17-396/17-696/17-960: Language Design and Prototyping, Spring 2020
Assignment 2: Concepts for Language Design

Assigned: Tuesday, January 21st
Due: Tuesday, January 28th, 11:59pm

Policy

You may work in groups of up to 2 for this assignment. Expectations for pairs in terms of coverage and level of detail will be increased. While pairs can divide up concepts to some extent, we expect that you'll discuss the design among yourselves rather than working completely independently.

Logistics

All clarifications (if any) to this assignment will be posted on the class discussion board on Piazza. Any revisions will be uploaded to the "assignments" page on the class web page.

1 Learning Objectives of This Assignment

In this assignment, you will apply Daniel Jackson's "Design by Concept" approach to your programming language. The emphasis is on understanding the method, and on improving your language design by clarifying its conceptual foundations, how each design concept works, and the purpose of each concept in the design.

2 Language Design by Concept

Start with the presentation you (or your partner) prepared for last week. Extend it by adding slides documenting the important *concepts* in your language design.

You should write one slide per concept. Since some students proposed quite large languages, we do not expect you to necessarily be comprehensive, but try to provide good coverage of the most important concepts in your language design. You may find it helpful to focus on a coherent subset of the final language that you envision. When choosing which concepts to include, prioritize concepts that are unique to your language first, then concepts that are shared by a small number of languages, then concepts that are widespread; also, prioritize concepts that you view as more important over those that are less important. In general, putting thought into the concepts you define is more important than defining lots of concepts.

Since the scope of the languages themselves vary, we suggest that you limit the scope of this assignment by the time available—given that this is a 1-week assignment in a 12-unit course, this is about 8 hours/person. In general, I'd like to see at least 5 concepts (8 for pairs). We also recognize that this is a first draft; you'll have an opportunity to refine your concepts later. So use concepts as a tool, and get something down on your design, recognizing that it is likely not perfect nor the final design.

When you write down each concept, your first priority is to focus on the concept name, purpose, and tactic—these are the most important to get right and will probably provide you with the most insight. Then, try to add something about how your concept works, broken into structure and behavior categories. It may be difficult to specify detailed structure and behavior for some concepts, so give detail where it is applicable, and otherwise a high-level description of how the concept operates will suffice.

Analyze your concepts according to the four principles discussed in class:

- One-to-One: Concepts and purposes should be in a one-to-one correspondence.

- Uniformity: A concept should apply generally and not be encumbered with special conditions.

- Genericity: Prefer generic concepts to ones that are specific to a particular application.

- Integrity: A concept's specification should continue to apply in the presence of other concepts, even if the concepts interact with one another

If your concepts do not follow the principles, try to change your concepts so that they do. If for some reason one of the principles is not satisfied, but there's no good way to satisfy it (either because it's not feasible or because it would make the design worse), include a short note explaining why this is the case.

Language design is iterative and can benefit from discussion. If you would like feedback on the concepts in your language design, send a draft to the instructor via email or Piazza, or (best) come to office hours. In the case of email/Piazza, the instructor will endeavor to provide you with feedback within 24 hours (and ideally sooner).

Update your slides from last week with any language design changes that you'd like to make based on your concept analysis. Of course, if you had ideas for improvement that did not come from concept analysis, you can include those changes too. There is no need to make the section of slides carried over from last week longer, unless you find it personally helpful to do so in documenting your language.

Add a slide at the end reflecting on this exercise. Did you find applying concepts to your language to be useful? If so, describe why, for example by describing something that was clarified or that changed (hopefully for the better) as a result of applying concepts. Conversely, or perhaps in addition, did you find that concepts were not a good fit in some ways for describing and/or improving your language design? In that case, why were they not a good fit?

Turn in your deck of new and revised slides on Canvas—as a PDF, a PPT, or a link to online slides.