**Test Plan for Bowling Game**

**Introduction**

The purpose of this test plan is to define the testing strategy, test objectives, risk assessment, test types, and approach for the backend of a 10-pin bowling game system developed in Python. The backend handles roll inputs and calculates final scores according to standard ten-pin bowling rules.

**Test Strategy**

We will adopt a **white-box unit testing strategy** since we have access to the internal logic. The focus is on correctness of score calculations for different bowling scenarios, including:

* Open frames
* Spares
* Strikes
* Consecutive strikes
* Tenth frame bonus rolls

Testing will be automated using **Python's unittest framework**.

**Risk Assessment**

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| --- | --- | --- | --- |
| Risk | Impact | Likelihood | Mitigation |
| Incorrect strike/spare logic | High | Medium | Write detailed unit tests for scoring rules |
| Index errors (list out-of-bounds) | Medium | High | Validate roll list length in tests |
| Incomplete frame handling | High | Medium | Explicit test cases for 10th frame bonus logic |
| Lack of code comments/documentation | Low | Medium | Use PythonDoc to document functions |

**Test Approach**

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| --- | --- | --- |
| Area | Test Type | Tools/Method |
| Score Calculation | Unit Testing | unittest |
| Frame Transitions | Unit Testing | Manual scenarios |
| Edge Cases | Unit Testing | Specific test data inputs |
| Bonus Roll Logic | Unit Testing | Simulated 10th frame rolls |

**Test Objectives**

* Verify that score calculation is accurate for:
  + Normal frames
  + Spares and strike bonuses
  + Edge cases (perfect game, all spares, all misses)
* Ensure roll inputs are correctly stored
* Validate 10-frame limit and proper handling of bonus rolls

**Exit Criteria**

* All unit tests pass with 100% functional coverage
* No unresolved bugs
* All documentation complete and correct

**Test Coverage Plan**

|  |  |
| --- | --- |
| Test Case | Description |
| TC1 | All zeros (gutter game) |
| TC2 | All ones (no spare or strike) |
| TC3 | One spare |
| TC4 | One strike |
| TC5 | Perfect game (12 strikes) |
| TC6 | All spares (10 frames with final bonus roll) |
| TC7 | Random mixed rolls with no spares/strikes |
| TC8 | Strike in the 10th frame with bonus rolls |
| TC9 | Spare in the 10th frame with 1 bonus roll |