

CS 206

Advanced Software Testing and Analysis

Project Report

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Experiment Results:

Benchmark	Coverage Criteria	Prioritization Method	Number of testcases	Number of faults exposed
totinfo	Statement	Random	6	7
		Total	5	12
		Additional	5	12
	Branch	Random	9	16
		Total	5	13
		Additional	5	13
tcas	Statement	Random	6	6
		Total	5	10
		Additional	5	10
	Branch	Random	12	9
		Total	13	13
		Additional	11	13
schedule	Statement	Random	8	2
		Total	3	2
		Additional	3	4
	Branch	Random	10	6
		Total	8	3
		Additional	7	5
Schedule2	Statement	Random	8	3
		Total	4	4
		Additional	4	3
	Branch	Random	13	4
		Total	7	5
		Additional	4	2
replace	Statement	Random	22	10
		Total	13	10
		Additional	9	4
	Branch	Random	27	17
		Total	21	19
		Additional	11	13
printtokens	Statement	Random	17	3
		Total	7	6
		Additional	5	4

printtokens2	Branch	Random	20	6
		Total	7	5
		Additional	6	4
	Statement	Random	11	6
		Total	4	7
		Additional	4	6
	Branch	Random	18	7
		Total	6	8
		Additional	4	7

Observations:

- The generated test suites are smaller as compared to the original number of test cases
- Statement coverage and Additional coverage prioritization did produce the smallest test suite for both statement and branch coverage
- Total coverage prioritization had exposed more faults than random and additional coverage prioritization methods
- Random coverage prioritization was not consistent in exposing the faults
- Branch coverage was more effective than statement coverage in exposing faults.

Working Screenshots:

abhi@DESKTOP-66NUP0I: /mnt/c/Users/abhin/Desktop/project-thebugsters-master/benchmarks

Branches executed:71.56% of 109

Taken at least once:35.78% of 109

Calls executed:27.63% of 76

Creating 'printtokens.c.gcov'

```
printtokens::statement::random---> 17
printtokens::statement::random::faults---> 3
printtokens::statement::total---> 7
printtokens::statement::total::faults---> 6
printtokens::statement::additional---> 5
printtokens::statement::additional::faults---> 4
printtokens::branch::random---> 20
printtokens::branch::random::faults---> 6
printtokens::branch::total---> 7
printtokens::branch::total::faults---> 5
printtokens::branch::additional---> 6
printtokens::branch::additional::faults---> 4
{ 'printtokens::branch::additional': [ '< inputs/uslin.301',
    'inputs/jk29',
    'inputs/uslin.284',
    '< inputs/newtst596.tst',
    'one doesntliketwo',
    'inputs/garbage/nothing'],
  'printtokens::branch::random': [ '< inputs/uslin.36',
    'inputs/uslin.1788',
    '< inputs/uslin.1280',
    '< inputs/newtst320.tst',
    'inputs/uslin.1094',
    '< inputs/uslin.225',
    '< inputs/uslin.728',
    'inputs/test287.noeof',
    '< inputs/tst202',
    'inputs/uslin.1619',
    'inputs/uslin.737',
    '< inputs/uslin.924',
    'inputs/uslin.1462',
    '< inputs/uslin.1134',
    '< inputs/uslin.543',
    '< inputs/uslin.1355',
    '< inputs/uslin.378',
    '< inputs/uslin.302',
    'one doesntliketwo',
    'inputs/garbage/nothing'],
  'printtokens::branch::total': [ '< inputs/uslin.301',
    '< inputs/uslin.1355',
    'inputs/uslin.1915',
    '< inputs/uslin.1285',
    '< inputs/uslin.650',
    'inputs/garbage/nothing',
    'one doesntliketwo'],
  'printtokens::statement::additional': [ '< inputs/uslin.1355',
    'inputs/uslin.846',
    'one doesntliketwo',
    'inputs/garbage/nothing',
    'inputs/uslin.284'],
  'printtokens::statement::random': [ 'inputs/uslin.546',
    'inputs/uslin.1448',
    '< inputs/newtst473.tst',
    '< inputs/uslin.27',
    '< inputs/tc191',
    '< inputs/uslin.1534',
    'inputs/jk45',
    'inputs/uslin.148',
```

```
abhi@DESKTOP-66NUP0I: /mnt/c/Users/abhin/Desktop/project-thebugsters-master/benchmarks
'inputs/test287.noeof',
'< inputs/tst202',
'inputs/uslin.1619',
'inputs/uslin.737',
'< inputs/uslin.924',
'inputs/uslin.1462',
'< inputs/uslin.1134',
'< inputs/uslin.543',
'< inputs/uslin.1355',
'< inputs/uslin.378',
'< inputs/uslin.302',
'one doesntliketwo',
'inputs/garbage/nothing'],
'printtokens::branch::total': [ 'inputs/uslin.301',
'< inputs/uslin.1355',
'inputs/uslin.1915',
'< inputs/uslin.1285',
'< inputs/uslin.650',
'inputs/garbage/nothing',
'one doesntliketwo'],
'printtokens::statement::additional': [ 'inputs/uslin.1355',
'inputs/uslin.846',
'one doesntliketwo',
'inputs/garbage/nothing',
'inputs/uslin.284'],
'printtokens::statement::random': [ 'inputs/uslin.546',
'inputs/uslin.1448',
'< inputs/newtst473.tst',
'< inputs/uslin.27',
'< inputs/tc191',
'< inputs/uslin.1534',
'inputs/jk45',
'inputs/uslin.148',
'inputs/uslin.997',
'< inputs/uslin.75',
'inputs/uslin.1250',
'inputs/uslin.1321',
'< inputs/tst100',
'< inputs/ts540',
'< inputs/uslin.237',
'one doesntliketwo',
'inputs/garbage/nothing'],
'printtokens::statement::total': [ 'inputs/uslin.1355',
'< inputs/uslin.301',
'< inputs/uslin.1285',
'< inputs/uslin.650',
'inputs/uslin.1391',
'inputs/garbage/nothing',
'one doesntliketwo']]
rm: cannot remove 'printtokens/printtokens.gcda': No such file or directory
rm: cannot remove 'printtokens/printtokens.c.gcno': No such file or directory
rm: cannot remove 'printtokens/v1/printtokens.gcda': No such file or directory
rm: cannot remove 'printtokens/v1/printtokens.gcno': No such file or directory
rm: cannot remove 'printtokens/v2/printtokens.gcda': No such file or directory
rm: cannot remove 'printtokens/v2/printtokens.gcno': No such file or directory
rm: cannot remove 'printtokens/v3/printtokens.gcda': No such file or directory
rm: cannot remove 'printtokens/v3/printtokens.gcno': No such file or directory
rm: cannot remove 'printtokens/v4/printtokens.gcda': No such file or directory
rm: cannot remove 'printtokens/v4/printtokens.gcno': No such file or directory
rm: cannot remove 'printtokens/v5/printtokens.gcda': No such file or directory
rm: cannot remove 'printtokens/v5/printtokens.gcno': No such file or directory
rm: cannot remove 'printtokens/v6/printtokens.gcda': No such file or directory
rm: cannot remove 'printtokens/v6/printtokens.gcno': No such file or directory
```

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```

segmentation fault
segmentation fault
segmentation fault
segmentation fault
schedule::branch::additional::faults---> 5
{ 'schedule::branch::additional': [ '6 7 3 < input/ct.36',
                                     '0 6 3 < input/ft.14',
                                     '1 9 10 < input/bdt.79',
                                     '2 5 < input/ft.20',
                                     '0 7 2 < input/adt.116',
                                     '1 9 9 < input/bdt.27',
                                     '1 2 3 < input/inp.hf.12'],
  'schedule::branch::random': [ '4 2 10 < input/ft.1',
                                '7 1 4 < input/add.100',
                                '5 4 3 < input/dat075',
                                '4 10 3 < input/inp.98',
                                '7 9 8 < input/inp.hf.11',
                                '7 1 9 < input/inp.hf.1',
                                '10 10 6 < input/bdt.42',
                                '2 3 < input/bdt.77',
                                '1 1 0 < input/inp.hf.12',
                                '2 7 9 < input/ft.6'],
  'schedule::branch::total': [ '6 7 3 < input/ct.36',
                              '3 0 3 < input/ct.6',
                              '8 3 9 < input/inp.hf.16',
                              '7 10 5 < input/inp.hf.6',
                              '9 8 5 < input/inp.hf.14',
                              '4 8 8 < input/inp.hf.3',
                              '0 1 0 < input/inp.hf.8',
                              '2 5 < input/ft.20'],
  'schedule::statement::additional': [ '8 3 9 < input/inp.hf.16',
                                       '2 5 < input/ft.20',
                                       '1 9 9 < input/bdt.27'],
  'schedule::statement::random': [ '0 0 4 < input/adt.140',
                                   '0 0 0 < input/tc.8',
                                   '9 9 7 < input/inp.64',
                                   '6 1 6 < input/lu128',
                                   '2 5 6 < input/ft.30',
                                   '9 7 3 < input/inp.56',
                                   '7 4 0 < input/adt.113',
                                   '3 < input/ft.1'],
  'schedule::statement::total': [ '8 3 9 < input/inp.hf.16',
                                  '9 8 5 < input/inp.hf.14',
                                  '2 5 < input/ft.20']]
rm: cannot remove 'schedule/schedule.gcda': No such file or directory

```


abhi@DESKTOP-66NUP0I: /mnt/c/Users/abhin/Desktop/project-thebugsters-master/benchmarks

Calls executed:63.16% of 38

Creating 'schedule2.c.gcov'

```
schedule2::statement::random---> 8
schedule2::statement::random::faults---> 3
schedule2::statement::total---> 4
schedule2::statement::total::faults---> 4
schedule2::statement::additional---> 4
schedule2::statement::additional::faults---> 3
schedule2::branch::random---> 13
schedule2::branch::random::faults---> 4
schedule2::branch::total---> 7
Segmentation fault
schedule2::branch::total::faults---> 5
schedule2::branch::additional---> 5
schedule2::branch::additional::faults---> 2
{ 'schedule2::branch::additional': [ '0 1 5 < input/inp.hf.14',
                                     '2 1 2 < input/et.7',
                                     '2 5 < input/ft.20',
                                     '1 0 -3 < input/zt.10',
                                     '0 0 0 < input/nt.6'],
  'schedule2::branch::random': [ '0 4 0 < input/dat619',
                                 '4 4 1 < input/tc.48',
                                 '3 3 5 < input/dat616',
                                 '1 4 5 < input/ct.40',
                                 '4 3 2 < input/nnt8',
                                 '7 9 8 < input/inp.hf.11',
                                 '8 6 2 < input/bdt.35',
                                 '2 5 6 < input/adt.55',
                                 '6 4 8 < input/bdt.82',
                                 '2 5 < input/ft.30',
                                 '2 9 10 < input/ft.9',
                                 '3 1 -5 < input/zt.1',
                                 '1 2 1 < input/dt.12'],
  'schedule2::branch::total': [ '0 1 5 < input/inp.hf.14',
                                '8 3 9 < input/inp.hf.16',
                                '2 1 3 < input/dt.21',
                                '1 2 1 < input/dt.12',
                                '1 4 2 < input/bdt.35',
                                '0 1 -2 < input/zt.13',
                                '2 5 < input/ft.20'],
  'schedule2::statement::additional': [ '1 2 3 < input/inp.hf.12',
                                         '2 5 < input/ft.20',
                                         '10 7 9 < input/ft.26',
                                         '1 0 -3 < input/zt.10'],
  'schedule2::statement::random': [ '9 4 9 < input/lu199',
                                    '10 9 2 < input/lu338',
                                    '3 0 0 < input/ct.4',
                                    '4 9 4 < input/ft.15',
                                    '4 5 5 < input/add.62',
                                    '1 < input/ad.1',
                                    '-1 2 4 < input/zt.3',
                                    '1 1 0 < input/ad.2'],
  'schedule2::statement::total': [ '1 2 3 < input/inp.hf.12',
                                   '2 1 3 < input/dt.21',
                                   '0 1 -2 < input/zt.13',
                                   '2 5 < input/ft.20'] }
```

rm: cannot remove 'schedule2/schedule2.gcda': No such file or directory

```
abhi@DESKTOP-66NUP0: /mnt/c/Users/abhin/Desktop/project-thebugsters-master/benchmarks
Calls executed:67.57% of 37
Creating 'tcas.c.gcov'

tcas::statement::random---> 6
tcas::statement::random::faults---> 6
tcas::statement::total---> 5
tcas::statement::total::faults---> 10
tcas::statement::additional---> 5
tcas::statement::additional::faults---> 10
tcas::branch::random---> 12
tcas::branch::random::faults---> 9
tcas::branch::total---> 13
tcas::branch::total::faults---> 13
tcas::branch::additional---> 11
tcas::branch::additional::faults---> 13
{ 'tcas::branch::additional': [ '798 1 1 2071 49 307 0 849 904 1 2 0',
                                '1118 1 1 712 261 735 1 423 450 0 1 1',
                                '1258 1 0 897 174 7253 1 629 500 0 0 1',
                                '1206 1 0 5140 355 730 2 980 693 2 2 0',
                                '700 1 1 400 300 600 2 100 500 0 1 1',
                                '906 0 0 4284 439 111 2 740 740 0 1 1',
                                '765 1 0 300 400 424 4 400 500 0 1 1',
                                '765 1 0 500 400 424 2 400 500 0 0 0',
                                '1078 1 1 581 567 655 0 1 1',
                                '854 1 1 4049 773 654 2 595 625 0 2 1',
                                '521 1 0 1907 348 2633 0 499 501 0 1 0'],
  'tcas::branch::random': [ '660 1 1 4014 407 561 3 501 400 0 1 1',
                            '848 1 0 2408 180 525 0 740 401 0 1 0',
                            '850 1 0 187 443 542 0 410 407 4 2 0',
                            '537 0 1 1397 427 1241 1 739 740 0 1 0',
                            '634 1 0 633 100 535 2 665 795 1 0 0',
                            '700 1 1 575 415 1 0 795 796 1 2 0',
                            '844 1 0 683 0 663 2 361 725 2 2 0',
                            '958 1 0 797 64 3253 2 399 200 1 0 1',
                            '0 1 0 1049 563 594 3 401 372 0 2 0',
                            '634 1 0 533 400 645 2 265 465 1 0 1',
                            '1132 1 0 0 607 565 1 351 593 2 2 1',
                            '1078 1 1 581 655 0 637 906 0 1 1'],
  'tcas::branch::total': [ '798 1 1 2071 49 307 0 849 904 1 2 0',
                           '634 1 1 633 200 535 2 665 795 0 1 1',
                           '867 1 1 1774 101 2204 0 499 499 1 0 1',
                           '698 1 0 3071 59 307 0 849 904 0 2 0',
                           '1118 1 1 712 261 735 1 423 450 0 1 1',
                           '727 1 1 1935 339 968 0 399 740 0 1 1',
                           '700 1 1 400 300 600 2 100 500 0 1 1',
                           '709 1 1 686 483 672 1 465 475 1 2 1',
                           '860 1 1 602 331 5657 3 639 740 1 1 0',
                           '594 1 1 5449 318 4116 1 400 501 1 1 1',
                           '854 1 1 4049 773 654 2 595 625 0 2 1',
                           '799 0 1 5588 485 211 0 399 499 0 0 1',
                           '1078 1 1 581 567 655 0 1 1'],
  'tcas::statement::additional': [ '1258 1 0 897 174 7253 1 629 500 0 0 1',
                                    '1',
                                    '1078 1 1 581 567 655 0 1 1',
                                    '907 1 0 560 342 601 3 961 399 2 2 1',
                                    '798 1 1 2071 49 307 0 849 904 1 2 0',
                                    '765 1 0 300 400 424 4 400 500 0 1 1'],
  'tcas::statement::random': [ '638 0 1 698 499 2465 3 500 501 0 0 0',
                               '800 1 0 735 323 724 2 233 584 0 2 0',
                               '1096 1 0 714 496 682 1 944 908 0 1 0',
                               '698 1 0 3071 59 307 0 849 904 1 2 0',
                               '934 1 0 533 30 545 2 565 21 0 0 1',
                               '0 1 1'],
```

```
abhi@DESKTOP-66NUP0I: /mnt/c/Users/abhin/Desktop/project-thebugsters-master/benchmarks
'765 1 0 300 400 424 4 400 500 0 1 1',
'765 1 0 500 400 424 2 400 500 0 0 0',
'1078 1 1 581 567 655 0 1 1',
'854 1 1 4049 773 654 2 595 625 0 2 1',
'521 1 0 1907 348 2633 0 499 501 0 1 0'],
'tcas::branch::random': [ '660 1 1 4014 407 561 3 501 400 0 1 1',
'848 1 0 2408 180 525 0 740 401 0 1 0',
'850 1 0 187 443 542 0 410 407 4 2 0',
'537 0 1 1397 427 1241 1 739 740 0 1 0',
'634 1 0 633 100 535 2 665 795 1 0 0',
'700 1 1 575 415 1 0 795 796 1 2 0',
'844 1 0 683 0 663 2 361 725 2 2 0',
'958 1 0 797 64 3253 2 399 200 1 0 1',
'0 1 0 1049 563 594 3 401 372 0 2 0',
'634 1 0 533 400 645 2 265 465 1 0 1',
'1132 1 0 0 607 565 1 351 593 2 2 1',
'1078 1 1 581 655 0 637 906 0 1 1'],
'tcas::branch::total': [ '798 1 1 2071 49 307 0 849 904 1 2 0',
'634 1 1 633 200 535 2 665 795 0 1 1',
'867 1 1 1774 101 2204 0 499 499 1 0 1',
'698 1 0 3071 59 307 0 849 904 0 2 0',
'1118 1 1 712 261 735 1 423 450 0 1 1',
'727 1 1 1935 339 968 0 399 740 0 1 1',
'700 1 1 400 300 600 2 100 500 0 1 1',
'709 1 1 686 483 672 1 465 475 1 2 1',
'860 1 1 602 331 5657 3 639 740 1 1 0',
'594 1 1 5449 318 4116 1 400 501 1 1 1',
'854 1 1 4049 773 654 2 595 625 0 2 1',
'799 0 1 5588 485 211 0 399 499 0 0 1',
'1078 1 1 581 567 655 0 1 1'],
'tcas::statement::additional': [ '1258 1 0 897 174 7253 1 629 500 0 0 0',
'1',
'1078 1 1 581 567 655 0 1 1',
'907 1 0 560 342 601 3 961 399 2 2 1',
'798 1 1 2071 49 307 0 849 904 1 2 0',
'765 1 0 300 400 424 4 400 500 0 1 1'],
'tcas::statement::random': [ '638 0 1 698 499 2465 3 500 501 0 0 0',
'800 1 0 735 323 724 2 233 584 0 2 0',
'1096 1 0 714 496 682 1 944 908 0 1 0',
'698 1 0 3071 59 307 0 849 904 1 2 0',
'934 1 0 533 30 545 2 565 21 0 0 1',
'0 1 1'],
'tcas::statement::total': [ '1258 1 0 897 174 7253 1 629 500 0 0 1',
'798 1 1 2071 49 307 0 849 904 1 2 0',
'907 1 0 560 342 601 3 961 399 2 2 1',
'765 1 0 300 400 424 4 400 500 0 1 1',
'1078 1 1 581 567 655 0 1 1]]
rm: cannot remove 'tcas/tcas.gcda': No such file or directory
```

```
abhi@DESKTOP-66NUP0: /mnt/c/Users/abhin/Desktop/project-thebugsters-master/benchmarks
Branches executed:81.82% of 88
Taken at least once:61.36% of 88
Calls executed:57.89% of 19
Creating 'totinfo.c.gcov'

totinfo::statement::random--> 6
totinfo::statement::random::faults--> 7
totinfo::statement::total--> 5
totinfo::statement::total::faults--> 12
totinfo::statement::additional--> 5
totinfo::statement::additional::faults--> 12
totinfo::branch::random--> 9
totinfo::branch::random::faults--> 16
totinfo::branch::total--> 5
totinfo::branch::total::faults--> 13
totinfo::branch::additional--> 5
totinfo::branch::additional::faults--> 13
{  'totinfo::branch::additional': [  '< universe/test99',
                                   '< universe/ntest32',
                                   '< universe/jk1AAS.mat',
                                   '< universe/ntest37',
                                   '< universe/ntest31'],
    'totinfo::branch::random': [  '< universe/test63.inc',
                                   '< universe/test92.inc',
                                   '< universe/jkAF0.mat',
                                   '< universe/12new44',
                                   '< universe/bnewt2',
                                   '< universe/tst51',
                                   '< universe/ntest9',
                                   '< universe/test15',
                                   '< universe/test345.inc'],
    'totinfo::branch::total': [  '< universe/test99',
                                   '< universe/12new51',
                                   '< universe/test17',
                                   '< universe/12new46',
                                   '< universe/ntest2'],
    'totinfo::statement::additional': [  '< universe/test99',
                                           '< universe/ntest39',
                                           '< universe/jk1AAS.mat',
                                           '< universe/ntest37',
                                           '< universe/ntest31'],
    'totinfo::statement::random': [  '< universe/tst2D.mat',
                                      '< universe/jkADZ.mat',
                                      '< universe/test399.inc',
                                      '< universe/test58',
                                      '< universe/12new27',
                                      '< universe/jkAAN.mat'],
    'totinfo::statement::total': [  '< universe/test99',
                                      '< universe/test58',
                                      '< universe/12new59',
                                      '< universe/12new51',
                                      '< universe/tst96']}]
rm: cannot remove 'totinfo/totinfo.gcda': No such file or directory
```