Teaching the Dynamic Memory Model

Background

Look at the following Python program:

```
list1 = [0,1,2]
list2 = list1
list1.append(3)
print(list2)
```

What would the program print - `[0,1,2]` or `[0,1,2,3]`? Any programmer with experience in Python would know the answer. However, complete beginners are often confused by examples like this. In the above case, it boils down to knowing that `list2=list1` creates a new reference to the same object rather than a copy of the existing object. Understanding more complicated examples would furthermore require that we mentally imagine the set of all objects as well as all references to them from different variables.

For a new programmer, it would have been an enormous help if there was a tool which visualizes the state of a program as a graph showing all objects as well as the references between them

Project description

Skulpt is a variant of Python implemented in JavaScript. It lets us compile and execute Python code directly in the browser. Skulpt doesn't scale well for serious web programming, but is ideal for running small programs which is all that we need for teaching. It is also what we used for developing the learning environment in the courses DAT425, DAT445, DAT455, DAT505 and TIN214.

The project is to develop an environment where students can execute example programs in Python and see the objects that the program creates as nodes in a graph. References from one object to another should be drawn as arrows between them. The project should build a simple user interface. In order to capture the moment when objects are created/modified some changes in Skulpt would be needed.

Suggested Reading Material

The documentation for Skulpt is here: https://skulpt.org/docs/index.html. It is not always comprehensive, but if something is not in the documentation, you can usually find it by searching on the web. Skulpt is also used in other web learning environments.

Target group

D, DV, IT, Z and E.
Students interested in web programming.

Special prerequisites

The students should have experience with Web programming. They should also know enough Python to be able to write example test programs.

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