Project Milestone 2 for CS569: Static Analysis and Model Checking for Dynamic Analysis

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I. Background

In the project proposal, I write about "Feedback-directed Random Test Generation" [1], which is raised by Pacheco, Carlos; Shuvendu K. Lahiri; Michael D. Ernst; and Thomsa Ball. The authors find a new way to improve the efficacy of random testing which mentions in their paper. The technique that authors present is improving random test generation by taking care of the feedback obtained from the input test cases that the generator created before [1]. If some of the input test cases, which have been tested, make no sense, the generator should avoid create a new test case with the same values.

II. Algorithm

The authors give the algorithm of Feedback-directed Random Test. There are three sequences: error sequence, non-error sequence, and new sequence. Error sequence and non-error sequence are used to store the cases that have been tested. New sequence is used to store the new case that generator creates. First of all, the generator will create a test case and put it into new sequence. Second, checking whether the new test case, which is stored in the new sequence, has been tested before. If the new test case has been tested then create a new case. Third, executing the new sequence and check the feedback. If the feedback has no error then store the new sequence into non-error sequence. If the feedback has error then store the new sequence into error sequence. This algorithm will avoid lots of non-sense test cases.

```
GenerateSequences (classes, contracts, filters, timeLimit)
1   errorSeqs ← {} // Their execution violates a contract.
2   nonErrorSeqs ← {} // Their execution violates no contract.
3   while timeLimit not reached do
4       // Create new sequence.
5       m (T1 . . . Tk) ← randomPublicMethod (classes)
6       (seqs, vals) ← randomSeqsAndVals (nonErrorSeqs, T1 . . . Tk)
7       newSeq ← extend(m, seqs, vals)
8       // Discard duplicates.
9       if newSeq ∈ nonErrorSeqs ∪ errorSeqs then
10          continue
11      end if
12      // Execute new sequence and check contracts.
13      (o, violated) ← execute(newSeq, contracts)
14      // Classify new sequence and outputs.
15      if violated = true then
```

```
            errorSeqs ← errorSeqs ∪ {newSeq}
        else
            nonErrorSeqs ← nonErrorSeqs ∪ {newSeq}
            setExtensibleFlags (newSeq, filters, o) // Apply filters.
        end if
    end while
    return (nonErrorSeqs, errorSeqs)
```

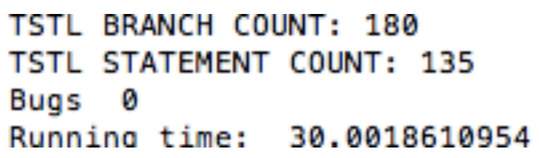
III. My tester2.py

This is the basic implementation of a novel test generation algorithm using the TSTL API. My program meets the basic requirement and support all of required command line. Define a function which is called parse_args(). I'm using the same function as randomtester.py [2]. This function will add command line parameters arguments and set input sys.argv into this parameters. Define a function which is called make_config(pargs, parser). This function is also the same as randomtester.py [2]. This function will return a dictionary which will let me using command line easily by calling config.xxx. Define a function which is called check_action(). This function will get a random action by using sut.randomEnabled(random seed) and check whether the action is safely by using sut.safely(action). If command line running is 1, then give the output as required. If the action is not ok then there is a bug. Output the failure massage. If command line fault is 1 then save different failure massages into different files. My tester2.py using the algorithm of "Feedback-directed Random Test Generation". There are three list: news, error, and nonerror. news will using to store sut.newStatements(). error will store the sut.currStatements() which find a bug. nonerror will store sut.currStatments() which don't contain a bug. When the algorithm generate a new statements, the algorithm will check whether the statements have been tested. If statements have been tested then generate a new statements. My tester2.py allow user give a time how long will the tester run.

IV. Improvement

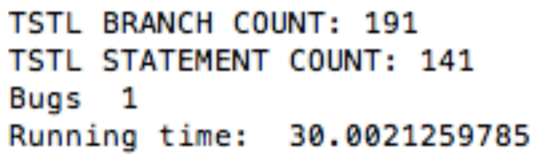
The tester2.py changes the insert function. In tester1.py will insert new state that needs to be test into the beginning of states. In tester2.py will insert new state into the end of the list.

Result of tester1.py run with 30 1 100 1 1 1 1:



```
TSTL BRANCH COUNT: 180
TSTL STATEMENT COUNT: 135
Bugs  0
Running time:  30.0018610954
```

Result of tester2.py run with 30 1 100 1 1 1 1:



```
TSTL BRANCH COUNT: 191
TSTL STATEMENT COUNT: 141
Bugs  1
Running time:  30.0021259785
```

Reference:
[1] Pacheco, Carlos; Shuvendu K. Lahiri; Michael D. Ernst; Thomas Ball (May 2007). "Feedback-directed random test generation". ICSE '07: Proceedings of the 29th International Conference on Software Engineering (IEEE Computer Society): 75–84.
[2] https://github.com/agroce/tstl