Risk Management for Functional Testing

1 Overview

Functional tests are essential to ensure the elevator system operates as expected. This document outlines the risk management strategies for the functional tests, focusing on the scheduling and door control systems. Additionally, it includes other potential risks and mitigation strategies.

2 Scheduling System

2.1 Risks

1. **Incorrect Scheduling Algorithm Implementation**
   - **Impact**: The elevator might not pick up passengers efficiently, leading to delays and user frustration.
   - **Mitigation**: Implement comprehensive unit tests for the scheduling algorithm. Perform code reviews and pair programming during development.
2. **Concurrency Issues**
   - **Impact**: Simultaneous requests might cause race conditions, leading to incorrect elevator behavior.
   - **Mitigation**: Use thread-safe data structures and concurrency control mechanisms. Conduct stress testing to identify and fix concurrency issues.
3. **Edge Cases**
   - **Impact**: Unhandled edge cases, such as simultaneous opposite requests on the same floor, can lead to unexpected behavior.
   - **Mitigation**: Identify and document potential edge cases. Ensure test cases cover all identified edge cases.

2.2 Test Cases and Mitigation

- **TestCase1**: Both elevators start on the first floor, and a passenger presses the up button.
  - **Mitigation**: Ensure the algorithm assigns the nearest available elevator.
- **TestCase2**: An elevator is near a floor when a request is made.

  - **Mitigation**: The scheduling algorithm should reassign the closest elevator without causing significant delays.

- **TestCase3**: Multiple requests are made on the same floor with different directions.
  - **Mitigation**: Ensure the algorithm handles simultaneous requests correctly without prioritizing one direction unfairly.

- **TestCase4**: Simultaneous requests from different floors.
  - **Mitigation**: Ensure the algorithm distributes requests evenly among elevators to optimize efficiency.

- **TestCase5**: Requests from different floors with overlapping destinations.
  - **Mitigation**: Ensure the algorithm handles overlapping requests efficiently.

3 Door Control System

3.1 Risks

1. **Door Not Opening/Closing Properly**
   - **Impact**: Passengers might be unable to enter or exit, causing safety concerns and operational delays.
   - **Mitigation**: Implement fail-safes and sensors to detect and correct door malfunctions. Conduct regular maintenance checks.
2. **Door Obstruction Detection Failure**
   - **Impact**: The door might close on passengers, causing injuries.
   - **Mitigation**: Install and regularly test obstruction detection sensors. Implement an emergency stop mechanism.
3. **Simultaneous Door Control Commands**
   - **Impact**: Conflicting commands (e.g., open and close) might cause erratic door behavior.
   - **Mitigation**: Ensure door control logic prioritizes safety and resolves conflicting commands systematically.

3.2 Test Cases and Mitigation

- **TestCase1**: Passenger presses the up button and tries to open the door just before it closes.
  - **Mitigation**: Ensure the door reopens when the open button is pressed during closing.

- **TestCase2**: Passenger continuously presses the open button.
  - **Mitigation**: Ensure the door remains open as long as the button is pressed and closes only after a timeout.

- **TestCase3**: Passenger presses the close button while the door is opening.
  - **Mitigation**: Ensure the door completes the opening cycle before attempting to close.
- **TestCase4**: Simultaneous door open requests from inside and outside the elevator.
  - **Mitigation**: Ensure the door control system prioritizes opening for passenger safety.

4 Other Potential Risks

4.1 Electrical/Mechanical Failures

- **Impact**: Hardware failures can cause the elevator to become inoperable.
- **Mitigation**: Implement regular maintenance schedules and use high-quality components. Include redundancy in critical systems.

4.2 Power Outages

- **Impact**: Elevators may become stuck between floors, causing safety risks.
- **Mitigation**: Equip elevators with backup power systems and manual override options.

4.3 Software Bugs

- **Impact**: Unhandled exceptions or logic errors can cause the system to fail.
- **Mitigation**: Use thorough testing methodologies, including unit tests, integration tests, and code reviews. Implement logging and monitoring to quickly identify and resolve issues.

4.4 Security Vulnerabilities

- **Impact**: Unauthorized access to the control system can cause malicious actions.
- **Mitigation**: Implement robust authentication and encryption. Conduct regular security audits and penetration testing.

5 Conclusion

This risk management plan highlights the potential risks associated with the functional tests of the elevator system, particularly focusing on the scheduling and door control systems. By implementing the proposed mitigation strategies, we aim to minimize these risks and ensure a safe and efficient elevator operation. Regular reviews and updates to this plan will help address new risks and maintain the system's reliability.