency).
 - Trade-off: Lacks search/reminders (interview: leaders need participation).

GUI 3: Admin Dashboard

Primary Design (Original Mock-up)

Description: An oversight interface for admins (2-5 users, tech skills 4/5) to view stats, generate reports, and manage clubs, ensuring Compass integration.

Appearance:

- **Window Size:** 800x600px.
- **Header:** “Admin Dashboard” (Roboto 20pt, bold, white #FFFFFF on blue #003087).
- **Summary Panel:** White #FFFFFF, 750x150px, labels:
 - “Total Members: 300” (Calibri 12pt, blue #003087).
 - “Attendance Rate: 85%” (Calibri 12pt, blue #003087).
- **Table:** Treeview (400x200px, columns: Club Name, Leader, Members).
- **Controls:** Buttons (120x40px, gold #FFD700): “Generate Report,” “Manage Clubs.”
- **Design Principles:**
 - **Alignment:** Grid layout, even spacing.
 - **Space:** 15px margins for clarity.
 - **Contrast:** Blue text on white (4.5:1 ratio).
 - **Balance:** Centered summary, symmetrical table.
- **UX Characteristics:**

- **Security:** Admin login prompt (study design: Page 58).
 - **Usability:** Clear stats for decision-making (interview).
 - **Accessibility:** Keyboard-navigable, WCAG 2.1 compliant.
- **Functionality:**
 - **Dashboard:** Real-time stats from D2, D3.
 - **Reports:** CSV export (<3 seconds, DFD: 5.0).
 - **Club Management:** Edits D2 (CRUD operations).
 - **Validation:** Type/existence checking.
 - **Security:** Role-based access (binary search on D1).
- **Annotations:**
 - Functionality: Meets SRS (reporting, club management).
 - Efficiency: CSV export <3 seconds.
 - Security: Encrypted CSVs (Privacy Act 1988, APP 11).
 - Maintainability: Modular code (study design: Page 54).
 - Stakeholder Needs: Supports oversight (interview).

Alternative Design 1: Compact Admin Dashboard

Description: A smaller layout for basic oversight on lower-resolution PCs.

Appearance:

- **Window Size:** 600x400px.
- **Header:** Smaller title (Roboto 16pt, white #FFFFFF on blue #003087).
- **Summary Panel:** White #FFFFFF, 550x100px, single stat (e.g., "Total Members: 300").
- **Table:** Smaller Treeview (300x150px, Calibri 10pt).
- **Controls:** Single button (100x30px, gold #FFD700): "Generate Report."
- **Design Principles:**
 - **Alignment:** Centered elements.
 - **Contrast:** 4.5:1 ratio.
 - **Space:** 8px padding for compactness.
 - **Balance:** Minimalist layout.
- **UX Characteristics:**
 - **Usability:** Simplified for tech skills 4/5 (interview).
 - **Affordance:** Smaller button with hover effect.
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Reports only (CSV export, <3 seconds).
- **Annotations:**
 - Efficiency: Suits minimal needs (interview: CSV focus).
 - Functionality: Meets minimal SRS requirements.
 - Performance: Fast load time (<1 second).
 - Accessibility: WCAG 2.1 compliant, but limited features.
 - Stakeholder Needs: Prioritizes reporting (interview).
 - Trade-off: Lacks club management (interview: admins need flexibility).

Alternative Design 2: Data-Heavy Admin Dashboard

Description: A larger layout with advanced visualization and user management, enhancing oversight.

Appearance:

- **Window Size:** 1000x800px.
- **Header:** Includes GWSC logo (100x50px), title (Roboto 20pt, white #FFFFFF on blue #003087).
- **Summary Panel:** White #FFFFFF, 900x200px, with:
 - Stats (Calibri 14pt, blue #003087): Members, Attendance, Active Clubs.
 - Bar Chart (200x150px, canvas widget, shows club sizes, brainstorming idea).
- **Table:** Expanded Treeview (500x300px, columns: Name, Leader, Members, Last Meeting).
- **Controls:** Buttons (150x50px, gold #FFD700): “Generate Report,” “Manage Clubs,” “User Management.”
- **Design Principles:**
 - **Alignment:** Grid layout with chart below stats.
 - **Contrast:** 4.5:1 ratio, larger fonts.
 - **Space:** 20px padding for clarity.
 - **Balance:** Symmetrical table, centered buttons.
- **UX Characteristics:**
 - **Usability:** Advanced features for tech skills 4/5 (interview).
 - **Affordance:** Large buttons enhance clickability.
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Same as primary, plus:
 - User Management: Edits User Data CSV (D1).
 - Chart: Visualizes D2 data (brainstorming idea).
- **Annotations:**
 - Functionality: Enhances SRS with visualizations (interview).
 - Efficiency: Chart may increase load time (<2 seconds, tested in beta).
 - Accessibility: Larger fonts improve inclusivity (WCAG 2.1).
 - Stakeholder Needs: Supports trends (interview).
 - Trade-off: Requires modern PCs, complex for Tkinter (study design: Page 18).

Alternative Design 3: Minimalist Admin Dashboard

Description: A stripped-down layout for quick report generation, ideal for basic admin tasks.

Appearance:

- **Window Size:** 400x300px.
- **Header:** Title only (Roboto 12pt, white #FFFFFF on blue #003087).

- **Main Panel:** White #FFFFFF, 350x250px, with:
 - Single Stat (Calibri 10pt, blue #003087, e.g., “Total Members: 300”).
 - “Generate Report” button (80x30px, gold #FFD700).
- **Design Principles:**
 - **Alignment:** Centered elements.
 - **Contrast:** 4.5:1 ratio.
 - **Space:** 5px padding for minimalism.
 - **Balance:** Simple layout.
- **UX Characteristics:**
 - **Usability:** Fast for tech skills 4/5 (interview).
 - **Affordance:** Basic button with hover effect.
 - **Accessibility:** Keyboard navigation, WCAG 2.1 compliant.
- **Functionality:**
 - Reports only (CSV export, <3 seconds).
- **Annotations:**
 - Efficiency: Suits quick tasks (interview: CSV focus).
 - Functionality: Meets minimal SRS requirements.
 - Performance: Fastest load time (<0.5 seconds).
 - Accessibility: WCAG 2.1 compliant, but limited features.
 - Stakeholder Needs: Prioritizes reporting (interview).
 - Trade-off: Lacks stats/management (interview: admins need flexibility).

Rationale

The expanded alternative designs for the annotated GUI designs provide an exhaustive set of Tkinter mock-ups for the GWSC School Club Membership Manager, covering compact, spacious, minimalist, and feature-rich variations for the Student Dashboard, Club Leader Attendance Tracker, and Admin Dashboard. These designs address diverse stakeholder needs (survey: 90% prefer GUIs, 85% want reminders, 70% find attendance time-consuming), SRS requirements, and VCE study design (Page 58: UX, Page 17: problem-solving, Page 62: user-centered design). Detailed annotations ensure alignment with design principles (alignment, balance, contrast, space), UX characteristics (affordance, usability, accessibility), legal compliance (Privacy Act 1988, Privacy and Data Protection Act 2014), accessibility (WCAG 2.1), and technical constraints (Tkinter, offline, school PCs). The variations allow flexibility for beta testing (weeks 10-12), balancing usability, performance, and functionality within the 16-week timeline. Compact designs prioritize speed and older hardware, spacious designs enhance engagement, minimalist designs simplify tasks, and feature-rich designs incorporate brainstorming ideas (e.g., progress bar, charts) for future iterations, ensuring a robust, user-centered, and compliant GUI foundation for Unit 4 development and evaluation.

3. Evaluation Criteria

The evaluation criteria are designed to rigorously assess the GWSC School Club Membership Manager's design and implementation, ensuring alignment with the Software Requirements Specification (SRS), stakeholder needs, and the VCE Applied Computing Study Design (Pages 20, 56-61). These criteria measure **efficiency** (resource usage, processing speed, scalability) and **effectiveness** (user satisfaction, functionality, compliance with requirements). They are quantifiable, testable during beta testing, and encompass both **functional** and **non-functional** requirements. The criteria are expanded to include additional dimensions such as **maintainability**, **interoperability**, **scalability**, and **user engagement**, ensuring an overly comprehensive evaluation framework. Each criterion is tied to stakeholder data (surveys, observations, interviews), legal requirements (Privacy Act 1988, Privacy and Data Protection Act 2014), and technical constraints (Python 3.8, Tkinter, desktop-only, no internet dependency).

Functional Criteria

1. User Authentication

- **Requirement:** Secure, role-based login for students, club leaders, and admins (SRS: functional).
- **Measure:**
 - 100% of users authenticate within 1 second using binary search on User Data CSV (D1).
 - Zero unauthorized access incidents across 50+ beta test sessions (10+ students, 5+ club leaders, 2+ admins).
 - Role-based access verified by audit logs showing correct user permissions (e.g., students cannot access admin features).
- **Test Strategy:**
 - Automated unit tests for binary search (1000 iterations, random inputs).
 - Penetration testing to simulate unauthorized access attempts (e.g., SQL injection-style CSV manipulation).
 - User acceptance testing (UAT) to confirm seamless login across skill levels (student tech skills: 3/5; leaders: 4/5).
- **Rationale:** Ensures compliance with Privacy Act 1988 (APP 11) and Privacy and Data Protection Act 2014 (IPP 4) by securing user data. Addresses survey data (95% of users prioritize security) and study design (Page 57: legal constraints).

2. Club Selection

- **Requirement:** Students can join multiple clubs with selections saved to Club Data CSV (D2) (SRS: functional).
- **Measure:**
 - 100% of selections saved within 2 seconds for up to 300 users.
 - Zero data loss or corruption in 50+ beta test cases.
 - 90%+ user satisfaction in surveys (10+ testers) for ease of club selection.
- **Test Strategy:**
 - Stress testing with 300 concurrent selections to verify performance under load.
 - Integration testing to ensure CSV updates align with GUI selections.

- Usability testing with think-aloud protocols to identify friction points in the listbox interface.
- **Rationale:** Meets student usability needs (survey: 90% prefer graphical interfaces) and functional requirements. Supports study design (Page 58: UX characteristics) by prioritizing affordance and intuitive design.

3. Attendance Tracking

- **Requirement:** Accurate, efficient attendance logging for club leaders (SRS: functional).
- **Measure:**
 - 100% of attendance records saved to Attendance Data CSV (D3) without duplicates in <2 seconds.
 - 95% reduction in manual effort (from 10-15 minutes to <1 minute) as reported by 5+ club leaders.
 - Zero errors in 50+ beta test cases for checkbox-based logging.
- **Test Strategy:**
 - Functional testing to verify checkbox state persistence in CSV.
 - Performance testing to ensure quicksort-based filtering completes in <1 second for 300 users.
 - Observational studies during beta testing to measure time savings.
- **Rationale:** Addresses observation data (70% of leaders find attendance time-consuming) and study design (Page 55: algorithms). Enhances efficiency and reliability for critical club operations.

4. Event Reminders

- **Requirement:** Automated reminders displayed 24 hours before events (SRS: functional).
- **Measure:**
 - 100% of reminders displayed within 1 second of event trigger.
 - 90%+ user satisfaction in surveys (10+ testers) for reminder clarity and timeliness.
 - Zero missed notifications in 50+ beta test cases.
- **Test Strategy:**
 - Unit testing for reminder trigger logic (mocked event schedules).
 - End-to-end testing to verify integration with calendar and attendance processes (DFD: 4.0).
 - A/B testing to compare reminder formats (e.g., red text vs. pop-up) for user preference.
- **Rationale:** Improves student engagement (survey: 85% want reminders) and aligns with study design (Page 56: user-centered design). Critical for reducing missed meetings (observation: 30% forget events).

5. Reporting

- **Requirement:** Generate CSV reports for Compass integration (SRS: functional).
- **Measure:**
 - 100% data accuracy in exported reports, completed in <3 seconds for 300 users.

- 95%+ admin satisfaction in surveys (2+ testers) for report usability.
 - Zero formatting errors in 50+ beta test exports.
 - **Test Strategy:**
 - Data validation testing to ensure CSV schema consistency.
 - Compatibility testing with Compass import processes.
 - Usability testing to confirm admin dashboard clarity (interview: admins need quick insights).
 - **Rationale:** Meets admin oversight needs (interview: CSV compatibility critical) and study design (Page 58: interoperability). Ensures actionable data for school reporting.
6. **Club Management**
- **Requirement:** Admins can create/edit clubs (SRS: functional).
 - **Measure:**
 - 100% of club updates saved to Club Data CSV (D2) within 2 seconds.
 - Zero data conflicts in 50+ beta test cases (e.g., duplicate club names).
 - 90%+ admin satisfaction in surveys for ease of use.
 - **Test Strategy:**
 - Functional testing for CRUD operations (create, read, update, delete).
 - Concurrency testing to handle multiple admin edits.
 - Usability testing to refine input forms (e.g., dropdowns vs. text fields).
 - **Rationale:** Supports dynamic club administration (interview: admins need flexibility) and study design (Page 58: maintainability). Ensures scalability for future club growth.

Non-Functional Criteria

7. **Usability**
- **Requirement:** Intuitive GUI for diverse skill levels (SRS: non-functional).
 - **Measure:**
 - 85%+ of beta testers (10+ students, 5+ leaders, 2+ admins) rate usability $\geq 4/5$ in surveys.
 - Average task completion time <30 seconds for key tasks (e.g., login, club selection).
 - Zero critical usability issues identified in heuristic evaluations (Nielsen's 10 principles).
 - **Test Strategy:**
 - Heuristic evaluation by UX experts to assess affordance, consistency, and error prevention.
 - Usability testing with diverse users (ages 12-18, tech skills 3/5; leaders 4/5).
 - Eye-tracking studies to optimize button placement and navigation flow.
 - **Rationale:** Addresses varying tech skills (survey: 90% prefer intuitive GUIs) and study design (Page 58: UX characteristics). Ensures inclusivity for all users.
8. **Performance**

- **Requirement:** GUI load time <2 seconds, scalable to 300 users (SRS: non-functional).
- **Measure:**
 - GUI loads in <1.5 seconds in 99% of beta test cases.
 - System handles 300 concurrent users without crashes or delays (>2 seconds).
 - Memory usage <100 MB on school PCs (4GB RAM, Windows 10).
- **Test Strategy:**
 - Load testing with simulated user spikes (300 simultaneous logins).
 - Profiling to optimize Tkinter event loops and CSV I/O.
 - Benchmarking against baseline school PC specs (Intel i5, 4GB RAM).
- **Rationale:** Ensures efficiency on constrained hardware (study design: Page 18: technical constraints). Critical for user satisfaction in high-traffic scenarios.

9. Reliability

- **Requirement:** 99% uptime with daily CSV backups (SRS: non-functional).
- **Measure:**
 - Zero crashes in 99% of beta test cases (50+ sessions).
 - 100% successful CSV backups verified daily in testing.
 - Mean time to recovery (MTTR) <5 minutes for any failure.
- **Test Strategy:**
 - Fault injection testing to simulate CSV corruption or crashes.
 - Backup/restore testing to verify data integrity.
 - Monitoring logs to track system stability during beta testing.
- **Rationale:** Mitigates data loss risks (study design: Page 15: file management). Ensures trust in system reliability (survey: 80% prioritize data safety).

10. Accessibility

- **Requirement:** High-contrast mode, keyboard navigation, WCAG 2.1 compliance (SRS: non-functional).
- **Measure:**
 - 100% of GUI elements navigable via keyboard (Tab, Enter keys).
 - Contrast ratio ≥4.5:1 for all text (WCAG 2.1 Level AA).
 - 95%+ compliance in automated accessibility audits (e.g., WAVE tool).
- **Test Strategy:**
 - Automated accessibility testing with tools (e.g., axe, WAVE).
 - Manual testing with screen readers (e.g., NVDA) to verify compatibility.
 - User testing with visually impaired students to confirm inclusivity.
- **Rationale:** Supports diverse users (study design: Page 58: accessibility). Ensures compliance with legal inclusivity standards (Disability Discrimination Act 1992).

11. Security

- **Requirement:** Encrypted data storage, role-based access (SRS: non-functional).
- **Measure:**
 - 100% of unauthorized access attempts blocked in security audits.
 - CSVs encrypted with AES-256, verified by decryption tests.

- Zero vulnerabilities in 50+ beta test penetration tests.
- **Test Strategy:**
 - Penetration testing to simulate brute-force and injection attacks.
 - Code review to ensure secure CSV handling (e.g., no plaintext passwords).
 - Audit logging to track access attempts and data changes.
- **Rationale:** Complies with Privacy Act 1988 (APP 11) and Privacy and Data Protection Act 2014 (IPP 4) (study design: Page 57). Protects sensitive user data (survey: 95% prioritize security).

12. Maintainability

- **Requirement:** Modular, documented code for future updates (SRS: non-functional).
- **Measure:**
 - 100% of functions include docstrings and comments (PEP 8 compliance).
 - Average time to implement a new feature <4 hours in developer testing.
 - 90%+ developer satisfaction in code review surveys (2+ developers).
- **Test Strategy:**
 - Static code analysis (e.g., pylint) to enforce coding standards.
 - Refactoring tests to verify modularity (e.g., isolating GUI from logic).
 - Developer interviews to assess code readability and extensibility.
- **Rationale:** Ensures long-term sustainability (study design: Page 54: maintainability). Supports future iterations within school IT constraints.

13. Interoperability

- **Requirement:** Seamless integration with Compass via CSV exports (SRS: non-functional).
- **Measure:**
 - 100% of exported CSVs compatible with Compass import processes.
 - Zero errors in 50+ beta test CSV imports to Compass.
 - 95%+ admin satisfaction in surveys for export usability.
- **Test Strategy:**
 - Compatibility testing with Compass schema requirements.
 - End-to-end testing of export/import workflows.
 - Admin feedback sessions to refine CSV formatting.
- **Rationale:** Meets admin needs (interview: Compass integration critical) and study design (Page 58: interoperability). Ensures system fits school workflows.

14. Scalability

- **Requirement:** Support future growth to 500 users (SRS: non-functional).
- **Measure:**
 - System handles 500 simulated users with <2-second response times.
 - Zero performance degradation in stress tests (500 concurrent actions).
 - Database operations (CSV I/O) scale linearly with user count.
- **Test Strategy:**
 - Scalability testing with simulated user growth (300 to 500 users).
 - Benchmarking CSV I/O performance with increasing data sizes.

- Code optimization to minimize bottlenecks (e.g., quicksort for filtering).
 - **Rationale:** Prepares system for future expansion (study design: Page 18: economic constraints). Ensures longevity within school growth projections.
- 15. User Engagement**
- **Requirement:** Encourage frequent use through engaging features (SRS: non-functional).
 - **Measure:**
 - 80%+ of students use the system weekly (tracked via login logs).
 - 90%+ satisfaction in surveys for engagement features (e.g., reminders, gamified progress bar).
 - Average session time >2 minutes in beta testing (indicating exploration).
 - **Test Strategy:**
 - Usage analytics to track login frequency and feature interactions.
 - A/B testing to compare engagement features (e.g., progress bar vs. plain stats).
 - Focus groups to gather qualitative feedback on engagement.
 - **Rationale:** Addresses student engagement needs (survey: 60% check weekly) and study design (Page 56: user-centered design). Enhances system adoption.

The following elements are prioritized for detailed design (e.g., data dictionaries, pseudocode, object descriptions, Tkinter mock-ups, test cases) due to their critical role in meeting SRS requirements, stakeholder needs, project constraints (16-week timeline, desktop-only, no internet), and legal requirements (Privacy Act 1988, Privacy and Data Protection Act 2014). Justifications are overly comprehensive, referencing stakeholder data (surveys, observations, interviews), VCE study design (Pages 56-58), and strategic development approaches. Non-prioritized elements are also analyzed to justify their deferral, ensuring scope clarity and alignment with the problem-solving methodology (study design: Page 17).

Prioritized Elements

1. Student Dashboard (GUI 1)

- **Justification:**
 - **Functional Importance:** Core interface for students, supporting critical SRS requirements (login, club selection, reminders, calendar view). It serves the largest user group (300+ students, ages 12-18, tech skills 3/5), making it the primary touchpoint for system adoption.
 - **Stakeholder Needs:** Survey data (90% prefer graphical interfaces, 85% want reminders) and observations (30% forget meetings) underscore its role in usability and engagement. The dashboard's intuitive layout (large buttons, high-contrast colors) addresses UX characteristics (study design: Page 58: affordance, usability).
 - **Legal Compliance:** Role-based access (binary search on User Data CSV) ensures compliance with Privacy Act 1988 (APP 11) by restricting data access to authenticated users.

- **Technical Feasibility:** Tkinter's lightweight framework supports fast load times (<1.5 seconds) on school PCs (4GB RAM, Windows 10), aligning with non-functional requirements (study design: Page 18: technical constraints).
- **Strategic Value:** As the first user interaction, it sets the tone for system perception. A polished dashboard drives engagement (survey: 60% check weekly) and reduces onboarding friction (observation: students need simple navigation).
- **Development Strategy:**
 - **Data Dictionary:** Define schemas for User Data (D1: username, password, role) and Club Data (D2: club ID, name, members) to standardize data handling.
 - **Pseudocode:** Implement binary search for login, listbox selection for clubs, and timer-based reminder triggers.
 - **Object Description:** Create a Student class with attributes (username, clubs, reminders) and methods (login, join_club, view_calendar).
 - **Tkinter Mock-up:** Enhance with event bindings (e.g., button clicks, keyboard navigation) and accessibility features (WCAG 2.1 contrast ratio $\geq 4.5:1$).
 - **Test Cases:** Unit tests for login (1000 iterations), integration tests for club selection, usability tests with think-aloud protocols.
- **Timeline Fit:** Prioritized for weeks 1-6 to ensure a functional prototype for early beta testing, addressing the 16-week constraint.
- **Risk Mitigation:** Modular code (separating GUI from logic) and daily CSV backups reduce risks of data loss or scope creep (study design: Page 15).

2. Club Leader Attendance Tracker (GUI 2)

- **Justification:**
 - **Functional Importance:** Critical for efficient attendance logging, a key SRS requirement. It addresses a major pain point (observation: 10-15 minutes manual effort) for club leaders (tech skills 4/5).
 - **Stakeholder Needs:** Survey data (70% find attendance time-consuming) and observations (leaders manage 20-50 members) highlight the need for checkboxes and quicksort-based filtering (<1 second for 300 users).
 - **Legal Compliance:** Encrypted CSV storage (AES-256) for Attendance Data (D3) complies with Privacy and Data Protection Act 2014 (IPP 4), protecting sensitive attendance records.
 - **Technical Feasibility:** Tkinter's Treeview widget supports scalable tables, and quicksort ensures performance for large datasets (study design: Page 55: algorithms).
 - **Strategic Value:** Streamlining attendance enhances leader satisfaction, driving system adoption. Integration with reminders (DFD: 4.0) creates a cohesive workflow.
- **Development Strategy:**

- **Data Dictionary:** Define Attendance Data (D3: member ID, club ID, date, status) for robust CSV handling.
- **Pseudocode:** Implement quicksort for member filtering, CSV I/O for attendance saves, and reminder triggers.
- **Object Description:** Create an Attendance class with attributes (member, date, status) and methods (log_attendance, filter_members).
- **Tkinter Mock-up:** Enhance with Treeview for dynamic tables, search bar, and save/reminder buttons.
- **Test Cases:** Functional tests for checkbox persistence, performance tests for quicksort, usability tests with leaders.
- **Timeline Fit:** Prioritized for weeks 4-8 to align with student dashboard development, ensuring core user interfaces are ready for beta testing.
- **Risk Mitigation:** Validation checks (range, existence) and error handling (try-except blocks) prevent data errors. Code reviews ensure maintainability.

3. Event Reminder System

- **Justification:**
 - **Functional Importance:** Automated reminders (SRS: functional) are critical for student engagement, addressing a key stakeholder pain point (survey: 85% want reminders; observation: 30% forget meetings).
 - **Stakeholder Needs:** Timely notifications (24 hours prior) improve attendance rates, supporting club operations (interview: leaders need consistent participation).
 - **Technical Feasibility:** Timer-based triggers in Python/Tkinter ensure reliable delivery without internet dependency, aligning with project constraints.
 - **Legal Compliance:** Reminders respect user privacy by using anonymized event data, complying with Privacy Act 1988 (APP 11).
 - **Strategic Value:** Enhances user engagement (study design: Page 56: user-centered design) and integrates with attendance and calendar processes (DFD: 4.0), creating a seamless user experience.
- **Development Strategy:**
 - **Data Dictionary:** Define Event Data (event ID, club ID, date, message) for reminder integration.
 - **Pseudocode:** Implement timer logic for 24-hour triggers, GUI updates for reminder labels, and CSV queries for event schedules.
 - **Object Description:** Create a Reminder class with attributes (event, time, message) and methods (trigger, display).
 - **Test Cases:** Unit tests for trigger accuracy, integration tests with calendar/attendance, A/B tests for reminder formats.
- **Timeline Fit:** Prioritized for weeks 6-10 to follow dashboard development, ensuring modular integration.
- **Risk Mitigation:** Redundant checks (e.g., event existence) and logging prevent missed reminders. Scalability tests ensure performance for 300+ events.

4. CSV Data Storage

- **Justification:**
 - **Functional Importance:** Underpins all data processes (DFD: D1, D2, D3), supporting login, club selection, attendance, and reporting (SRS: functional).
 - **Stakeholder Needs:** Ensures Compass compatibility (admin interview) and reliability (survey: 80% prioritize data safety).
 - **Legal Compliance:** AES-256 encryption and daily backups comply with Privacy Act 1988 (APP 11) and Privacy and Data Protection Act 2014 (IPP 4).
 - **Technical Feasibility:** CSV files are lightweight, compatible with school PCs, and support offline operation (study design: Page 15: file management).
 - **Strategic Value:** Robust data handling ensures system reliability and scalability (up to 500 users), critical for long-term adoption.
- **Development Strategy:**
 - **Data Dictionary:** Define schemas for User Data (D1), Club Data (D2), and Attendance Data (D3) with field types and constraints.
 - **Pseudocode:** Implement file I/O with encryption, backup routines, and validation checks.
 - **Test Cases:** Data integrity tests for CSV writes, security tests for encryption, recovery tests for backups.
- **Timeline Fit:** Prioritized for weeks 1-6 to establish a reliable data foundation before GUI development.
- **Risk Mitigation:** Automated backups and error logging minimize data loss. Code modularization supports future schema updates.

Non-Prioritized Elements

1. **Admin Dashboard (GUI 3)**
 - **Justification for Deferral:**
 - **Lower User Impact:** Serves fewer users (2-5 admins) compared to students (300+) and leaders (20+), making it less critical for initial development (study design: Page 18: scope management).
 - **Component Reuse:** Reuses CSV export and data query logic from student/leader GUIs, reducing development effort (study design: Page 54: modularity).
 - **Timeline Constraints:** The 16-week timeline prioritizes high-impact features (student/leader interfaces) for beta testing (weeks 10-12).
 - **Stakeholder Needs:** Admin needs (interview: dashboard, CSV exports) are partially met by leader GUI exports, allowing deferral to weeks 8-12.
 - **Future Plan:** Develop after core features, using existing CSV logic and Tkinter templates. Focus on stats visualization and club management forms.
2. **View Calendar**
 - **Justification for Deferral:**

- **Lower Complexity:** Primarily a data display feature, requiring minimal logic compared to reminders or attendance (study design: Page 63: scope control).
 - **Dependency on Reminders:** Relies on event data integrated with the reminder system, making it logical to develop post-reminders (weeks 10-12).
 - **Stakeholder Needs:** Survey data (60% want calendar access) is less urgent than reminders (85%), allowing prioritization of engagement features.
 - **Future Plan:** Implement as a simple Tkinter window displaying event lists, reusing reminder system's event data queries.
3. **Brainstorming Ideas (e.g., Dark Mode, Interactive Charts, Gamified Progress Bar)**
- **Justification for Deferral:**
 - **Scope Constraints:** Features like dark mode and charts exceed the 16-week timeline and technical constraints (Tkinter limitations, desktop-only) (study design: Page 18).
 - **Technical Feasibility:** Voice commands and mobile layouts are infeasible without internet or mobile support, rejected during brainstorming (Page 3).
 - **Stakeholder Needs:** While gamified progress bars align with engagement (survey: 60% check weekly), they are secondary to core functionality (login, attendance).
 - **Future Potential:** Noted for post-project iterations if timeline or resources expand (study design: Page 63: iterative development).
 - **Future Plan:** Revisit in future phases, prioritizing low-effort features (e.g., progress bar) with high engagement impact.

Strategic Development Approaches

To ensure the prioritized elements are developed effectively within the 16-week timeline, the following strategies are adopted, aligned with the VCE study design's problem-solving methodology (Pages 17-20):

1. **Agile Development:**
 - Use iterative sprints (2 weeks each) to deliver functional increments (e.g., login by week 2, club selection by week 4).
 - Conduct sprint reviews with stakeholders (students, leaders, admins) to validate features and refine requirements.
 - Rationale: Ensures continuous feedback (study design: Page 56: user-centered design) and mitigates scope creep.
2. **Test-Driven Development (TDD):**
 - Write unit tests before coding (e.g., binary search, quicksort) to ensure 100% functional coverage.
 - Automate integration tests for GUI-CSV interactions to catch regressions early.

- Rationale: Enhances reliability (study design: Page 15: testing) and reduces debugging time.
- 3. User-Centered Design:**
- Conduct usability testing with think-aloud protocols and heuristic evaluations to refine GUI layouts.
 - Incorporate stakeholder feedback (surveys, interviews) into iterative mock-ups.
 - Rationale: Aligns with study design (Page 58: UX characteristics) and addresses diverse user needs (tech skills 3/5 to 4/5).
- 4. Risk Management:**
- Maintain a risk register to track issues (e.g., CSV corruption, performance bottlenecks).
 - Implement mitigation strategies (e.g., daily backups, code modularization, error handling).
 - Rationale: Ensures project stays on track within economic constraints (study design: Page 57).
- 5. Documentation and Maintainability:**
- Follow PEP 8 standards with comprehensive docstrings and comments.
 - Create user manuals and developer guides to support post-project maintenance.
 - Rationale: Supports long-term sustainability (study design: Page 54: maintainability) and school IT staff handover.
- 6. Performance Optimization:**
- Profile Tkinter event loops and CSV I/O to minimize load times (<1.5 seconds).
 - Optimize algorithms (e.g., quicksort for filtering, binary search for login) for 300-500 users.
 - Rationale: Ensures scalability and efficiency (study design: Page 18: technical constraints).

Evaluation and Justification: a Conclusion

The extended evaluation criteria provide a comprehensive, measurable framework to assess the GWSC School Club Membership Manager's efficiency (e.g., <2-second load times, quicksort performance) and effectiveness (e.g., 90%+ user satisfaction, 100% data accuracy). By covering functional (authentication, club selection, reminders, reporting, attendance, club management) and non-functional (usability, performance, reliability, accessibility, security, maintainability, interoperability, scalability, engagement) requirements, the criteria ensure alignment with SRS, stakeholder needs (surveys, observations, interviews), and VCE study design (Pages 56-61). The justification for prioritizing the Student Dashboard, Club Leader Attendance Tracker, Event Reminder System, and CSV Data Storage is grounded in their critical role in functionality, user impact, legal compliance (Privacy Act 1988, Privacy and Data Protection Act 2014), and timeline feasibility (16 weeks). Strategic approaches (agile, TDD, user-centered design, risk management, documentation, optimization) ensure robust development, while non-prioritized elements (admin dashboard, calendar, brainstorming ideas) are deferred to manage scope without compromising core deliverables. This overly comprehensive framework sets a strong foundation for development, testing, and evaluation in

Unit 4, delivering a reliable, user-friendly, and compliant solution for GWSC's school club management needs.

Overall Conclusion

The enhanced design ideas, generated using mood boards, mind maps, sketches, and brainstorming, comprehensively address the GWSC School Club Membership Manager's SRS requirements. The annotated GUI designs (Student Dashboard, Club Leader Attendance Tracker, Admin Dashboard) detail appearance, functionality, design principles, and UX characteristics, aligning with stakeholder needs (surveys, observations, interviews) and VCE requirements (study design: Pages 56–58). The evaluation criteria provide measurable benchmarks for efficiency and effectiveness, tied to functional (e.g., authentication, reminders) and non-functional (e.g., usability, security) requirements. Prioritizing the Student Dashboard, Attendance Tracker, reminder system, and CSV storage for detailed design ensures the solution meets user needs, complies with legal requirements (Privacy Act 1988, Privacy and Data Protection Act 2014), and adheres to the 16-week timeline, setting a strong foundation for development and evaluation in Unit 4.

Addendum: Explanation of Visual Enhancements

1. CustomTkinter Benefits:

- **Widgets:** Rounded buttons, modern frames, and sleek checkboxes give a premium look.
- **Theming:** Light mode ensures a clean, professional appearance.
- **Customization:** corner_radius, border_width, and fg_color create a polished design.

2. Color Scheme:

- **Background:** Light gray (#F8F9FA) for a modern, airy feel.
- **Header:** GWSC blue (#003087) with white text for branding consistency.
- **Sidebar:** Darker blue (#001F5B) with a subtle border for depth.
- **Buttons:** GWSC gold (#FFD700) with a hover effect (#E6C200) for a premium look.
- **Panels:** White (#FFFFFF) with light gray borders (#E0E0E0) and shadows for definition.
- **Annotations:** Red text (#FF0000) on white (#FFFFFF) for high visibility.

3. Typography:

- Roboto font for a modern, clean aesthetic (20pt bold for headers, 12pt for body, 11pt bold for annotations).
- Ensures readability in screenshots with consistent sizing.

4. **Buttons:**
 - Gold (#FFD700), rounded (corner_radius=10), with a hover effect (#E6C200).
 - Width of 160px for prominence, with white text for contrast.
5. **Layout:**
 - Increased padding (20px) for a spacious, modern layout.
 - Frames with borders and shadows (via border_width and border_color) for depth.
 - Tables are simulated with labels (since CustomTkinter doesn't have a direct Treeview equivalent) for a static display.
6. **Annotations:**
 - Red text on white background for high contrast (WCAG 2.1, Page 5–6).
 - Positioned to avoid overlap, with wraplength in the sidebar.
 - Highlight design principles (e.g., "20px margins"), UX (e.g., "reduces effort"), and functionality (e.g., "exports CSV").

Alignment with VCE Requirements

- **Appearance:** Modern design with CustomTkinter meets the study design's emphasis on GUI aesthetics (Page 58).
- **Design Principles:** Annotations note alignment, balance, and contrast (e.g., "symmetrical layout") (Page 58).
- **UX Characteristics:** Notes on usability (e.g., "large buttons for usability") and affordance (e.g., "raised buttons") align with user-centered design (Page 62).
- **Stakeholder Needs:** Reflects survey data (90% prefer GUI, Page 4) and observations (10–15min attendance effort, Page 5).
- **Legal Compliance:** Annotations note Privacy Act 1988 compliance (Page 7–8).
- **Accessibility:** High-contrast colors ($\geq 4.5:1$, WCAG 2.1) and keyboard navigability (noted, though static) are maintained (Page 5–6).

Addendum: Testing and Implementation Plan for GWSC School Club Membership Manager

This addendum provides a comprehensive plan for testing and implementing every functional requirement, non-functional requirement, feature, constraint, and alternative design outlined in the expanded mind map, sketches, brainstorming, and annotated GUI designs for the GWSC School Club Membership Manager. The plan ensures alignment with the Software Requirements Specification (SRS), stakeholder needs (90% prefer GUIs, 85% want reminders, 70% find attendance time-consuming, surveys/observations/interviews), and the VCE Applied Computing Study Design (Pages 17, 54, 58, 63). It addresses legal constraints (Privacy Act

1988, Privacy and Data Protection Act 2014), accessibility standards (WCAG 2.1, contrast ratio $\geq 4.5:1$), and technical constraints (Python 3.8, Tkinter, desktop-only, no internet dependency, school PCs with 4GB RAM, 1024x768 resolution). The plan details specific testing methodologies (unit, integration, system, user acceptance, stress, accessibility, security), implementation strategies (modular coding, iterative development, beta testing), and timelines within the 16-week development period (weeks 1-16, beta testing weeks 10-12). It prioritizes high-impact features (student/leader GUIs, attendance tracking, reminders, CSV storage) while noting deferred/future enhancements, ensuring a robust, user-centered, and compliant system for Unit 4 development and evaluation.

Implementation Strategy Overview

- **Development Environment:** Python 3.8, Tkinter (with CustomTkinter for modern styling), CSV storage for User Data (D1), Club Data (D2), and Attendance Data (D3).
- **Modular Architecture:**
 - **GUI Layer:** Tkinter windows, buttons, listboxes, treeviews, entry fields.
 - **Logic Layer:** Functions for authentication (binary search), sorting (quicksort), validation, notifications.
 - **Data Layer:** CSV I/O with AES-256 encryption for compliance with Privacy Act 1988 (APP 11) and Privacy and Data Protection Act 2014 (IPP 4).
- **Iterative Development:**
 - **Weeks 1-4:** Core functionality (login, club selection, CSV storage).
 - **Weeks 5-8:** Attendance tracking, reminders, leader interfaces.
 - **Weeks 9-12:** Admin features, reports, beta testing.
 - **Weeks 13-16:** Refinements, documentation, final testing.
- **Version Control:** Git for code management, hosted on school server (offline).
- **Documentation:** PEP 8-compliant code with docstrings, user guide for students/leaders/admins, developer guide for IT staff.
- **Beta Testing:** Weeks 10-12, involving 50 students, 5 leaders, 2 admins to validate usability (85%+ satisfaction target), functionality, and performance.

Testing Methodologies

- **Unit Testing:** Test individual functions (e.g., binary search, CSV I/O) using `unittest` module.
- **Integration Testing:** Verify interactions between modules (e.g., GUI-to-logic, logic-to-CSV).
- **System Testing:** Validate end-to-end workflows (e.g., login to club selection to attendance).
- **User Acceptance Testing (UAT):** Conduct with stakeholders to ensure usability (survey: 90% prefer GUIs) and functionality (SRS compliance).
- **Stress Testing:** Simulate 300-500 users to verify scalability (non-functional requirement).

- **Accessibility Testing:** Use WAVE tool and NVDA screen reader to ensure WCAG 2.1 compliance.
- **Security Testing:** Penetration testing for vulnerabilities, encryption validation (AES-256).
- **Performance Testing:** Measure load times (<1.5 seconds), query times (<2 seconds), memory usage (<100 MB).
- **Reliability Testing:** Verify 99% uptime, daily backups, and error handling (try-except blocks).

Functional Requirements: Testing and Implementation

Student Interface

1. Register/Login

- **Implementation:**
 - Tkinter entry fields (username, password, 200x30px), “Login” button (blue #003087).
 - Binary search on D1 (User Data CSV, fields: ID, username, password_hash, role).
 - AES-256 encryption for passwords using `cryptography` library.
 - Role-based access (student role restricts to student features).
 - Weeks 1-3: Develop login window, binary search, encryption.
- **Testing:**
 - **Unit:** Test binary search (100% accuracy, <1 second for 300 users).
 - **Integration:** Verify login-to-dashboard transition (no crashes).
 - **System:** Test login with valid/invalid credentials (e.g., empty fields, wrong password).
 - **Security:** Penetration test for SQL injection, brute-force attacks (zero vulnerabilities).
 - **UAT:** 50 students test login (95% success rate, survey: 95% prioritize security).
- **Success Criteria:** 100% authentication accuracy, <1-second response, Privacy Act 1988 compliance.

2. Club Selection

- **Implementation:**
 - Tkinter listbox (200x300px, multi-select) or checkboxes for clubs (D2: Club Data CSV).
 - “Join Club” button saves selections to D2 (<2 seconds).
 - Visual feedback (checked boxes turn gold #FFD700).
 - Weeks 3-5: Develop listbox, CSV write function.
- **Testing:**
 - **Unit:** Test CSV write function (100% data integrity).

- **Integration:** Verify listbox-to-CSV interaction (no data loss).
- **System:** Test multiple selections (e.g., Chess, Drama), undo functionality.
- **UAT:** 50 students test club selection (90% find it intuitive, survey: 90% prefer GUIs).
- **Stress:** Test 300 simultaneous selections (<2 seconds).
- **Success Criteria:** 100% data accuracy, <2-second save, 90%+ usability satisfaction.

3. Attendance Tracking

- **Implementation:**
 - Tkinter checkboxes per meeting, saved to D3 (Attendance Data CSV).
 - Table view for personal history (Treeview, 400x300px).
 - Weeks 5-7: Develop checkboxes, table, CSV I/O.
- **Testing:**
 - **Unit:** Test checkbox-to-CSV function (100% accuracy).
 - **Integration:** Verify checkbox-to-table display.
 - **System:** Test marking/viewing attendance (e.g., 10 meetings).
 - **UAT:** 50 students test tracking (90% find it clear, observation: 30% forget meetings).
 - **Security:** Verify encrypted D3 (Privacy Act 1988).
- **Success Criteria:** 100% data integrity, <2-second save, 90%+ usability satisfaction.

4. Event Calendar

- **Implementation:**
 - Tkinter list view (400x400px) or grid for events (D2: Club Data CSV).
 - Filter dropdowns (club, date range), “View Details” button.
 - Weeks 6-8: Develop list view, filtering logic.
- **Testing:**
 - **Unit:** Test event query function (100% accuracy, <1 second).
 - **Integration:** Verify filter-to-list display.
 - **System:** Test filtering (e.g., Chess Club, May 2025).
 - **UAT:** 50 students test calendar (90% find it useful, survey: 60% want calendar).
- **Success Criteria:** 100% event accuracy, <1-second load, 90%+ usability satisfaction.

5. Reminders

- **Implementation:**
 - Tkinter label (red #FF0000) or pop-up 24 hours before events.
 - Timer logic checks D2 for upcoming events.
 - Weeks 6-8: Develop timer, notification display.
- **Testing:**
 - **Unit:** Test timer accuracy (100% event detection).

- **Integration:** Verify event-to-notification display.
- **System:** Test reminder for multiple events (e.g., 5 clubs).
- **UAT:** 50 students test reminders (90% find them helpful, survey: 85% want reminders).
- **Success Criteria:** 100% notification accuracy, <1-second display, 90%+ satisfaction.

6. User Profile

- **Implementation:**
 - Tkinter entry fields (name, year level, password), “Save Changes” button.
 - Updates D1 (<1 second), queries D2 for clubs.
 - Weeks 7-9: Develop form, CSV I/O.
- **Testing:**
 - **Unit:** Test profile update function (100% accuracy).
 - **Integration:** Verify form-to-CSV interaction.
 - **System:** Test editing name/password, viewing clubs.
 - **UAT:** 50 students test profile (90% find it intuitive, survey: 60% want personalization).
 - **Security:** Verify encrypted D1 (Privacy Act 1988).
- **Success Criteria:** 100% data integrity, <1-second save, 90%+ usability satisfaction.

Club Leader Interface

1. Member Management

- **Implementation:**
 - Tkinter Treeview (400x300px) for rosters, search bar (quicksort, <1 second).
 - “Add/Remove Member” buttons update D2.
 - Weeks 5-7: Develop Treeview, quicksort, CSV I/O.
- **Testing:**
 - **Unit:** Test quicksort (100% accuracy, <1 second for 300 users).
 - **Integration:** Verify search-to-roster display.
 - **System:** Test adding/removing members (e.g., 50 members).
 - **UAT:** 5 leaders test management (90% find it efficient, survey: 70% want efficiency).
 - **Stress:** Test 300 members (<2 seconds).
- **Success Criteria:** 100% data accuracy, <2-second update, 90%+ satisfaction.

2. Attendance Recording

- **Implementation:**
 - Tkinter checkboxes in Treeview, date dropdown.
 - Saves to D3 (<2 seconds), undo option.

- Weeks 5-7: Develop checkboxes, CSV I/O.
- **Testing:**
 - **Unit:** Test attendance save function (100% accuracy).
 - **Integration:** Verify checkbox-to-CSV interaction.
 - **System:** Test marking attendance for 50 members.
 - **UAT:** 5 leaders test recording (90% find it fast, observation: 10-15 minutes manual effort).
 - **Security:** Verify encrypted D3 (IPP 4).
- **Success Criteria:** 100% data integrity, <2-second save, 90%+ satisfaction.

3. Event Notifications

- **Implementation:**
 - Tkinter form for custom messages, “Send” button.
 - Saves to D2, triggers notifications (DFD: 4.0).
 - Weeks 6-8: Develop form, notification logic.
- **Testing:**
 - **Unit:** Test message save function (100% accuracy).
 - **Integration:** Verify form-to-notification delivery.
 - **System:** Test sending to 50 members.
 - **UAT:** 5 leaders test notifications (90% find them effective, interview: need participation).
- **Success Criteria:** 100% delivery accuracy, <1-second send, 90%+ satisfaction.

4. Club Analytics

- **Implementation:**
 - Tkinter labels for attendance rates, CSV export.
 - Queries D2, D3 (<1 second).
 - Weeks 8-10: Develop labels, query logic.
- **Testing:**
 - **Unit:** Test query function (100% accuracy).
 - **Integration:** Verify query-to-label display.
 - **System:** Test analytics for 10 clubs.
 - **UAT:** 5 leaders test analytics (90% find them useful, interview: need insights).
- **Success Criteria:** 100% data accuracy, <1-second load, 90%+ satisfaction.

5. Communication Tools

- **Implementation:**
 - Tkinter text field for messages, template dropdown.
 - Saves to D2, sends to members.
 - Weeks 8-10: Develop form, messaging logic.
- **Testing:**
 - **Unit:** Test message send function (100% accuracy).
 - **Integration:** Verify form-to-delivery.

- **System:** Test group messaging (e.g., 50 members).
- **UAT:** 5 leaders test messaging (90% find it clear, observation: email overuse).
- **Success Criteria:** 100% delivery accuracy, <1-second send, 90%+ satisfaction.

Admin/GWSC Committee Interface

1. Dashboard

- **Implementation:**
 - Tkinter labels for stats (members, attendance), Treeview for clubs.
 - Queries D2, D3 (<1 second).
 - Weeks 9-11: Develop labels, Treeview.
- **Testing:**
 - **Unit:** Test stat query function (100% accuracy).
 - **Integration:** Verify query-to-label display.
 - **System:** Test dashboard for 10 clubs, 300 members.
 - **UAT:** 2 admins test dashboard (90% find it clear, interview: need insights).
- **Success Criteria:** 100% data accuracy, <1-second load, 90%+ satisfaction.

2. Reports

- **Implementation:**
 - Tkinter button for CSV export, filter dropdowns.
 - Exports D2, D3 (<3 seconds, DFD: 5.0).
 - Weeks 9-11: Develop export function, filters.
- **Testing:**
 - **Unit:** Test CSV export (100% accuracy).
 - **Integration:** Verify filter-to-export.
 - **System:** Test export for 300 members, 10 clubs.
 - **UAT:** 2 admins test reports (95% Compass compatibility, interview).
 - **Interoperability:** Verify CSV in Compass (100% compatibility).
- **Success Criteria:** 100% export accuracy, <3-second export, 95%+ satisfaction.

3. Club Management

- **Implementation:**
 - Tkinter form for CRUD operations on clubs (D2).
 - Dropdown for leader assignment.
 - Weeks 9-11: Develop form, CSV I/O.
- **Testing:**
 - **Unit:** Test CRUD functions (100% accuracy).
 - **Integration:** Verify form-to-CSV interaction.
 - **System:** Test creating/editing 10 clubs.
 - **UAT:** 2 admins test management (90% find it flexible, interview).
 - **Security:** Verify encrypted D2 (Privacy Act 1988).

- **Success Criteria:** 100% data integrity, <2-second update, 90%+ satisfaction.

4. User Management

- **Implementation:**
 - Tkinter form for user CRUD, password reset.
 - Updates D1, logs actions.
 - Weeks 9-11: Develop form, CSV I/O.
- **Testing:**
 - **Unit:** Test user update function (100% accuracy).
 - **Integration:** Verify form-to-CSV interaction.
 - **System:** Test adding/editing 300 users.
 - **UAT:** 2 admins test management (90% find it secure, survey: 95% prioritize security).
 - **Security:** Verify encrypted D1, audit logs (Privacy Act 1988).
- **Success Criteria:** 100% data integrity, <2-second update, 90%+ satisfaction.

5. System Settings

- **Implementation:**
 - Tkinter dropdowns for backups, reminders.
 - Saves to config CSV (<1 second).
 - Weeks 1-6: Develop form, file I/O.
- **Testing:**
 - **Unit:** Test config save function (100% accuracy).
 - **Integration:** Verify form-to-config interaction.
 - **System:** Test backup/reminder settings.
 - **UAT:** 2 admins test settings (90% find it flexible, interview).
 - **Reliability:** Verify daily backups (100% success).
- **Success Criteria:** 100% config accuracy, <1-second save, 90%+ satisfaction.

Brainstorming Features

1. Gamified Progress Bar (Student)

- **Implementation:**
 - Tkinter canvas for bar (green #00FF00 to red #FF0000).
 - Queries D3 for attendance % (<1 second).
 - Weeks 6-8: Develop canvas, query logic.
- **Testing:**
 - **Unit:** Test bar update function (100% accuracy).
 - **Integration:** Verify query-to-canvas display.
 - **System:** Test bar for 50 students.
 - **UAT:** 50 students test bar (90% find it engaging, survey: 60% check weekly).
- **Success Criteria:** 100% accuracy, <1-second update, 90%+ satisfaction.

2. Bulk Attendance Upload (Leader)

- **Implementation:**
 - Tkinter file dialog for CSV import.
 - Validates schema, updates D3 (<2 seconds).
 - Weeks 4-8: Develop import function, validation.
- **Testing:**
 - **Unit:** Test import function (100% accuracy).
 - **Integration:** Verify import-to-D3 interaction.
 - **System:** Test 300 records import.
 - **UAT:** 5 leaders test upload (90% find it efficient, survey: 70% want efficiency).
- **Success Criteria:** 100% data integrity, <2-second import, 90%+ satisfaction.

3. Audit Log (Admin)

- **Implementation:**
 - Tkinter table for logs (timestamp, user, action).
 - Saves to CSV (<1 second).
 - Weeks 8-10: Develop table, logging logic.
- **Testing:**
 - **Unit:** Test log save function (100% accuracy).
 - **Integration:** Verify action-to-log recording.
 - **System:** Test logs for 100 actions.
 - **UAT:** 2 admins test logs (90% find it secure, survey: 95% prioritize security).
 - **Security:** Verify encrypted logs (Privacy Act 1988).
- **Success Criteria:** 100% log accuracy, <1-second save, 90%+ satisfaction.

4. Tutorial Mode (General)

- **Implementation:**
 - Tkinter pop-ups for tooltips on first login.
 - Saves completion to D1.
 - Weeks 6-8: Develop pop-ups, logic.
- **Testing:**
 - **Unit:** Test tooltip display function (100% accuracy).
 - **Integration:** Verify tooltip-to-D1 interaction.
 - **System:** Test tutorial for login, club selection.
 - **UAT:** 50 students test tutorial (90% find it helpful, survey: 90% prefer GUIs).
- **Success Criteria:** 100% display accuracy, <1-second load, 90%+ satisfaction.

5. Deferred Features (e.g., Dark Mode, Mobile Support):

- **Implementation:**
 - Planned for post-project (week 16+).

- Dark Mode: Tkinter style changes (gray #333333 theme).
- Mobile: Requires new framework (e.g., Kivy, infeasible now).
- **Testing:**
 - **Unit:** Test style changes (dark mode, 100% widget coverage).
 - **System:** Test on simulated mobile (future).
 - **UAT:** Plan for 50 students post-project (90% satisfaction target).
- **Success Criteria:** Deferred, noted for future iterations (study design: Page 63).

Non-Functional Requirements: Testing and Implementation

1. Usability

- **Implementation:**
 - Large buttons (120x40px), clear fonts (Calibri 12-16pt).
 - Error prevention (validation, undo options).
 - Weeks 1-12: Apply across all GUIs.
- **Testing:**
 - **UAT:** 50 students, 5 leaders, 2 admins test GUIs (85%+ satisfaction, survey: 90% prefer GUIs).
 - **System:** Measure task completion (<30 seconds for login, club selection).
 - **Accessibility:** Verify with WAVE tool (100% WCAG 2.1 Level AA).
- **Success Criteria:** 85%+ satisfaction, <30-second tasks, 100% WCAG compliance.

2. Performance

- **Implementation:**
 - Optimize binary search (<1 second), quicksort (<1 second), CSV I/O (<2 seconds).
 - Limit memory usage (<100 MB).
 - Weeks 1-12: Profile and optimize code.
- **Testing:**
 - **Performance:** Measure load times (<1.5 seconds, 99% cases), query times (<2 seconds).
 - **Stress:** Simulate 500 users (linear scaling, <2-second responses).
 - **System:** Verify on school PCs (4GB RAM).
- **Success Criteria:** <1.5-second load, <100 MB memory, 500-user scalability.

3. Reliability

- **Implementation:**
 - Daily CSV backups (verified in testing).
 - Try-except blocks for all inputs.
 - Weeks 1-6: Implement backups, error handling.

- **Testing:**
 - **Reliability:** Test uptime (99% during 8 AM-4 PM).
 - **System:** Verify backup restoration (100% data recovery).
 - **Unit:** Test error handling (100% input coverage).
- **Success Criteria:** 99% uptime, 100% backup success, zero crashes in 99% tests.

4. Accessibility

- **Implementation:**
 - High-contrast mode ($\geq 4.5:1$ ratio).
 - Keyboard navigation (Tab, Enter for all elements).
 - Weeks 1-12: Apply WCAG 2.1 guidelines.
- **Testing:**
 - **Accessibility:** Use WAVE, NVDA (100% WCAG 2.1 Level AA).
 - **UAT:** Test with 5 students with disabilities (90% satisfaction).
 - **System:** Verify keyboard navigation (100% element coverage).
- **Success Criteria:** 100% WCAG compliance, 90%+ satisfaction.

5. Security

- **Implementation:**
 - AES-256 encryption for D1, D2, D3.
 - Role-based access (binary search on D1).
 - Audit logs for all actions.
 - Weeks 1-10: Implement encryption, access controls.
- **Testing:**
 - **Security:** Penetration test (zero vulnerabilities in 50+ tests).
 - **Unit:** Test encryption/decryption (100% accuracy).
 - **System:** Verify role restrictions (e.g., students can't access admin).
 - **UAT:** 2 admins verify security (95% confidence, survey: 95% prioritize security).
- **Success Criteria:** Zero vulnerabilities, 100% encryption compliance, Privacy Act 1988 adherence.

6. Maintainability

- **Implementation:**
 - Modular code (GUI, logic, data layers).
 - PEP 8 compliance, 100% docstrings.
 - Developer guide for IT staff.
 - Weeks 1-16: Apply coding standards, document.
- **Testing:**
 - **Unit:** Verify modularity (100% function independence).
 - **System:** Test feature updates (<4 hours implementation).
 - **UAT:** IT staff review guide (90% satisfaction).
- **Success Criteria:** 100% PEP 8 compliance, <4-hour updates, 90%+ satisfaction.

7. Interoperability

- **Implementation:**
 - Standard CSV schema for Compass compatibility.
 - Export functions for D2, D3.
 - Weeks 9-11: Develop exports.
- **Testing:**
 - **Interoperability:** Test CSV in Compass (100% compatibility in 50+ tests).
 - **System:** Verify export accuracy (300 members, 10 clubs).
 - **UAT:** 2 admins test exports (95% satisfaction, interview).
- **Success Criteria:** 100% Compass compatibility, 95%+ satisfaction.

8. Scalability

- **Implementation:**
 - Optimize algorithms (binary search, quicksort).
 - Linear CSV I/O scaling for 500 users.
 - Weeks 1-12: Optimize data handling.
- **Testing:**
 - **Stress:** Simulate 500 users (<2-second responses).
 - **Performance:** Verify query times (<2 seconds for 500 users).
 - **System:** Test on school PCs (4GB RAM).
- **Success Criteria:** Linear scaling, <2-second responses for 500 users.

9. User Engagement

- **Implementation:**
 - Reminders, progress bar for engagement.
 - Track usage via logs (D1).
 - Weeks 6-10: Develop engagement features.
- **Testing:**
 - **UAT:** 50 students test engagement (80%+ weekly usage, survey: 60% check weekly).
 - **System:** Verify session times (>2 minutes average).
 - **Unit:** Test log accuracy (100% usage tracking).
- **Success Criteria:** 80%+ weekly usage, >2-minute sessions, 90%+ satisfaction.

Constraints: Testing and Implementation

1. Economic Constraints

- **Implementation:**
 - Use free tools (Python, Tkinter).
 - 1-2 developers, 16-week timeline.
 - Weeks 1-16: Prioritize high-impact features (student/leader GUIs).
- **Testing:**

- **System:** Verify timeline adherence (100% completion by week 16).
- **UAT:** Ensure stakeholder satisfaction (85%+ for prioritized features).
- **Success Criteria:** 100% timeline adherence, no external costs.

2. Technical Constraints

- **Implementation:**
 - Tkinter for GUI, CSV for storage, no internet.
 - Optimize for school PCs (4GB RAM, 1024x768).
 - Weeks 1-12: Develop within constraints.
- **Testing:**
 - **Performance:** Verify on school PCs (<1.5-second load, <100 MB memory).
 - **System:** Test offline operation (100% functionality).
- **Success Criteria:** 100% constraint compliance, <1.5-second load.

3. Legal Constraints

- **Implementation:**
 - AES-256 encryption for D1, D2, D3.
 - Role-based access, audit logs.
 - Weeks 1-10: Implement security measures.
- **Testing:**
 - **Security:** Penetration test (zero vulnerabilities).
 - **System:** Verify compliance (Privacy Act 1988, IPP 4, Disability Discrimination Act 1992).
- **Success Criteria:** 100% legal compliance, zero vulnerabilities.

4. Social Constraints

- **Implementation:**
 - Intuitive GUIs for tech skills 3/5 (students), 4/5 (leaders/admins).
 - Accessible for ages 12-18, cultural diversity.
 - Weeks 1-12: Design for inclusivity.
- **Testing:**
 - **UAT:** Test with diverse students (90% satisfaction, survey: 90% prefer GUIs).
 - **Accessibility:** Verify WCAG 2.1, cultural neutrality (100% compliance).
- **Success Criteria:** 90%+ satisfaction, 100% inclusivity compliance.

5. Operational Constraints

- **Implementation:**
 - Ensure 99% uptime, daily backups.
 - Scale to 500 users.
 - Weeks 1-12: Implement reliability measures.
- **Testing:**
 - **Reliability:** Test uptime (99% during school hours).

- **Stress:** Verify 500-user scalability (<2-second responses).
- **Success Criteria:** 99% uptime, 100% backup success, 500-user scalability.

Alternative Designs: Testing and Implementation

Student Dashboard

1. Compact Design (600x400px)

- **Implementation:**
 - Smaller widgets (listbox 150x200px, buttons 100x30px).
 - Weeks 3-5: Develop compact layout.
- **Testing:**
 - **Performance:** Verify <1-second load on 800x600 PCs.
 - **UAT:** 50 students test usability (85% satisfaction).
 - **System:** Test core functions (login, club selection).
- **Success Criteria:** <1-second load, 85%+ satisfaction.

2. Spacious Design (1000x800px)

- **Implementation:**
 - Larger widgets (listbox 250x400px, buttons 150x50px).
 - Add progress bar (canvas widget).
 - Weeks 6-8: Develop spacious layout.
- **Testing:**
 - **Performance:** Verify <2-second load on modern PCs.
 - **UAT:** 50 students test engagement (90% satisfaction).
 - **System:** Test progress bar (100% accuracy).
- **Success Criteria:** <2-second load, 90%+ satisfaction.

3. Minimalist Design (400x300px)

- **Implementation:**
 - Basic widgets (listbox 100x150px, button 80x30px).
 - Weeks 3-5: Develop minimalist layout.
- **Testing:**
 - **Performance:** Verify <0.5-second load.
 - **UAT:** 50 students test simplicity (85% satisfaction).
 - **System:** Test login, club selection.
- **Success Criteria:** <0.5-second load, 85%+ satisfaction.

Club Leader Attendance Tracker

1. Compact Design (600x400px)

- **Implementation:**
 - Smaller table (300x200px), single button (100x30px).
 - Weeks 5-7: Develop compact layout.
- **Testing:**
 - **Performance:** Verify <1-second load.
 - **UAT:** 5 leaders test efficiency (85% satisfaction).
 - **System:** Test attendance tracking.
- **Success Criteria:** <1-second load, 85%+ satisfaction.

2. Feature-Rich Design (1000x800px)

- **Implementation:**
 - Expanded table (500x400px), bulk upload button.
 - Weeks 5-8: Develop feature-rich layout.
- **Testing:**
 - **Performance:** Verify <2-second load.
 - **UAT:** 5 leaders test features (90% satisfaction).
 - **System:** Test bulk upload, analytics.
- **Success Criteria:** <2-second load, 90%+ satisfaction.

3. Minimalist Design (400x300px)

- **Implementation:**
 - Small table (200x150px), single button (80x30px).
 - Weeks 5-7: Develop minimalist layout.
- **Testing:**
 - **Performance:** Verify <0.5-second load.
 - **UAT:** 5 leaders test speed (85% satisfaction).
 - **System:** Test attendance tracking.
- **Success Criteria:** <0.5-second load, 85%+ satisfaction.

Admin Dashboard

1. Compact Design (600x400px)

- **Implementation:**
 - Single stat, small table (300x150px), one button.
 - Weeks 9-11: Develop compact layout.
- **Testing:**
 - **Performance:** Verify <1-second load.
 - **UAT:** 2 admins test reporting (85% satisfaction).
 - **System:** Test CSV export.
- **Success Criteria:** <1-second load, 85%+ satisfaction.

2. Data-Heavy Design (1000x800px)

- **Implementation:**

- Expanded table (500x300px), chart (canvas widget).
 - Weeks 9-11: Develop data-heavy layout.
 - **Testing:**
 - **Performance:** Verify <2-second load.
 - **UAT:** 2 admins test visualization (90% satisfaction).
 - **System:** Test chart, user management.
 - **Success Criteria:** <2-second load, 90%+ satisfaction.
3. **Minimalist Design (400x300px)**
- **Implementation:**
 - Single stat, one button (80x30px).
 - Weeks 9-11: Develop minimalist layout.
 - **Testing:**
 - **Performance:** Verify <0.5-second load.
 - **UAT:** 2 admins test simplicity (85% satisfaction).
 - **System:** Test CSV export.
 - **Success Criteria:** <0.5-second load, 85%+ satisfaction.

Additional Sketches (Event Calendar, User Profile, System Settings)

1. **Event Calendar**
- **Implementation:**
 - List view (400x400px), filter dropdowns.
 - Weeks 6-8: Develop list, filtering logic.
 - **Testing:**
 - **Unit:** Test filter function (100% accuracy).
 - **System:** Test event display (10 clubs).
 - **UAT:** 50 students test calendar (90% satisfaction).
 - **Success Criteria:** <1-second load, 90%+ satisfaction.
2. **User Profile**
- **Implementation:**
 - Entry fields (200x30px), “Save” button.
 - Weeks 7-9: Develop form, CSV I/O.
 - **Testing:**
 - **Unit:** Test update function (100% accuracy).
 - **System:** Test editing profile, viewing clubs.
 - **UAT:** 50 students test profile (90% satisfaction).
 - **Success Criteria:** <1-second save, 90%+ satisfaction.
3. **System Settings**

- **Implementation:**
 - Dropdowns (150x30px), “Apply” button.
 - Weeks 1-6: Develop form, config I/O.
- **Testing:**
 - **Unit:** Test config save (100% accuracy).
 - **System:** Test backup/reminder settings.
 - **UAT:** 2 admins test settings (90% satisfaction).
- **Success Criteria:** <1-second save, 90%+ satisfaction.

Future Enhancements

- **Implementation:**
 - Post-project (week 16+): Dark mode, mobile support, interactive charts.
 - Requires additional resources (e.g., Kivy for mobile, matplotlib for charts).
- **Testing:**
 - **Unit:** Test new features (100% accuracy).
 - **UAT:** Plan for 50 students, 5 leaders, 2 admins (90% satisfaction).
 - **System:** Test on new platforms (e.g., mobile).
- **Success Criteria:** Deferred, 90%+ satisfaction in future iterations (study design: Page 63).

Timeline and Resource Allocation

- **Weeks 1-4:** Core (login, club selection, CSV storage), 60% effort.
- **Weeks 5-8:** Attendance, reminders, leader features, 25% effort.
- **Weeks 9-12:** Admin features, beta testing, 10% effort.
- **Weeks 13-16:** Refinements, documentation, 5% effort.
- **Resources:** 1-2 developers, school PCs, Python/Tkinter, Git, no budget for external tools.
- **Beta Testing:** Weeks 10-12, 50 students, 5 leaders, 2 admins, IT staff.

Rationale

This addendum provides an exhaustive plan for testing and implementing every functional requirement (e.g., login, attendance, reports), non-functional requirement (e.g., usability, security), feature (e.g., progress bar, audit log), constraint (e.g., technical, legal), and alternative design (e.g., compact, spacious) for the GWSC School Club Membership Manager. It aligns with SRS, stakeholder needs (surveys, observations, interviews), and VCE study design (Pages 17, 54, 58, 63), ensuring a user-centered, compliant, and efficient system. Detailed testing methodologies (unit, integration, UAT, stress, accessibility, security) and implementation strategies (modular coding, iterative development) guarantee robust functionality, performance (<1.5-second load), reliability (99% uptime), and accessibility (WCAG 2.1). The 16-week

timeline prioritizes high-impact features while noting deferred enhancements (e.g., mobile support) for future iterations, supporting development, beta testing (weeks 10-12), and evaluation in Unit 4 with 85%+ stakeholder satisfaction and 100% compliance with legal/technical constraints.

Addendum: Comprehensive Testing Plan for GWSC School Club Membership Manager

This addendum outlines the testing strategy for the GWSC School Club Membership Manager, ensuring all functional and non-functional requirements are validated for the six interfaces: Student Dashboard, Club Leader Attendance Tracker, Admin Dashboard, Event Calendar, User Profile, and System Settings. The table below details each test, including the component, test type, description, tools, metrics, acceptance criteria, and testing phase, aligning with the Software Requirements Specification (SRS), stakeholder needs (90% prefer GUIs, 85% want reminders, 70% want efficient attendance), VCE Applied Computing Study Design (Pages 17, 54, 58, 63), technical constraints (Python 3.8, Tkinter, 4GB RAM PCs, offline CSV storage), legal requirements (Privacy Act 1988, Privacy and Data Protection Act 2014, AES-256 encryption), and accessibility standards (WCAG 2.1). Testing occurs across unit, integration, system, user acceptance, performance, accessibility, security, and stress testing phases, conducted in weeks 10-14 of the 16-week timeline.

Interface	Component/Feature	Test Type	Test Description	Tools	Metrics	Acceptance Criteria	Testing Phase
Student Dashboard	Login	Unit	Test binary search on User Data CSV (D1) with valid/invalid credentials.	unitest	Accuracy: 100%	Correctly authenticates valid users, rejects invalid ones in <1 second.	Weeks 10-11

Student Dashboard	Login	Integration	Verify login redirects to dashboard and loads user data from D1.	unit test	Success rate: 100%	Seamless transition to dashboard, data loaded in <1.5 seconds.	Weeks 11-12
Student Dashboard	Club Selection	Unit	Test listbox selection saves to Club Data CSV (D2) with validation.	unit test	Accuracy: 100%	Saves valid selections, rejects invalid (e.g., empty) in <2 seconds.	Weeks 10-11
Student Dashboard	Club Selection	System	End-to-end: login, select club, verify D2 update.	Manual, unit test	Success rate: 100%	Club selection updates D2 accurately in <3 seconds.	Weeks 12-13
Student Dashboard	Reminders	Unit	Test reminder display from D2 for events within 24 hours.	unit test	Accuracy: 100%	Displays correct reminders in <1 second.	Weeks 10-11
Student Dashboard	Reminders	UAT	50 students verify reminder visibility and usability.	Survey, stopwatch	Satisfaction: 85%+	85%+ rate reminders as clear, displayed in <1.5 seconds.	Weeks 13-14
Student Dashboard	Usability	UAT	50 students complete tasks (login, select club, view reminders).	Survey, stopwatch	Satisfaction: 85%+, Time: <2 min	85%+ find interface intuitive, tasks completed in <2 minutes.	Weeks 13-14

Student Dashboard	Performance	Performance	Measure load time and memory usage on 4GB RAM PC.	<code>time</code> , <code>psutil</code>	Load time: <1.5s, Memory: <100 MB	Loads in <1.5 seconds, uses <100 MB memory.	Weeks 12-13
Student Dashboard	Accessibility	Accessibility	Verify WCAG 2.1 compliance (contrast, keyboard navigation).	WAVE, manual	Compliance: 100%	4.5:1 contrast ratio, fully keyboard-navigable.	Weeks 12-13
Student Dashboard	Security	Security	Test AES-256 encryption of D1 and role-based access.	<code>hashlib</code> , manual	Vulnerabilities: 0	100% encryption success, only students access dashboard.	Weeks 12-13
Club Leader Attendance Tracker	Attendance Logging	Unit	Test checkbox saves to Attendance Data CSV (D3) with validation.	<code>unitest</code>	Accuracy: 100%	Saves valid attendance, rejects invalid (e.g., duplicates) in <2 seconds.	Weeks 10-11
Club Leader Attendance Tracker	Attendance Logging	System	End-to-end: select member, log attendance, verify D3 update.	Manual, <code>unitest</code>	Success rate: 100%	Attendance updates D3 accurately in <3 seconds.	Weeks 12-13
Club Leader	Member Search	Unit	Test quicksort search on D3	<code>unitest</code>	Accuracy: 100%, Time: <1s	Returns correct results in <1 second.	Weeks 10-11

Attendance Tracker			for 300 members.				
Club Leader Attendance Tracker	Member Search	Stress	Test search with 300 simultaneous queries.	<code>unitest</code> , script	Time: <2s	Maintains <2-second response for 300 users.	Weeks 12-13
Club Leader Attendance Tracker	Reminders	Unit	Test reminder trigger for selected members.	<code>unitest</code>	Accuracy: 100%	Sends reminders accurately in <1 second.	Weeks 10-11
Club Leader Attendance Tracker	Usability	UAT	5 leaders complete tasks (log attendance, search, send reminders).	Survey, stopwatch	Satisfaction: 85%+, Time: <2 min	85%+ find interface efficient, tasks completed in <2 minutes.	Weeks 13-14
Club Leader Attendance Tracker	Performance	Performance	Measure load time and memory usage for 300 members.	<code>time</code> , <code>psutil</code>	Load time: <1.5s, Memory: <100 MB	Loads in <1.5 seconds, uses <100 MB memory.	Weeks 12-13
Club Leader Attendance Tracker	Interoperability	Integration	Verify CSV export compatibility with Compass.	Manual, Excel	Compatibility: 100%	CSV opens in Compass with 100% data integrity.	Weeks 12-13

Admin Dashboard	Stats Display	Unit	Test real-time stats from D2, D3 (e.g., total members, attendance rate).	<code>unitest</code>	Accuracy: 100%	Displays correct stats in <1 second.	Weeks 10-11
Admin Dashboard	Report Generation	Unit	Test CSV export from D2, D3 with 100% accuracy.	<code>unitest</code>	Accuracy: 100%	Exports correct data in <3 seconds.	Weeks 10-11
Admin Dashboard	Report Generation	System	End-to-end: generate report, verify CSV content.	Manual, <code>unitest</code>	Success rate: 100%	Generates accurate CSV in <3 seconds.	Weeks 12-13
Admin Dashboard	Club Management	Unit	Test CRUD operations on D2 (add, edit, delete club).	<code>unitest</code>	Accuracy: 100%	Completes operations accurately in <2 seconds.	Weeks 10-11
Admin Dashboard	Usability	UAT	2 admins complete tasks (view stats, generate report, manage clubs).	Survey, stopwatch	Satisfaction: 85%+, Time: <3 min	85%+ find interface effective, tasks completed in <3 minutes.	Weeks 13-14
Admin Dashboard	Security	Security	Test role-based access (admin-only) and AES-256 encryption of D2, D3.	<code>hashlib</code> , manual	Vulnerabilities: 0	Only admins access dashboard, 100% encryption success.	Weeks 12-13

Admin Dashboard	Reliability	Stress	Test dashboard with 5 admins generating reports simultaneously.	Script, manual	Uptime: 99%	Maintains 99% uptime, <2-second response.	Weeks 12-13
Event Calendar	Event Display	Unit	Test event query from D2 for given date range.	unit test	Accuracy: 100%	Displays correct events in <1 second.	Weeks 10-11
Event Calendar	Filtering	Unit	Test club/date filters on D2 data.	unit test	Accuracy: 100%	Filters correctly in <1 second.	Weeks 10-11
Event Calendar	Usability	UAT	50 students filter and view events.	Survey, stopwatch	Satisfaction: 85%+, Time: <1 min	85%+ find calendar intuitive, tasks completed in <1 minute.	Weeks 13-14
Event Calendar	Performance	Performance	Measure load time for 100 events.	time, psutil	Load time: <1.5s, Memory: <100 MB	Loads in <1.5 seconds, uses <100 MB memory.	Weeks 12-13
User Profile	Profile Editing	Unit	Test updates to D1 (name, password) with validation.	unit test	Accuracy: 100%	Saves valid updates, rejects invalid (e.g., short password) in <1 second.	Weeks 10-11

User Profile	Club Viewing	Unit	Test query of joined clubs from D2.	unitest	Accuracy: 100%	Displays correct clubs in <1 second.	Weeks 10-11
User Profile	Usability	UAT	50 students edit profile and view clubs.	Survey, stopwatch	Satisfaction: 85%+, Time: <1 min	85%+ find interface intuitive, tasks completed in <1 minute.	Weeks 13-14
User Profile	Security	Security	Test AES-256 encryption of D1 updates.	hashlib , manual	Vulnerabilities: 0	100% encryption success, secure updates.	Weeks 12-13
System Settings	Backup Configuration	Unit	Test backup schedule saves to config CSV.	unitest	Accuracy: 100%	Saves valid schedule in <1 second.	Weeks 10-11
System Settings	Backup Execution	Integration	Verify daily backup of D1, D2, D3.	Manual, unitest	Success rate: 100%	Completes backup with 100% data integrity in <5 seconds.	Weeks 11-12
System Settings	Reliability	Stress	Test 30 consecutive backup cycles.	Script, manual	Success rate: 100%	100% backup success, 99% uptime.	Weeks 12-13

System Settings	Usability	UAT	2 admins configure settings.	Survey, stopwatch	Satisfaction: 85%+, Time: <1 min	85%+ find interface intuitive, tasks completed in <1 minute.	Weeks 13-14
All Interfaces	Accessibility	Accessibility	Verify WCAG 2.1 compliance across all GUIs (contrast, navigation).	WAVE, manual	Compliance: 100%	4.5:1 contrast ratio, fully keyboard-navigable.	Weeks 12-13
All Interfaces	Performance	Performance	Measure system-wide load time and memory on 4GB RAM PC.	<code>time</code> , <code>psutil</code>	Load time: <1.5s, Memory: <100 MB	All interfaces load in <1.5 seconds, use <100 MB memory.	Weeks 12-13
All Interfaces	Security	Security	Penetration test for vulnerabilities (e.g., SQL injection, unauthorized access).	Manual, <code>hashlib</code>	Vulnerabilities: 0	Zero vulnerabilities, 100% encryption success.	Weeks 12-13
All Interfaces	Reliability	Stress	Test system with 300 users across all interfaces.	Script, manual	Uptime: 99%	Maintains 99% uptime, <2-second response per interface.	Weeks 12-13

This testing plan ensures comprehensive validation of the GWSC School Club Membership Manager, meeting all SRS requirements, stakeholder expectations (90% GUI preference, 85% reminder need, 70% attendance efficiency), and study design criteria (Pages 17, 63). Tests are scheduled within weeks 10-14, using Python libraries (`unittest`, `time`, `psutil`, `hashlib`)

and manual tools (WAVE, surveys, Excel), ensuring feasibility within the 16-week timeline and technical constraints (Tkinter, 4GB RAM). Legal compliance (Privacy Act 1988, AES-256 encryption) and accessibility (WCAG 2.1) are fully addressed, with UAT targeting 85%+ stakeholder satisfaction.

Stakeholder Feedback Plan for GWSC School Club Membership Manager

This addendum documents the analysis and incorporation of stakeholder feedback to shape the design, development, and evaluation of the GWSC School Club Membership Manager, ensuring alignment with VCE Applied Computing Study Design (Page 62: user-centered design), Software Requirements Specification (SRS), and stakeholder needs (90% prefer GUIs, 85% want reminders, 70% want efficient attendance). It addresses Criterion 4 by demonstrating how feedback drives a user-centered approach.

Feedback Summary

- **Source:** Surveys (50 students, 5 club leaders, 2 admins), observations (30% forget meetings, 10-15 minutes manual attendance), interviews (admins need Compass-compatible reports).
- **Key Findings:**
 - 90% prefer graphical interfaces for usability (students: tech skills 3/5, leaders: 4/5).
 - 85% want reminders to address forgetfulness (30% miss meetings).
 - 70% prioritize efficient attendance tracking (leaders: 10-15 minutes manual effort).
 - 60% want calendar access for event planning.
 - 95% prioritize data security (Privacy Act 1988 compliance).
 - 80% value data safety and reliability (daily backups).

Incorporation Plan

- **Design (Weeks 1-4):**
 - Use CustomTkinter for GUIs with gold #FFD700 buttons, blue #003087 backgrounds, and Calibri 12-20pt fonts (90% GUI preference).
 - Implement reminders with red #FF0000 pop-ups, 24-hour triggers (85% need).

- Design attendance trackers with quicksort search (<1s) and checkboxes (70% efficiency need).
 - Include event calendar with filterable grid view (60% calendar need).
 - Ensure WCAG 2.1 compliance (4.5:1 contrast, keyboard navigation) and AES-256 encryption (95% security priority).
- **Development** (Weeks 5-12):
 - Prioritize student dashboard (login, club selection, reminders) and leader attendance tracker (checkboxes, search) for high-impact features (90% GUI, 70% efficiency).
 - Implement CSV exports for Compass compatibility (admin interviews).
 - Use modular code with try-except blocks for reliability (80% data safety).
- **Evaluation** (Weeks 13-14):
 - Conduct UAT with 50 students, 5 leaders, 2 admins, targeting 85%+ satisfaction (usability, efficiency).
 - Measure task completion times: <30s for login/club selection, <1 min for attendance logging.
 - Iterate based on feedback (e.g., adjust reminder timing if <85% satisfaction).
- **Feedback Iteration Log**:
 - Week 12: Beta testing with 20 students, 3 leaders; adjust button sizes if <90% find intuitive.
 - Week 14: Final UAT, refine calendar filters if <85% satisfaction.

Trade-offs and Justifications

- **Feature-Rich vs. Compact Designs:** Prioritized 800x600px GUIs over compact 600x400px to balance usability (90% GUI preference) and performance (<1.5s load on 4GB RAM).
- **Deferred Features:** Mobile support and dark mode deferred due to timeline (16 weeks) and Tkinter constraints, focusing on core SRS requirements (login, attendance, reporting).
- **Security vs. Complexity:** AES-256 encryption prioritized over complex features (e.g., two-way messaging) to meet 95% security priority and Privacy Act 1988.

This plan ensures stakeholder feedback drives a user-centered, compliant, and efficient system, with UAT validating 85%+ satisfaction and alignment with SRS and study design.

Future Iteration Note for GWSC School Club Membership Manager

This addendum outlines a plan for deferred features to support iterative development post-project, aligning with VCE Applied Computing Study Design (Page 63: iterative development) and addressing stakeholder desires (60% want mobile access, 60% check weekly for engagement). It ensures scalability and future relevance while maintaining focus on the 16-week timeline.

- **Mobile Support:** Seek funding in 2026 for iOS/Android apps, enabling responsive GUIs and USB-based desktop sync (60% want mobile access). Plan: Prototype with Kivy in 2026-2027, deploy by 2028.
- **Gamification:** Add badges (e.g., "10 meetings attended") and leaderboards post-project to boost engagement (60% check weekly). Plan: Implement in Tkinter by Q3 2025, test with 50 students.
- **Interactive Visualizations:** Integrate matplotlib for admin charts (e.g., attendance trends) with future hardware upgrades (admin interview: visualization need). Plan: Develop in 2026, test with 2 admins.

These iterations will leverage future resources (funding, upgraded PCs) to enhance usability, engagement, and oversight, building on the current system's robust foundation (SRS compliance, 85%+ UAT satisfaction).

Writeup Addressing Criterion 4

This writeup addresses Criterion 4 of the VCE Applied Computing Study Design, which assesses students' skills in generating design ideas and developing evaluation criteria for the GWSC School Club Membership Manager. It demonstrates how design ideas were generated using ideation tools, annotated to explain appearance and functionality, evaluated against functional and non-functional requirements, and justified for further development. The writeup references relevant sections of this document (mind map, sketches, brainstorming, annotated GUI designs, and addendum) to evidence compliance, aligning with the Software Requirements Specification (SRS), stakeholder needs (90% prefer GUIs, 85% want reminders, 70% find attendance time-consuming), legal constraints (Privacy Act 1988, Privacy and Data Protection

Act 2014), accessibility standards (WCAG 2.1), and technical constraints (Python 3.8, Tkinter, desktop-only, no internet dependency). Placed after the conclusion, it summarizes how the project meets Criterion 4, with addendums following for further detail.

1. Generating Design Ideas Using Ideation Tools

Design ideas for the GWSC School Club Membership Manager were generated using a range of ideation tools to foster divergent thinking and capture stakeholder needs, as required by Criterion 4 and the VCE study design (Page 14). The **Expanded Brainstorming** section employed a hybrid session (in-person and virtual via Zoom and Miro whiteboard) with 10 stakeholders (4 students, 3 club leaders, 2 admins, 1 IT staff) to generate an exhaustive set of features, including gamified progress bars, bulk attendance uploads, and audit logs. Sticky notes on Miro and anonymous Google Forms submissions ensured inclusivity and diverse input. The **Mind Map** section used a digital mind map (created with Lucidchart) to structure ideas around user groups (students, leaders, admins) and constraints (technical, legal, economic), categorizing features like login, attendance tracking, and reporting. The **Expanded Sketches** section utilized hand-drawn and digital sketches (via Figma) to visualize six interfaces (Student Dashboard, Club Leader Attendance Tracker, Admin Dashboard, Event Calendar, User Profile, System Settings), incorporating stakeholder feedback (survey: 90% prefer GUIs). These tools—brainstorming, mind mapping, and sketching—aligned with user-centered design principles (study design: Page 62), capturing stakeholder needs (e.g., 85% want reminders) and SRS requirements, ensuring a robust foundation for ideation.

2. Annotating Design Ideas for Appearance and Functionality

Design ideas were annotated to explain the appearance and functionality of the software solution, focusing on at least three GUIs, as required by Criterion 4 and the study design (Page 58). The **Expanded Alternative Designs for Annotated GUI Designs** section provides detailed annotations for three primary GUIs—Student Dashboard, Club Leader Attendance Tracker, and Admin Dashboard—along with alternative layouts (compact, spacious, minimalist, feature-rich). Annotations cover:

- **Appearance:** Window sizes (e.g., 800x600px for Student Dashboard), colors (blue #003087, gold #FFD700, 4.5:1 contrast ratio), fonts (Calibri 12-20pt), and layout (e.g., left-aligned sidebar, centered main panel). Design principles like alignment, balance, contrast, and space ensure visual clarity (study design: Page 58).
- **Functionality:** Features like login (binary search on User Data CSV, <1 second), club selection (saves to Club Data CSV, <2 seconds), attendance tracking (checkboxes to Attendance Data CSV), and reporting (CSV export, <3 seconds). Annotations detail validation (existence/type checking), error handling (try-except blocks), and compliance with SRS.

- **UX Characteristics:** Affordance (raised buttons with hover effects), usability (large buttons for tech skills 3/5), and accessibility (keyboard navigation, WCAG 2.1).
- **Stakeholder Alignment:** Annotations link to survey data (90% prefer GUIs, 85% want reminders), observations (30% forget meetings), and interviews (admins need Compass-compatible reports).

Additional GUIs (Event Calendar, User Profile, System Settings) in the **Expanded Sketches** section are similarly annotated, ensuring comprehensive coverage. These annotations clarify how each GUI meets stakeholder needs, SRS requirements, and constraints (e.g., Privacy Act 1988, Tkinter limitations), providing a clear blueprint for development.

3. Developing Evaluation Criteria for Design Ideas and Software Solution

Evaluation criteria were developed to assess the design ideas and the final software solution, referencing functional and non-functional requirements, as required by Criterion 4 and the study design (Pages 17, 63). These criteria, detailed in the **Addendum: Testing and Implementation Plan**, measure the efficiency and effectiveness of the solution, to be used in Criterion 10 evaluation. The criteria are:

- **Functional Requirements:**
 - **Login/Authentication:** 100% accuracy, <1-second response, role-based access (Privacy Act 1988 compliance). Tested via unit tests (binary search) and UAT (50 students, 95% success rate).
 - **Club Selection:** 100% data integrity, <2-second save, 90%+ usability satisfaction. Tested via integration tests (listbox-to-CSV) and UAT (50 students).
 - **Attendance Tracking:** 100% data accuracy, <2-second save, 90%+ satisfaction. Tested via system tests (checkboxes for 50 members) and UAT (5 leaders).
 - **Reminders:** 100% notification accuracy, <1-second display, 90%+ satisfaction. Tested via integration tests (event-to-notification) and UAT (50 students).
 - **Reporting:** 100% export accuracy, <3-second export, 95% Compass compatibility. Tested via interoperability tests and UAT (2 admins).
- **Non-Functional Requirements:**
 - **Usability:** 85%+ stakeholder satisfaction, <30-second task completion (e.g., login, club selection). Measured via UAT (50 students, 5 leaders, 2 admins) and task time analysis.
 - **Performance:** <1.5-second GUI load, <2-second queries, <100 MB memory. Measured via performance tests on school PCs (4GB RAM).
 - **Reliability:** 99% uptime, 100% backup success, zero crashes in 99% tests. Tested via reliability tests (daily backups) and system tests.

- **Accessibility:** 100% WCAG 2.1 Level AA compliance (e.g., 4.5:1 contrast, keyboard navigation). Tested via WAVE tool and NVDA screen reader.
 - **Security:** Zero vulnerabilities, 100% encryption compliance (AES-256 for CSVs). Tested via penetration testing and unit tests.
 - **Scalability:** Linear scaling for 500 users, <2-second responses. Tested via stress tests (500 simultaneous users).
- **Efficiency Metrics:**
 - Task completion time (e.g., <30 seconds for attendance logging, addressing 10-15 minutes manual effort).
 - Query response time (e.g., <1 second for quicksort search on 300 users).
 - Load time (<1.5 seconds for all GUIs on 1024x768 school PCs).
- **Effectiveness Metrics:**
 - Stakeholder satisfaction (85%+ across students, leaders, admins, survey: 90% prefer GUIs).
 - Requirement fulfillment (100% SRS compliance for login, attendance, reporting).
 - Error rate (<1% for inputs, validated via try-except blocks).
 - Engagement (80%+ weekly usage, addressing 30% forgetting meetings).

These criteria, linked to SRS and stakeholder needs (surveys, observations, interviews), provide a measurable framework for evaluating design ideas (e.g., compact vs. spacious dashboards) and the final solution in Criterion 10, ensuring alignment with study design (Page 63).

4. Justifying Elements for Further Development

The selection of design elements for further development into detailed designs was justified based on stakeholder needs, SRS alignment, feasibility within the 16-week timeline, and evaluation criteria, as required by Criterion 4. The **Expanded Brainstorming** and **Expanded Alternative Designs for Annotated GUI Designs** sections prioritize high-impact elements, with justifications as follows:

- **Student Dashboard (Primary Design, 800x600px):**
 - **Justification:** Addresses survey (90% prefer GUIs, 85% want reminders) and observation (30% forget meetings) with intuitive login, club selection, and reminder features. Meets SRS functional requirements (login, club selection, reminders) and non-functional requirements (usability, <1.5-second load). Feasible with Tkinter, prioritized for weeks 1-5 due to high student usage (300 users). Compact alternative (600x400px) included for older PCs, but primary design balances usability and performance (UAT target: 90% satisfaction).
 - **Evidence:** Annotated GUI Designs, Addendum (testing plan for login, club selection).

- **Club Leader Attendance Tracker (Primary Design, 800x600px):**
 - **Justification:** Reduces manual effort (observation: 10-15 minutes) with checkboxes, quicksort search (<1 second), and reminders, addressing survey (70% want efficiency). Meets SRS (attendance tracking, notifications) and non-functional requirements (reliability, security via encrypted CSVs). Feasible for weeks 5-8, critical for 5-10 leaders managing 20-50 members. Feature-rich alternative (1000x800px) with bulk upload prioritized for efficiency (brainstorming idea), while compact design ensures compatibility with older PCs.
 - **Evidence:** Expanded Sketches, Brainstorming, Addendum (bulk upload testing).
- **Admin Dashboard (Primary Design, 800x600px):**
 - **Justification:** Supports oversight (interview: admins need reports, trends) with stats, CSV exports (<3 seconds), and club management, meeting SRS and interoperability requirements (95% Compass compatibility). Feasible for weeks 9-11, critical for 2-5 admins. Non-functional requirements (security, maintainability) met via encrypted CSVs and modular code. Compact design (600x400px) prioritized for minimal needs, while data-heavy alternative (1000x800px) deferred due to Tkinter complexity.
 - **Evidence:** Annotated GUI Designs, Addendum (reporting, security testing).
- **Additional Interfaces (Event Calendar, User Profile, System Settings):**
 - **Justification:** Event Calendar addresses survey (60% want calendar) and SRS (event display), feasible for weeks 6-8, enhancing engagement. User Profile supports personalization (survey: 60% want settings), feasible for weeks 7-9, meeting security requirements (Privacy Act 1988). System Settings enables backups and reminder customization (interview: admins need flexibility), critical for reliability (99% uptime), implemented in weeks 1-6. These are prioritized for their impact on usability and compliance.
 - **Evidence:** Expanded Sketches, Addendum (calendar, profile, settings testing).
- **Brainstorming Features (e.g., Gamified Progress Bar, Bulk Attendance Upload, Audit Log):**
 - **Justification:** Progress bar enhances engagement (survey: 60% check weekly), feasible for weeks 6-8. Bulk upload reduces leader effort (survey: 70% want efficiency), feasible for weeks 4-8. Audit log ensures security (survey: 95% prioritize security), feasible for weeks 8-10. These align with SRS and evaluation criteria (90%+ satisfaction), prioritized for high impact. Deferred features (e.g., dark mode, mobile support) rejected due to timeline and technical constraints (Tkinter, desktop-only), noted for future iterations (study design: Page 63).
 - **Evidence:** Expanded Brainstorming, Addendum (feature testing).
- **Deferred/Rejected Elements:**

- **Justification:** Features like dark mode, mobile support, and interactive charts were deferred due to high complexity (Tkinter limitations), timeline constraints (16 weeks), and lower priority compared to core SRS requirements (login, attendance, reporting). These are noted for post-project development with additional resources (study design: Page 63), ensuring focus on high-impact, feasible elements (e.g., student/leader GUIs, CSV storage).
- **Evidence:** Expanded Brainstorming, Addendum (deferred features).

The prioritization of primary designs, key features (e.g., progress bar, audit log), and additional interfaces balances stakeholder needs, SRS compliance, and feasibility, supported by evaluation criteria (e.g., 85%+ satisfaction, <1.5-second load). The **Addendum: Testing and Implementation Plan** ensures these elements are rigorously tested (unit, integration, UAT) and implemented (weeks 1-12), with beta testing (weeks 10-12) validating efficiency and effectiveness for Criterion 10.

Conclusion

This writeup demonstrates compliance with Criterion 4 by detailing the generation of design ideas using ideation tools (brainstorming, mind mapping, sketching), annotating three GUIs (Student Dashboard, Club Leader Attendance Tracker, Admin Dashboard) and additional interfaces for appearance and functionality, developing evaluation criteria tied to functional and non-functional requirements, and justifying elements for further development based on stakeholder needs, SRS, and feasibility. Referencing the **Mind Map**, **Expanded Sketches**, **Expanded Brainstorming**, **Expanded Alternative Designs for Annotated GUI Designs**, and **Addendum**, the project ensures a user-centered, compliant, and efficient design process, setting a strong foundation for development and evaluation in Unit 4.