# Python Trace Table Tutor (T3)

### **Overall description**

T3 is an interactive tool for learning Python code tracing. It is a product of a collaboration between UPitt and CMU. Students need to write down line numbers, initial and updated values of variables and printed outputs during the line—by-line execution of a piece of code. Hints, student modeling and adaptive problem selection are provided to support student learning.

T3 is designed based on a cognitive task analysis on hand code-tracing quizzes (UPitt) and iterative conceptualization (CMU & UPitt), implemented with <u>Cognitive Tutor Authoring Tool</u> and hosted in <u>TutorShop</u> (CMU), and supported by a novel learner model for program patterns by a hierarchical Bayesian network (UPitt) and adaptive problem selection algorithm (CMU & UPitt).

Other details can be found in the section *Cognitive Tutors for Computer Science Education* under *Smart Content from Carnegie Mellon University*.

You can try it by accessing <a href="https://tutorshop.web.cmu.edu/">https://tutorshop.web.cmu.edu/</a> (username/password: teststu01/teststu01).



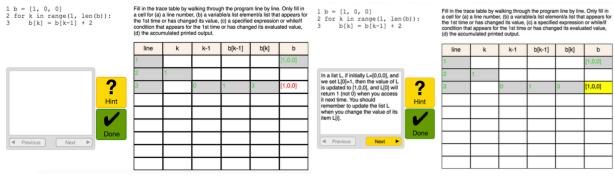
Fill in the trace table by walking through the program line by line. Only fill in a cell for (a) a line number, (b) a variable/a list element/a list that appears for the 1st time or has changed its value, (c) a specified expression or while/if condition that appears for the 1st time or has changed its evaluated value, (d) the accumulated printed output.

line k k-1 b[k-1] b[k] b



	 	~[···]	~[1	-
,				

Initial interface



(a) feedback interface

(b) hint interface

## Support language and volume of content

T3 supports Python. It covers *for loop, condition* and *lists* topics, with a special focus on common basic programming patterns (i.e., *for&for, for&x+=i, for&lists*). Currently there are 66 problems available. However, we have created an automated process allowing generating CTAT format problems given a Python file (based on the library provided by the <u>Online Python Tutor</u>).

#### Supported integration protocols for sign-on and data logging

The integration protocols for sign-on can be found in CMU <u>CTAT/TutorShop site</u> and relevant developers. Data logging is supported by CMU <u>DataShop</u>.

#### References and links

Huang, Y. (2018). Learner modeling for integration skills in programming (Doctoral dissertation, University of Pittsburgh). [Thesis] (Advisor: Peter Brusilovsky@UPitt, Committee Members: Kenneth Koedinger@CMU, Christian Schunn@UPitt, Marek Druzdzel@UPitt).

Huang, Y., Guerra-Hollstein, J., Barria-Pineda, J., & Brusilovsky, P. (2017). Learner modeling for integration skills. In *Proceedings of the 25th Conference on user modeling, adaptation and personalization* (pp. 85-93). [paper] [slides]