**Software Quality Assurance (SQA) Plan**

**By Alok Aashish Vernekar**

**Date: September 14th, 2025**

**Signature Page**

**Prepared by: Alok Aashish Vernekar Date: 14th September, 2025**

**(Name)**

**Reviewed by 1: Aditya Anand Pramod Date: 15th September, 2025  
 <(Reviewer Name)>**

**Reviewed by 2: Akshar Dhruv Krishnan Date: 15th September, 2025  
 <(Reviewer Name)>**

**Reviewed by 2: Pratham Ranjan Date: 15th September, 2025  
 <(Reviewer Name)>**

**Approved by : Akshar Dhruv Krishnan Date: 17th September, 2025  
 (Name)**

**Approved by: Aditya Anand Pramod Date: 17th September,2025**

**Document Change Record**

| **Revision** | **Description of Change** | **Approved**  **by** | **Date** |
| --- | --- | --- | --- |
| **0.10** | **Initial Draft** | **Alok Aashish Vernekar** | **05/09/25** |
| **0.11** | **Final Draft** | **Alok Aashish Vernekar** | **14/09/25** |
| **0.12** | **Updating reference documents for final draft** | **Ananthan Srinath Adhvait** | **18/09/25** |
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# **Purpose and Scope**

## ***Purpose***

The purpose of this Software Quality Assurance (SQA) Plan is to establish the goals, processes, and responsibilities required to implement effective quality assurance functions for the TechDojo project.

The Software Quality Assurance Plan provides the framework necessary to ensure a consistent approach to software quality assurance throughout the project life cycle. It defines the approach that will be used by the QAM and Software Quality (SQ) personnel to monitor and assess software development processes and products to provide objective insight into the maturity and quality of the software. The systematic monitoring of products, processes, and services will be evaluated to ensure they meet requirements and comply with policies, standards, and procedures, as well as applicable Institute of Electrical and Electronic Engineers (IEEE) and ISO standards.

## ***Scope***

The purpose of SQA is to ensure that the software developed does not deviate from the original intended product. SQA is also concerned with identifying any errors, omissions, inconsistencies, and alternatives, enhancements or improvements that can be made at any stage of development.

TechDojo is a gamified coding education platform targeting beginner, intermediate, and advanced learners. The system includes web application (Next.js), mobile application (React Native), backend services (Python Django), real-time multiplayer games (WebSocket), and third-party API integrations (GitHub API, Groq AI). The project timeline is 3 months with prototype delivery in 1 month.

# **Reference Documents**

* IEEE STD 730-2002, IEEE Standard for Software Quality Assurance Plans (<http://standards.ieee.org/reading/ieee/std_public/description/se/730-2002_desc.html>)
* ISO IEC 90003:2004 Software Standard (<https://www.iso.org/obp/ui/#iso:std:iso-iec:90003:ed-1:v1:en>)
* TechDojo System Requirement Specifications (<https://docs.google.com/document/d/1ncB2ch7B0IXH4BRDvRUf8HOP4ulg6dMKkGcZvK84gdU/edit?tab=t.0> )
* Advanced Software Engineering CZ3002 Course Lab Requirements (<https://drive.google.com/file/d/1YzEcfhx3mihQKv_ergItQHBIekIEyXgj/view?usp=share_link>)

[Update the reference document list to include a list of project documents used or referenced in the development of this plan. This includes policies, standards, procedures, guidelines, and other similar documents. Note: the last documents listed are examples of project documents that you might include.]

# **Management**

This section describes the management organizational structure, its roles and responsibilities, and the software quality tasks to be performed.

## ***Management Organisation***

The implementation of the quality assurance system is the responsibility of the Quality Assurance Manager (QAM).

### **Project Management**

The Project Manager will be responsible for approving:-

* The system requirement specification document
* The overall time scale for the project
* The choice of system development life cycle
* The choice of software development tools and techniques utilised
* The selection of project teams
* The training of project teams

### **Assurance Management**

The QAM provides Project Management with visibility into the processes being used by the software development teams and the quality of the products being built. The QAM maintains a level of independence from the project and the software developers.

In support of software quality assurance activities, the QAM has assigned and secured Software Quality personnel from the pool of available SQ trainees to coordinate and conduct the SQ activities for the project and report back results and issues.

## ***Tasks***

This section summarizes the tasks (product and process assessments) to be performed during the development of software. These tasks are selected based on the developer’s Project Plan and planned deliverables, and identified reviews.

### **Product Assessments**

The following product assessments will be conducted by SQ personnel:

* User Authentication System (OAuth with GitHub/Google)
* Learning Pathway Components (Duolingo-style lessons, Blockly interface)
* Single-player Games (PyGame/React-based mini-games)
* Multiplayer DSA Competition System (real-time WebSocket battles)
* AI Chatbot ("Grokking the \_\_\_" system design helper)
* GitHub Profile Reviewer (career feedback component)
* Mobile Application (React Native cross-platform compatibility)
* Database Schema (user progress, streaks, leaderboards)

### **Process Assessments**

The following process assessments will be conducted by SQ personnel:

* Peer Review Process (as required by course Verification Process Area)
* Sprint Planning and Retrospective Process
* GitHub Integration and API Management Process
* Real-time Game Performance Monitoring Process

## ***Roles and Responsibilities***

This section describes the roles and responsibilities for each assurance person assigned to the Project.

### **QAM**

Responsibilities include, but are not limited to:

* Secure and manage SQ personnel resource levels
* Ensure that SQ personnel have office space and the appropriate tools to conduct SQ activities
* Provide general guidance and direction to the SQ personnel responsible for conducting software quality activities and assessments
* Assist SQ personnel in the resolution of any issues/concerns and/or risks identified as a result of software quality activities
* Escalate any issues/concerns/risks to project management

### **Software Quality Personnel**

Responsibilities include, but are not limited to:

* Develop and maintain the project software quality assurance plan
* Generate and maintain a schedule of software quality assurance activities
* Conduct process and product assessments, as described within this plan
* Identify/report findings, observations, and risks from all software assurance related activities to the QAM

# **Documents**

## ***Purpose***

This section identifies the minimum documentation governing the requirements, development, verification, validation, and maintenance of software that falls within the scope of this software quality plan. Each document below shall be assessed (reviewed) by SQ personnel.

## ***Minimum Document Requirements***

* TechDojo System Requirement Specifications
* Use Case Model
* Backlog
* Meeting Minutes

# **Standards, Practices, Conventions and Metrics**

## ***Purpose***

This section highlights the standards, practices, quality requirements, and metrics to be applied to ensure a successful software quality program.

## ***Software Quality Programme***

These practices and conventions are tools used to ensure a consistent approach to software quality for all programs/projects.

The four most important qualities that are deemed particularly important in this project are:

**Usability** - The platform must provide intuitive interfaces for learners across beginner, intermediate, and advanced skill levels. This includes clear navigation between Duolingo-style lessons, seamless transitions into coding games, and accessible drag-and-drop Blockly interfaces that don't overwhelm new programmers while still engaging experienced users.

**Performance** - Real-time multiplayer DSA battles require sub-200ms latency to maintain competitive fairness and user engagement. Additionally, the system must handle rapid WebSocket communications, support concurrent gaming sessions, and ensure smooth synchronization between web and mobile platforms without lag that would disrupt the learning experience.

**Reliability** - The platform must consistently handle multiple concurrent users without data corruption or loss of learning progress. User streaks, achievements, and competitive rankings must be preserved even during system updates or temporary outages. OAuth authentication and third-party API integrations must fail gracefully without compromising user accounts.

**Maintainability** - Code must remain manageable across the diverse technology stack spanning Next.js web frontend, React Native mobile application, Python Django backend, and real-time WebSocket services. Development practices must support rapid iteration during the 3-month timeline while ensuring new features don't break existing functionality across platforms.

#### 

### **Standard Metrics**

The following standard metrics are the minimum planned metrics that will be collected, reported, and maintained in the area of software quality assurance:

* Code Review Completion Rate (percentage of pull requests reviewed before merge)
* Real-time Game Response Time (WebSocket message round-trip latency in milliseconds)
* API Integration Uptime (percentage of successful third-party API calls to GitHub and Groq)
* Cross-platform Feature Parity (percentage of features working identically on web and mobile)
* Automated Test Coverage (percentage of codebase covered by unit and integration tests)
* User Story Completion Velocity (story points completed per sprint cycle)
* System Performance Under Load (concurrent users supported without degradation)

# **Software Reviews**

## ***Purpose***

This section identifies the number and type of system/subsystem reviews and engineering peer reviews that will be supported by the SQ Personnel. The project milestone chart, and the SQ Personnel resource levels determine the reviews that are supported.

## ***Minimum Software Reviews***

For each review, SQ will assess the review products to assure that review packages are being developed according to the specified criteria, the review content is complete, accurate, and of sufficient detail, and Requests for Action are captured, reviewed, and tracked to closure. In addition, SQ will assess the processes used to conduct the reviews to determine if appropriate personnel are in attendance, correct information is presented, entry and exit criteria are met, and appropriate documents are identified for update.

The following software reviews will be assessed by SQ:

* Project Plan Review
* Requirements Analysis Review
* Software Design Review
* Test Plan Review
* Acceptance Review

# **Test**

SQ personnel will assure that the test management processes and products are being implemented per Test Plan. This includes all types of testing of software system components as described in the test plan, specifically during integration testing (verification) and acceptance testing (validation). SQ personnel will monitor testing efforts to assure that test schedules are adhered to and maintained to reflect an accurate progression of the testing activities. SQ will assure that tests are conducted using approved test procedures and appropriate test tools, and that test anomalies are identified, documented, addressed, and tracked to closure. In addition, SQ will assure that assumptions, constraints, and test results are accurately recorded to substantiate the requirements verification/validation status. SQ personnel will review post-test execution related artifacts including test reports, test results, problem reports, updated requirements verification matrices, etc.

Testing will include validation of TechDojo's real-time multiplayer functionality, cross-platform synchronization between web and mobile applications, and third-party API integrations with GitHub and Groq AI services.

# **Problem Reporting and Corrective Action**

SQ personnel generate, track, and trend assessment findings and observations in Github Issues, which serves as our Reporting and Corrective Action System. It will be directly integrated with the project repository.

Testing will include validation of TechDojo's real-time multiplayer functionality, cross-platform synchronization between web and mobile applications, and third-party API integrations with GitHub and Groq AI services.

# **Tools, Techniques and Methodologies**

SQ personnel will require access to the following:

## ***Software Quality Tools***

* Microsoft Office tools (i.e., Word, Excel, and PowerPoint)
* GitHub (version control and code review workflow)
* GitHub Actions (continuous integration)
* Jest (unit testing for React components)
* Django Test Framework (backend API testing)
* Postman (API integration testing)

# **Media Control**

SQ deliverables will be documented in one of the following Microsoft software applications: Word, Excel, or PowerPoint. Deliverables will be in soft copy, with the exception of completed checklists from process and product assessments. See Section 12 for additional details on the collection and retention of key records. Software Quality personnel will request space on the project’s secured server for SQ records. This server is password protected and backed up nightly.

All project files will be maintained in the GitHub repository with version control and branch protection requiring code review. Configuration management of all deliverables including SQ Assessment Reports will be handled through GitHub's version control system.

# **Supplier Control**

Third-party service dependencies include GitHub API for OAuth user authentication and repository profile analysis functionality, Groq AI API for chatbot services, Google Cloud Run for backend hosting, and Vercel for frontend hosting. SQ personnel will monitor API usage limits, service availability, hosting uptime, and integration stability for these external service providers.

# **Record Collection, Maintenance, and Retention**

SQ personnel will maintain records that document assessments performed on the project. Maintaining these records will provide objective evidence and traceability of assessments performed throughout the project’s life cycle. There are two types of records that will be maintained: Hardcopy and Electronic. SQ personnel will maintain electronic or hard copies of all assessment reports and findings. SQ Project folders will contain hard copies of the assessment work products such as completed checklists, supporting objective evidence, and notes.

The table below identifies the record types that will be collected, as well as the Record Custodian and Retention period

| **Record Title** | **Record Custodian** | **Record Retention** |
| --- | --- | --- |
| SQA Assessments | SQ Personnel | One Year |
| SQA Checklists | SQ Personnel | One Year |
| Deliverable Defects | SQ Personnel | One Year |

# **Training**

SQ personnel have fundamental knowledge in the following areas through prior experience, training, or certification in methodologies, processes, and standards:

∙ Audits and Reviews (Assessments)

∙ Risk Management

∙ Software Assurance

∙ Configuration Management

∙ Software Engineering

∙ ISO 9001, ISO 9000-3

∙ CMMI

∙ Verification and Validation

# **Risk Management**

SQ personnel will assess the project’s risk management process and participate in weekly risk management meetings and report any software risks to the QAM and the project manager.

Key quality risks for TechDojo include real-time multiplayer performance not meeting <200ms latency requirement, third-party API rate limiting affecting GitHub and Groq AI integrations, and cross-platform synchronization issues between web and mobile applications.

# **SQA Plan Change Procedure and History**

SQ personnel are responsible for the maintenance of this plan. It is expected that this plan will be updated throughout the life cycle to reflect any changes in support levels and SQ activities. Proposed changes shall be submitted to the Quality Assurance Manager (QAM), along with supportive material justifying the proposed change.