Project Proposal

Project Name  
The name of this project is **Mutest**.

Team with Contact information  
The project idea and execution is going to be developed by only one person.   
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Project Purpose  
The project purpose is to design and implement a tool that introduces controlled mutations into Python source code and reports a mutation to evaluate the effectiveness of the test suite.

Background   
I’m a software engineering student with a quality assurance certificate and I have been working on my Python abilities. Unfortunately, I’m not used to writing test cases and unit testing (because the certification focused more on the documentation and requirements rather than testing, so even though I should be more knowledgeable in the testing side but I’m not so I will need to research and try an error during the development of the project.

Description  
Mutest is a software tool that applies mutation testing techniques to evaluate the effectiveness of existing automated test suites. The system works by introducing small modifications, called mutations, into the source code. These mutations can include changes such as flipping Boolean values, altering arithmetic operators, or modifying conditional statements. Once mutations are applied, the tool executes the project’s test suite against the modified code.

If the test suite fails to detect the introduced changes, the mutations are recorded as surviving mutants. These surviving mutants represent weaknesses in the test suite and are stored for further analysis. Mutest compiles the results into a structured report that highlights the types of mutations applied, the total number of surviving mutants, and the parts of the code where they occurred.

The tool is designed to function as an automated process. It will be implemented with a mutation engine capable of handling common code transformations, a test execution module that runs the existing tests against the mutated program, and a reporting component that generates outputs in both human-readable and machine-readable formats. An additional integration component will allow the tool to run as part of a continuous integration environment, ensuring that mutation testing can be triggered automatically during the software development workflow.

Significance  
This project demonstrates **advanced QA automation** and **pipeline engineering**, which are highly valued in industry.

On my resume, I would highlight:

* “Developed a mutation testing tool for CI/CD pipelines (Mutest), improving test suite robustness by detecting undetected code mutations.”
* Skills in **CI/CD, automated testing, software quality assurance, pipeline integration, DevOps tooling**.

New Computer Science Concepts  
Another critical part of your senior project is that you demonstrate that you have become a  
self-reliant learner. Please describe the new things you will need to learn to complete this  
project. These items should be computer science / software engineering concepts.  
Your sole reason should not be to learn a language or learn a language better. Though you  
may want to learn a new aspect of a language not covered in previous classes found in the  
major, this should not be the only new concepts you want to learn.  
You may consider a new tool, technology, 3rd party software, or programming concept.  
Note: Do not underestimate how long it will take to learn new technologies and concepts.  
Take some time to do preliminary research so that you have a feeling for how much time  
may be required to come-up-to-speed on the new technology or concept.  
Interestingness  
Describe why this project is interesting and exciting to you. Senior projects get hard, hit  
road-blocks, and cause people to want to quit. If you are excited about your project, this will  
help you stay motivated and complete your project.

Tasks and Schedule

|  |  |  |  |
| --- | --- | --- | --- |
| **Week** | **Task** | **Hours** | **Goal** |
| 1 - 2 | Research mutation testing and AST basics | 18 | Research foundation and parsing prototype |
| 3 – 4 | Build basic mutant generator (3 operator types only) | 18 | Core mutation engine prototype |
| 5 - 6 | Implement test execution and kill/survive tracking | 20 | First end-to-end test run |
| 7 | Mutation score calculation | 10 | Mutation scoring integrated |
| 8 - 9 | Basic CLI and simple reporting | 18 | Usable CLI with reporting |
| 10 - 11 | Minimal CI/CD integration | 15 | Pipeline-ready prototype |
| 12 | Documentation | 10 | Complete documentation |
| 13 | Testing the tool | 10 | Final tests |
| 14 | Final polish and presentation prep | 10 | Final demo and presentation |

Total hours: 129

I would like to acknowledge the assistance of OpenAI’s ChatGPT, which helped me in brainstorming and organizing the project schedule.

Resources  
List resources needed to complete your project. This may include hardware, software  
licenses, reference material, etc. Specify the estimated cost for each resource. Include  
hardware, software, compliers, books, websites, mentors, events, and videos associated  
with languages, tools, and software you need for the project.  
Dependencies  
What are your dependencies for the success of your project? What are the languages you  
need to install? What IDE will you use? What platform (Windows, Mac, Web, Servers) are  
you going to use? Where are you going to develop and test the solution? How are you going  
to install & deploy the solution? Are you dependent on other people providing anything for  
you to complete your project? Are there any permissions you need to obtain?  
This is to help you recognize if there are things you'll need to buy, and if so, if that is feasible  
for you. In some cases, the department may have limited funds to purchase equipment that  
can be reused for future projects. But recognize that if the department purchases  
equipment it will stay with the department.  
Risks  
Identify the risks of completing the project. This should include a list of things you don’t  
know how to do and will need to learn.