Debugging & Traceability

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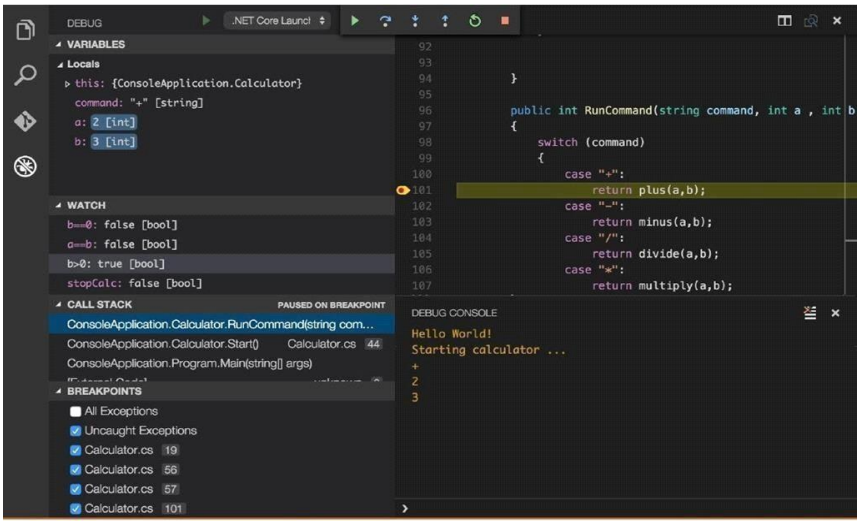
Team ID	PNT2022TMID17260
Project Name	Real-Time River Water Quality Monitoring andControl System
Maximum Mark	2marks

FORMATIVE STUDY

To understand the current limitations of automatic hint delivery and opportunities to improve it, we observed the hint giving practices of teachers in a local introductory CS course as they helped students debug incorrect code for programming assignments.

We analyzed 132 Q&A posts from the CS course's online discussion forum where instructors answered students' debugging questions. Additionally, we conducted a semi-structured interview with a teaching assistant from the same course to gain insight into the patterns of hint-giving that we observed in the online discussions. This analysis yielded three design guidelines that motivated the design of Trace

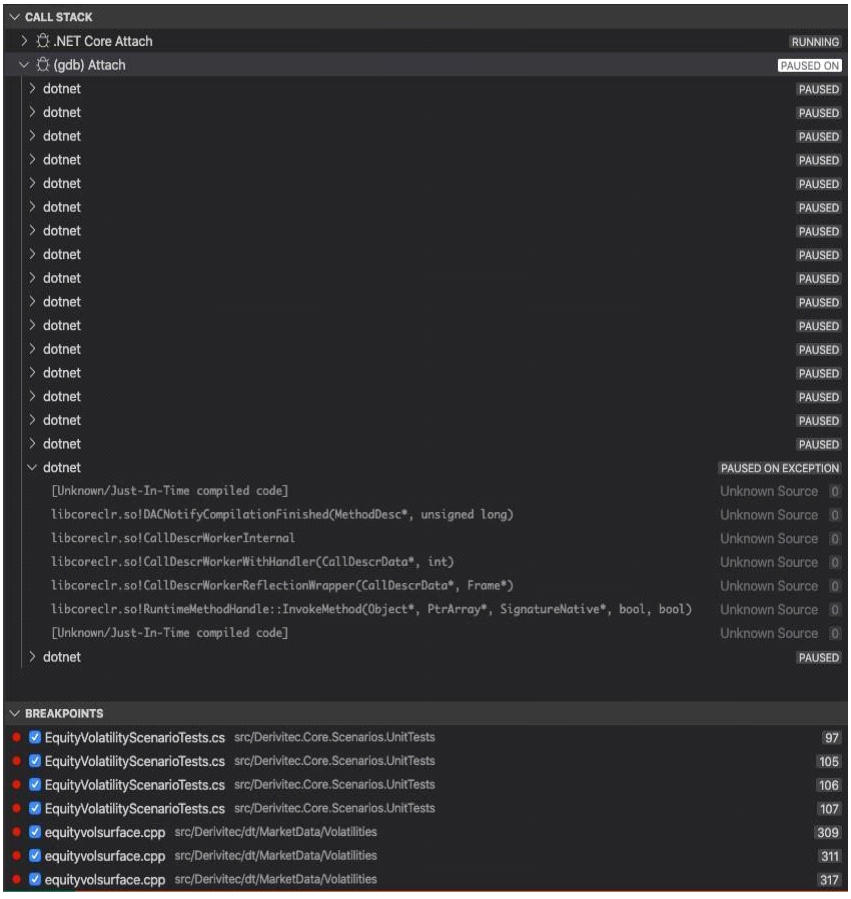


INTERFACE DESIGN:

The interface can leverage this pair of incorrect and correct programs to show the student the difference between the actual behavior of their submission and expected behavior which would passall the test cases for the assignment.

The system executes the incorrect and fixed programs, and stores a snapshot of both their internal states at every execution point. Using this information, the system interface, shown in Figure 2,renders execution traces of both the incorrect (D) and fixed (E) programs side-by-side. To help the student
find the behavioral differences, the interface highlights where the incorrect program diverges from the
fixed one

At the start of each study session, we gave each participant a 6-minute tutorial on both Python Tutor and Trace Diff to familiarize them with each interface. We then gave each participantfour incorrect submissions (two for Trace Diff and two for Python Tutor) and asked to perform two tasksfor each problem: (1) point out the location of the bug and (2) fix the bug. For each incorrect submission,
we explained the programming assignment to the participant and then gave them ten minutes to performthe tasks



EVALUATION

To see if Trace Diff can help students debug their code efficiently, we conducted acontrolled experiment and evaluated our interface alongside the Online Python Tutor interface.

We recruited 17 students (male: 15, female: 2; undergraduate: 13, graduate: 4) from a local university to participate in this study. All participants major in computer science and have experience in the Python programming language. In preparation for this study, we collected a dataset of incorrect student submissions to programming problems assigned in CS1, an introductory computer science courseat our university.