Putting Software Testing Terminology to the Test

M.A.Sc. Seminar

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Fall 2024

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Drasil

What is Drasil?

My project was originally focused on Drasil, "a framework for generating all of the software artifacts from a stable knowledge base, focusing currently on scientific software" (Hunt et al., 2021)

Drasil's Logo (Carette et al., 2021)

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- I worked on Drasil as an Undergraduate Summer Research Assistant during the summers of 2018 and 2019
- "Recipes" specify how information from the knowledge based is used to generate software artifacts, including:
  - SRS (HTML, PDF, Markdown)
  - Code (Python, Java, C#, C++, Swift, Julia)
  - READMEs and Makefiles
  - Drasil's own website[1]!

Drasil's Logo (Carette et al., 2021)

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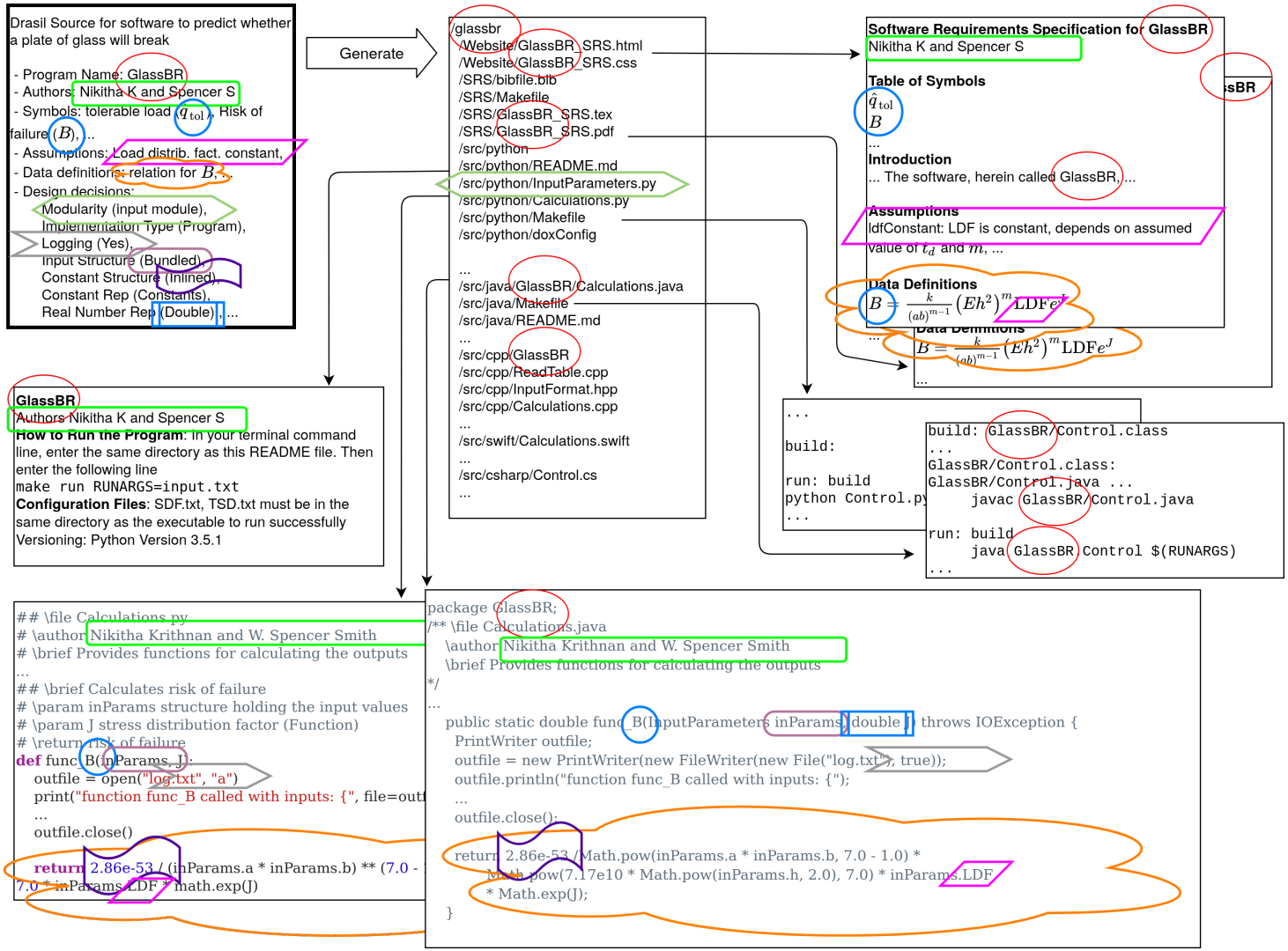
Visualizing Drasil's Traceability



Knowledge flow from knowledge base to artifacts; by Dr. Spencer Smith

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RIP to GOOT and TestGen

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  3. Generate test cases!
- There was a big assumption in this plan that drastically changed my project

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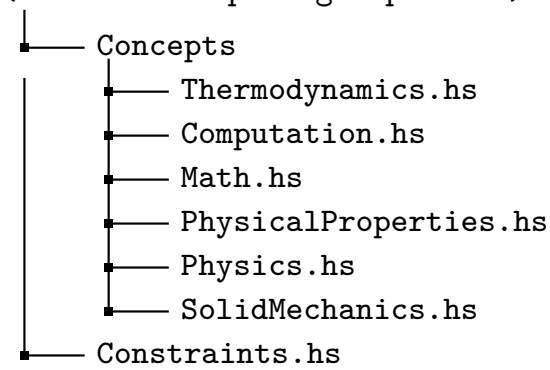

[2] READMEs excluded for brevity; see https://github.com/JacquesCarette/Drasil/tree/main/code/drasil-data/lib/Data/Drasil

The Need for a Knowledge Base

- Drasil is built for "(well understood) research software" (Carette et al., 2021) based on knowledge of:
  1. Concepts used by the software,
  2. Math used by the software or its derivation, and

(drasil-data package[2] part #1)

```
Concepts
    Thermodynamics.hs
    Computation.hs
    Math.hs
    PhysicalProperties.hs
    Physics.hs
    SolidMechanics.hs
Constraints.hs
```

(drasil-data package[2] part #2)

```
Equations/Defining
    Derivations.hs
    Physics.hs
Theories
    Physics.hs
Units
    PhysicalProperties.hs
    Physics.hs
    SolidMechanics.hs
    Thermodynamics.hs
SI_Units.hs
```

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  3. Information used by Drasil used for generating artifacts

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    Thermodynamics.hs
    Computation.hs
    Math.hs
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```

(drasil-data package[2] part #3)

```
Concepts
    Documentation.hs
    Education.hs
    Software.hs
Software
    Products.hs
Citations.hs
People.hs
```

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The Need for A Knowledge Base (cont.)

- Before we can generate test cases, we need to "teach" Drasil how to build them and what information is needed to do so
- If knowledge about testing is to be "well understood", it needs to be documented clearly, consistently, and correctly

The Need for A Knowledge Base (cont.)

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- If knowledge about testing is to be "well understood", it needs to be documented clearly, consistently, and correctly
- Independently of Drasil, if the field of software engineering holds code to a high standard in terms of clarity, consistency, and robustness, then the literature that supports code development should be held to this same standard!

The Lack of a Knowledge Base

"The Problem"

- Unfortunately, a search for a systematic, rigorous, and complete taxonomy for software testing revealed that the existing ones are inadequate and incomplete:
  - Tebes et al. (2020) focus on *parts* of the testing process (e.g., test goal, testable entity),
  - Souza et al. (2017) prioritize organizing testing approaches over defining them, and
  - Unterkalmsteiner et al. (2014) focus on the "information linkage or transfer" (p. A:6) between requirements engineering and software testing.

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The Problem with Testing Literature

Unstandardized Standards

Problem Statement

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- This does not actually say anything about Drasil's output!

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  1. A more well-defined, Master's level scope
  2. Targets a more complex artifact that is harder to verify
  3. Gives Drasil another "bragging point"!

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3. Testing provides a greater degree of confidence in Drasil's capabilities
4. Generating code for testing allows for it to be done "properly" instead of taking shortcuts commonly taken by humans

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"The information you have should be just as useful for generating tests as it should be for manually running them." — Dr. Jacques Carette

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     - Projectile's implementation in other languages
     - Other examples where code is generated: GlassBR, NoPCM, DblPendulum, PD Controller (Hunt et al., 2021)

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   - These test cases will also be added to Drasil's CI/CD to ensure that future changes preserve the code's functionality

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- The past and current Drasil team have created a truly amazing framework!

Thank you!

Questions?

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References

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