Research Initiatives

As interim Randolph faculty, I sent the following proposal to Randolph director Liebrock recommending how to spend the Randolph faculty salary this year, along with a budget spreadsheet. I have proceeded with those parts of this plan that time and human resources have allowed.

> Proposal and Budget Justification – Jeffery Interim 2022-2023 Randolph
> Basic Assumption: the budget is $128,000
>
> Interim Randolph endowed chair Jeffery proposes to spend the funds budgeted for salary in the 2022-2023 year as follows.
>
> 1. A fraction of the budget (approximately $20K) will be allocated to provide support for the Randolph summer programs in 2023. This funding includes salary for Jeffery and one other instructor to participate in said summer programs.
>
> 2. The remainder of the budget is proposed to be used as seed money to initiate a research project in computer science education that may lead to subsequent extramural funding proposals and increase the NMT CSE department capacity in the area of computer science research. Research projects are labor intensive and student employees require training time to come up to speed. It is proposed to provide funding for one graduate student RA and one undergraduate student for two years.
>
> The CS education research project that will be initiated will build a prototype software tool for learning Python. The proposed tool will analyze Python source code, provide novel diagnostics or hints, generate a visual representation of the static aspects of the program structure, and provide a simple animated representation of program execution for a subset of the language. The research questions asked will include: can an immersive first-person depiction of programs and their executions improve the level of success students experience in their first Python course?

It is worth mentioning that there are other ways that these funds in interim years could be spent, such as saving up funds to allow a higher salary offer for the eventual non-interim Randolph faculty member.

CS Education Library Components

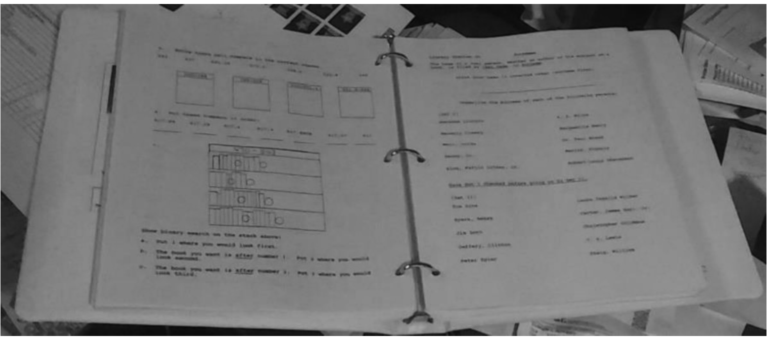
Any repository of for CS Educational tools is going to require infrastructure, such as a web server. It is going to have to address licensing and provide an mechanism for ranking/evaluating library components. At present there are an enormous number of CS education resources scattered across the internet.

Library Framework Components

These components will be used across all content: content repository with submission, update and browsing capabilities; concept map and user knowledge modeling database; crowdsourcing/peer-review content rating system.

Elementary Grade Components

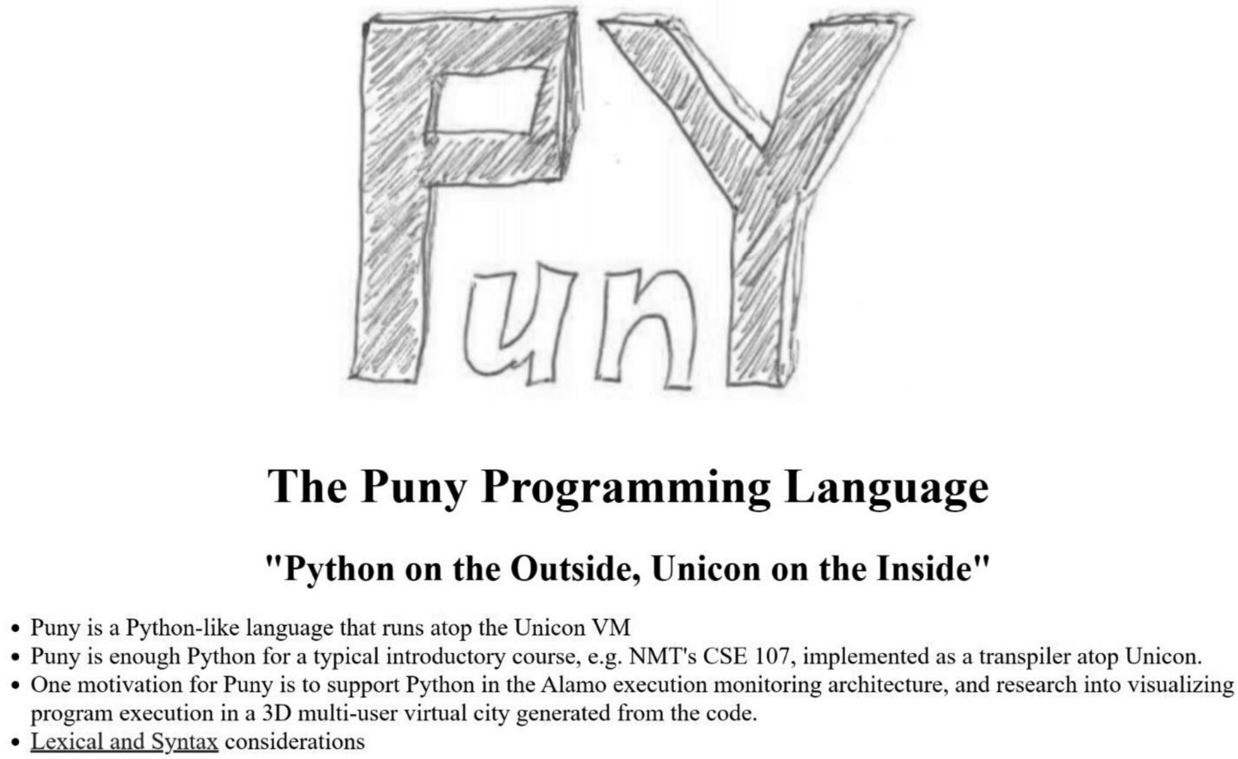
A recommend seed/starter component for the elementary level is “Library Stations”, a series of 100 library/information processing lessons that introduce computational thinking using a library metaphor. This originally hands-on material accessibly teaches information processing in the context of managing a library. It needs to be adapted into a software application if it is to become a seed component.



I believe in Library Stations because I learned binary searching and radix sorting algorithms in about 5th grade, although I didn’t learn to program until 10th grade and didn’t learn the technical CS terminology until university CS studies.

Middle School Components

A recommended seed/starter component for the middle-school level is PunY, a user-friendly Python language learning tool. PunY is currently under construction and is the focus of the NMT CSE 423 class on compiler construction in Spring 2023. From www.cs.nmt.edu/~jeffery/puny/:



The Puny Programming Language

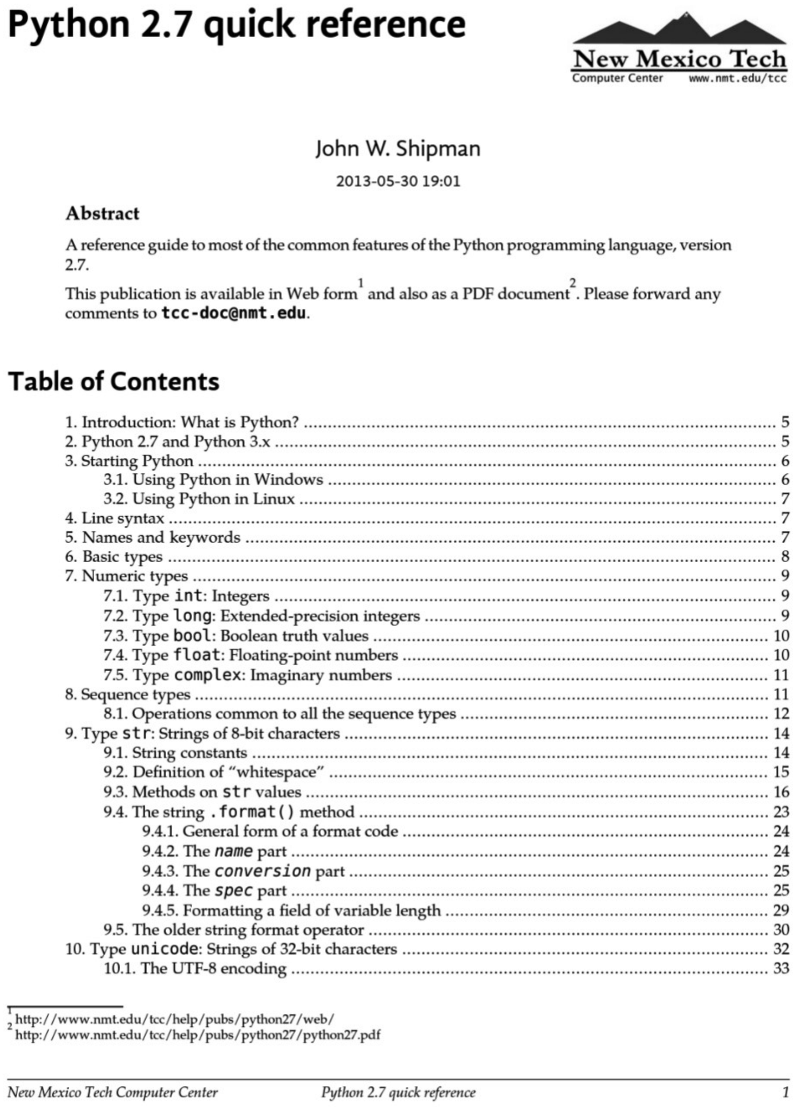
"Python on the Outside, Unicon on the Inside"

- Puny is a Python-like language that runs atop the Unicon VM
- Puny is enough Python for a typical introductory course, e.g. NMT's CSE 107, implemented as a transpiler atop Unicon.
- One motivation for Puny is to support Python in the Alamo execution monitoring architecture, and research into visualizing program execution in a 3D multi-user virtual city generated from the code.
- Lexical and Syntax considerations

PunY will support both individual, self-paced study as well as camps and classrooms. The reason to build a new implementation of Python atop my Unicon programming language is to provide better help, better graphics facilities for students to program with, and the ability to run student programs within my program execution monitoring framework.

High School Components

A recommended set of seed/starter components for the high-school level is Chipman. This adaptation of John Shipman's tutorials and references, starting with Python and Python's Tkinter library, will update and extend John's hypertext documents to incorporate exercises using elements of interactive text adventures, MUDs, and classic online tutorial formats used in the 1980's. I have placed a copy of the Shipman materials up at www.cs.nmt.edu/~jeffery/Shipman and am currently going through those materials to evaluate which ones are the most promising. For example, the following image is the first page of https://www.cs.nmt.edu/~jeffery/Shipman/www/docs/tcc/help/pubs/python27/python27.pdf.



Python 2.7 quick reference

New Mexico Tech
Computer Center www.nmt.edu/tcc

John W. Shipman

2013-05-30 19:01

Abstract

A reference guide to most of the common features of the Python programming language, version 2.7.

This publication is available in Web form[1] and also as a PDF document[2]. Please forward any comments to **tcc-doc@nmt.edu**.

Table of Contents

[1] http://www.nmt.edu/tcc/help/pubs/python27/web/
[2] http://www.nmt.edu/tcc/help/pubs/python27/python27.pdf

New Mexico Tech Computer Center *Python 2.7 quick reference* *1*

Conclusion

CS Education activities are ongoing at NMT. While we are waiting for the right person to come and take a leadership role in this area, we are planning and planting seeds and building awareness of the topic within the faculty and student body in the Computer Science and Engineering department. Efforts like the CS Education library will be the work of many individuals, not just the one new person that we bring on to the faculty.