Q1



**Mutant 2:**Reachability: Will always be reached; true  
Infection: (B < A) ≠ (B > A) , or A ≠ B  
Propagation: Will always propagate. ; true

Full test specification: true ∧ (A ≠ B) ∧ true = (A ≠ B).

Test case : A=5, B = 7

**Mutant 4:**Reachability: if (B<A) true , mutant 4 will be reached; (B < A) = true   
Bomb() signals a failure as soon as it is executed, so the infection and propagation will be true.  
Infection: true  
Propagation: true  
Full test specification: (B < A) ∧ true ∧ true = (B < A)  
Test case : A=7, B = 5

**Mutant 5:**Reachability: if (B<A) true , mutant 5 will be reached; (B < A) = true   
Infection will occur if value of A and B are different.  
Infection: A ≠ B  
Propagation: true  
Full test specification: (B < A) ∧ (A ≠ B) ∧ true = (B < A)  
Test case : A=7, B = 5

**Mutant 6:**Reachability: if (B<A) true , mutant 6 will be reached; (B < A) = true   
failOnZero() will signal a failure as soon as B is zero. And if B is zero, the mutant will be killed. So,  
Infection : B = 0  
Propagation: true  
Full Test specification : (B < A) ∧ (B = 0) ∧ true = (B < A) ∧ (B = 0)  
Test case ; A = 2, B = 0.

Q2.   
  
When the mujava tool was used to mutate the implementation of the roman program, total 480 mutants were generated. All of the generated mutants were traditional mutants, and none of the generated mutants were class mutants.   
The number of different types of traditional mutants that were generated were the following:

|  |  |
| --- | --- |
| AORB | 52 |
| AORS | 0 |
| AOIU | 2 |
| AOIS | 68 |
| AODU | 0 |
| AODS | 0 |
| ROR | 112 |
| COR | 2 |
| COD | 0 |
| COI | 19 |
| SOR | 0 |
| LOR | 0 |
| LOI | 18 |
| LOD | 0 |
| ASRS | 52 |
| SDL | 101 |
| VDL | 0 |
| CDL | 13 |
| ODL | 41 |

The results were the following for traditional mutants:

|  |  |
| --- | --- |
| Live Mutants # | 57 |
| Killed Mutants # | 423 |
| Total Mutants # | 480 |
| Mutant Score | 88.0% |