|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mutant** | **Original** **Code** | **Fault** **Injected** | **Found** | | |
| *Concolic* | *Concrete* | *Harness* |
| 3 | if (y != z) | if (y < z) |  |  |  |
| 122 | if (!z) | if (false && !z) |  |  |  |
| 42 | int compare(int x, int y) | int compare(int x, short int y) |  |  |  |
| 260 | return -1; | return -1 \* -1; |  |  |  |
| 481 | return 0; | return 1; //0; |  |  |  |
| 37 | if (y->red) | if (!y->red) |  |  |  |
| 74 | if (!w->right->red) | if (false && !w->right->red) |  |  |  |
| 78 | if (x == x->parent->right) | if (x < x->parent->right) |  |  |  |
| 113 | while((!x->red) && (root != x)) | while((!x->red) || (root != x)) |  |  |  |
| 157 | if (y->red) | if (!y->red) |  |  |  |
| 301 | if (y->red) | if (~y->red) |  |  |  |

Concolic traces found 6 mutants that concrete swarm testing failed to detect, 1 of which was caught by the custom harness. Concrete swarm testing found 24 mutants that concolic failed to detect, 9 of which were caught by the harness.

Concolic traces found 48 mutants that the harness failed to detect, while the harness found only 9 mutants that concolic failed to detect (all of which were caught by concrete swarm testing, as mentioned above).

Concrete swarm testing found 58 mutants that the harness failed to detect, while the harness found only 1 mutant that swarm testing failed to detect; this mutant was successfully caught by concolic.

46.5% (169 out of 353) mutants caught by concolic traces occurred after the execution of a symbolic function call.