EC4219: Software Engineering

Lecture 9 — Problem Solving using SMT Solvers (2)

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2024 Spring

Using Z3 in OCaml

- Using Z3 in OCaml can be a bit more tricky than Python.
- For easy use, I provide a module containing some useful wrapper functions.

https://github.com/gist-pal/ec4219-software-engineering/tree/main/z3-examples

- To compile and execute the file named `test.ml`, run the following command.

```
$ run.sh test
```

Example 1: Propositional Logic

Consider the formula

$$F : (p \rightarrow q) \wedge (r \leftrightarrow \neg q) \wedge (\neg p \vee r).$$

Below is the Python code for checking the satisfiability of F.

```
1 from z3 import *
2 p = Bool ('p')
3 q = Bool ('q')
4 r = Bool('r')
5 solve (Implies (p,q), r == Not (q), Or (Not(p), r))
```

Write a corresponding OCaml code.

Example 2: Integer

Write an OCaml code corresponding to the Python code below.

```
1 from z3 import *
2
3 x = Int ('x')
4 y = Int ('y')
5 solve (x > 2, y < 10, x + 2*y == 7)
```

Example 3: Array

Consider the formula in the theory of arrays T_A.

$$F : a[i] = e \rightarrow \forall j.a\langle i \triangleleft e\rangle[j] = a[j]$$

Write an OCaml code for checking the validity of F. Assume i and e are integer-typed variables.

Summary

- Problem solving using Z3 with OCaml
- Mid-term exam
  - Date: 4/15 (Monday), 1:00 pm – 2:15 pm
  - Place: EECS B203
  - Coverage: Lec 0 – Lec 9
  - Open-book test: You can bring any printed material. You can bring any book. No electronic devices!
  - 4-7 problems + 10–15 O/X questions
  - Each problem can consist of several sub-problems.
  - For some problems and questions, you may lose some points if you give wrong answers!