CS6888 Program Analysis and its Application #HW3

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Task1 Setup

Step 1: compile the tcas.c

 # gcc tcas.c -o tcas -ftest-coverage -fprofile-arcs

It confuses me gcc-6 will have 16 fail tests and gcc-7 will have 12 fail tests.

Step 2: run the test in the runtests.sh

Step 3: for each test:

Remove the .gcda file (it will record last tests)

store the .gcov file to /output/fail if the test fails(returns "F"), store the coverage information to /output/failPrint as txt file;

store the .gcov file to /output/success if the test fails(returns "P"); store the coverage information to /output/successPrint as txt file;

In total 12 failed tests, 1596 success tests for 1609 tests.

Code "task1.py" is attached.

Task 2: Implement fault isolation technique

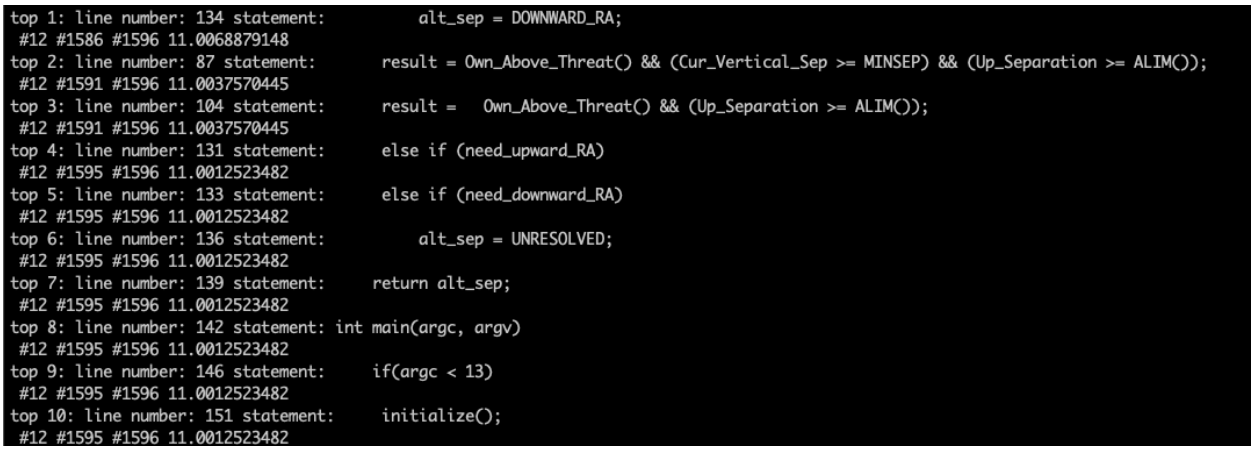
Step 1: traversal all files in /output/fail, for every line, if it doesn't start with "-" or "#####", store the line number in a dict. Every fail test will refresh this dict. Store the statement in another dict, which key is the line number, value is the line statement.

Step 2: traversal all files in /output/success, for every line, if it doesn't start with "-" or "#####", store the line number in a dict. Every success test will refresh this dict. Store the statement in another dict, which key is the line number, value is the line statement.

Step 3: calculate the S(s) for each executing statement s in fail tests.

Code "task2.py" is attached.

Task 3: Run experiments and report findings



The result is the above picture. I have tested my scripts in small size gcov files and it works well.

I think the fault may exist in 131-142 line since the these lines have the most tops. And it will cause the fault tests in the main function.

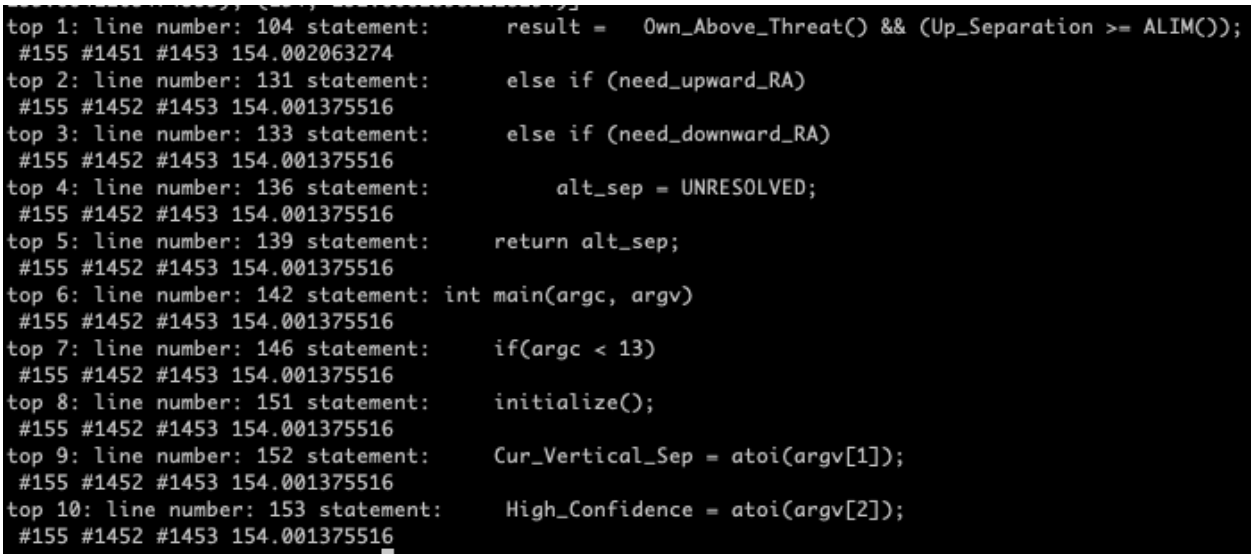
3 Variants:

Tacs_f1.c: in line 122

// Mutant: change (&& ((&&)||)) to all ||

if (enabled || ((tcas_equipped || intent_not_known) || !tcas_equipped))

Total test: 1609 Total success: 1453 Total fail: 155

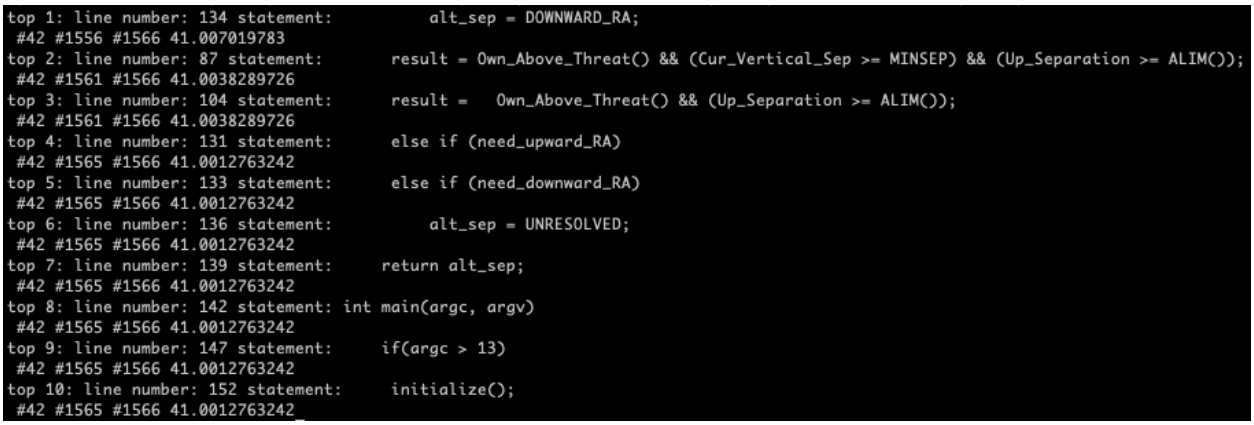


I changed the decision condition of alf_sep_test function, and the top 1 – top 5 all in this function. So this is a pretty good bug finding!

Tacs_f2.c: in line 146

// Mutant: change < to >
if(argc > 13)

Total test: 1609 Total success: 1566 Total fail: 42

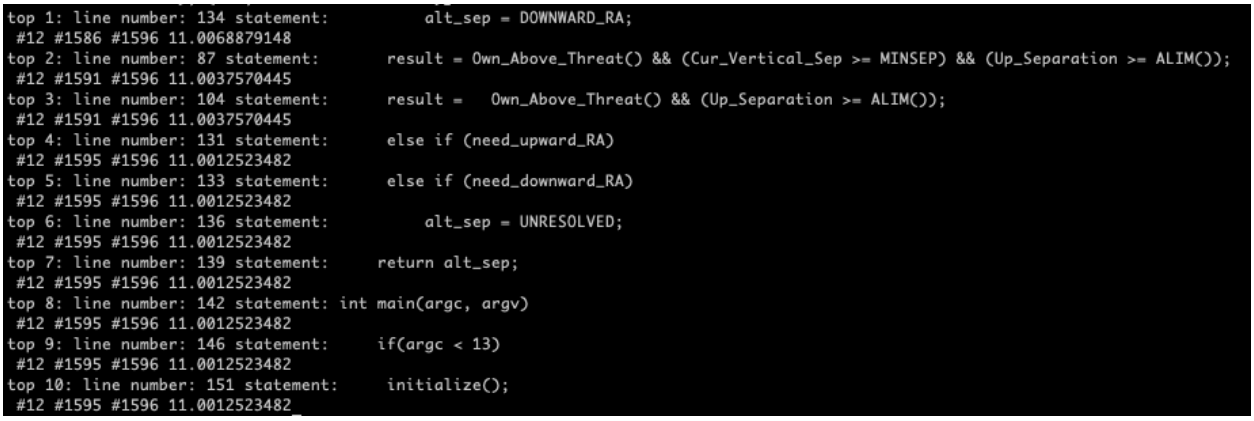


I change the line 146 in the main function. In the top 9 is exactly the fault I made. Though the rank is not so high and same as the original fault provided by our professor. I think that line is only responsible for "Error: Command line arguments". So doesn't affect normal tests.

Tacs_f3.c: in line 120

// Mutant: change alt_sep = UNRESOLVED to alt_sep = UNRESOLVED + 1
alt_sep = UNRESOLVED + 1;

Total test: 1609 Total success: 1596 Total fail: 12



The output is same as the tcas.c. I guess this line doesn't make change to the tracks. It only has invisible impact on the program.

Conclusion: fault isolation skill is useful and efficient. It could help us narrow the scope and focus on high-risk lines. However, it could not tell us exact line is the line cause the problem, and may not able to find the invisible impact fault line. So large impact fault is easier to find with this tool, small impact fault is harder to find.