|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Initial population** | | **Sdl** | **Opr** | | **Var** | | **Con** | | **Ms** |
| Tc1(1,0,-3) | | 1,3,4,12,15,16 |  | |  | |  | | 6/42=14 |
| **Tc2(88,34,98)** | | 3,6,8,11,16 | 7,8,15 | | 1,2,6 | |  | | 11/42=26 |
| Tc3(0,77,0) replace by tc10 | | 1,4,5,12,15,16 |  | |  | |  | | 6/42=14 |
| **Tc4(100,100,100)** | | 3,7,16 | 7,8,11,12,14,15 | | 1,2,3,4,5,6 | |  | | 15/42=36 |
|  | |  |  | |  | |  | |  |
| **live mutants (sdl 2,9,10,13,14) opr(1,2,3,4,5,6,9,10,13,16,17,18,19,20)**  **Tc2,tc3,tc4 are non-redundant and have higher ms so selected for GA, crossover (8)high =(100,34,98), (88,100,100)**  **Low(2) crossover= (88, 34,98), (0,77,0) same child, mutated(18) =(88,38,98) (0,73,0) Iteration 1** | | | | | | | | | |
| Tc5(100,34,98) | 3,6,8,11,16 | | 7,14,15 | 1,5,6 | |  | | 11/42=26 | |
| **Tc6(88,100,100)** | 3,6,9,10,16 | | 7,8,11,12,16,19 | 1,2,3,4 | |  | | 15/42=36 | |
| Tc7(88,38,98) | 3,6,8,11,16 | | 7,8,15 | 1,2,6 | |  | | 11/42=26 | |
| Tc8(0,73,0) | 1,4,5,12,15,16 | |  |  | |  | | 6/42=14 | |
|  |  | |  |  | |  | |  | |
| **live mutants (sdl 2,13,14) opr(1,2,3,4,5,6,9,10,13,17,18,20)**  **Tc2,tc3,tc4,tc6 are non-redundant and have higher ms so selected for GA, crossover (19)high = (88,100,100) (100,100,100)**  **Low(22) crossover= (0, 77,2), (88,34,96) same child, mutated(5) =(80,100,100) (108,100,100) Iteration 2** | | | | | | | | | |
| Tc9(80,100,100) | 3,6,9,10,16 | | 7,8,11,12,16,19 | 1,2,3,4 | |  | | 15/42=36 | |
| **Tc10(108,100,100)** | 1,4,5,12,15,16 | | 2 |  | |  | | 7/42=17 | |
| **Tc11(0,77,2)** | 1,4,5,12,15,16 | | 1 |  | |  | | 7/42=17 | |
| Tc12(88,34,96) | 3,6,8,11,16 | | 7,8,15 | 1,2,6 | |  | | 11/42=26 | |
|  |  | |  |  | |  | |  | |
| **live mutants (sdl 2,13,14) opr(3,4,5,6,9,10,13,17,18,20)**  **tc2,tc4,tc6,tc10,tc11 are selected population as non-redundant**  **crossover (5) high = (84,100,100) (104,100,100)**  **Low(8) crossover= (0,100,100), (108,77,0) Iteration 3** | | | | | | | | | |
| Tc13(84,100,100) | 3,6,9,10,16 | | 7,8,11,12,16,19 | 1,2,3,4 | |  | | 15/42=36 | |
| Tc14(104,100,100) | 1,4,5,12,15,16 | | 2 |  | |  | | 7/42=17 | |
| Tc15(0,100,100) | 1,4,5,12,15,16 | | 1 |  | |  | | 7/42=17 | |
| Tc16(108,77,0) | 1,4,5,12,15,16 | |  |  | |  | | 6/42=14 | |
|  |  | |  |  | |  | |  | |
| **live mutants (sdl 2,13,14) opr(3,4,5,6,9,10,13,17,18,20)**  **no new mutant killed or tc added so perform 2 point mutation on(13,14,15,16)**  **= (80,100,108),(96,100,108),(8,100,108),(100,77,108) Iteration3 again** | | | | | | | | | |
| **Tc13(80,100,108)** | 1,4,5,12,15,16 | | 6 |  | |  | | 7/42=17 | |
| Tc14(96,100,108) | 1,4,5,12,15,16 | | 6 |  | |  | | 7/42=17 | |
| Tc15(8,100,108) | 1,4,5,12,15,16 | | 6 |  | |  | | 7/42=17 | |
| Tc16(100,77,108) | 1,4,5,12,15,16 | | 6 |  | |  | | 7/42=17 | |
|  |  | |  |  | |  | |  | |
| **live mutants (sdl 2,13,14) opr(3,4,5,9,10,13,17,18,20)**  **tc2,tc4,tc6,tc10,tc11,tc13 are new selected population as non-redundant.**  **Perform crossover(23) high=(** **88 100 100), ( 100 100 100),**  **low(8) crossover= (0,100,108) (80,77,2) same child, mutated(12)=(86,116,100),(100,116,100) Iteration 4** | | | | | | | | | |
| **Tc17(88,116,100)** | 1,4,5,12,15,16 | | 4 |  | |  | | 7/42=17 | |
| Tc18(100,116,100) | 1,4,5,12,15,16 | | 4 |  | |  | | 7/42=17 | |
| Tc19(0,100,108) | 1,4,5,12,15,16 | |  |  | |  | | 6/42=14 | |
| **Tc20(80,77,2)** | 2,5,13,14,16 | | 13 |  | |  | | 6/42=14 | |
|  |  | |  |  | |  | |  | |
| **live mutants (sdl 2,13,14) opr(3,5, 9,10, 17,18,20)**  **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20 are new selected population as non-redundant.**  **Perform crossover(9) high=(** **88 100 100), ( 100 100 100),**  **low(22) crossover= (0,77,2), (80,77,2) same child, mutated(7)=(90,100,100),(102,100,100),(2,77,2) (82,77,2) Iteration 5** | | | | | | | | | |
| Tc21(90,100,100) | 3,6,9,10,16 | | 7,8,11,12,16,19 | 1,2,3,4 | |  | | 15/42=36 | |
| Tc22(102,100,100) | 1,4,5,12,15,16 | | 2 |  | |  | | 7/42=17 | |
| **Tc23(2,77,2)** | 2,5,13,14,16 | | 10 |  | |  | | 6/42=14 | |
| Tc24(82,77,2) | 2,5,13,14,16 | | 13 |  | |  | | 6/42=14 | |
|  |  | |  |  | |  | |  | |
| **live mutants= opr(3,5, 9, 17,18,20)**  **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20,tc23 are new selected population as non-redundant.**  **Perform crossover(9) high=(** **88 100 100), ( 100 100 100),**  **low(22) crossover= (2,77,2), (80,77,2) same child, mutated(2)=(24,100,100),(36,100,100),(0,77,2) (82,77,2) Iteration 6** | | | | | | | | | |
| Tc25(36,100,100) | 3,6,9,10,16 | | 7,8,11,12,16,19 | 1,2,3,4 | |  | | 15/42=36 | |
| Tc26(24,100,100) | 3,6,9,10,16 | | 7,8,11,12,16,19 | 1,2,3,4 | |  | | 15/42=36 | |
| Tc27(0,77,2) | 1,4,5,12,15,16 | | 1 |  | |  | | 7/42=17 | |
| Tc28(82,77,2) | 2,5,13,14,16 | | 13 |  | |  | | 6/42=14 | |
|  |  | |  |  | |  | |  | |
| **live mutants= opr(3,5, 9, 17,18,20)**  **no new mutant killed or tc added, perform 2 point mutation (25,26,27,28)**  **= (36,-28,101),(24,-28,101),(66,-51,4),(18,-51,4)**  **Iteration 6 again** | | | | | | | | | |
| Tc25(36,-28,101) | 1,4,5,12,15,16 | |  |  | |  | | 6/42=14 | |
| Tc26(24,-28,101) | 1,4,5,12,15,16 | |  |  | |  | | 6/42=14 | |
| Tc27(0,-56,3) | 1,4,5,12,15,16 | |  |  | |  | | 6/42=14 | |
| **Tc28(82,-56,3)** | 1,4,5,12,15,16 | | 3 |  | |  | | 7/42=17 | |
|  |  | |  |  | |  | |  | |
| **live mutants= opr(5,9,17,18,20)**  **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20,tc23,tc28 are new selected population as non-redundant.**  **Perform crossover(23) high= (88,100,100) (100,100,100)**  **low(2) crossover= (66,77,2)(16,77,2) same child, mutated(14) =(88,96,100)(100,96,100) Iteration 7** | | | | | | | | | |
| Tc29(88,96,100) | 3,6,8,11,16 | | 7,8,11 | 1,2,3 | |  | | 11/42=26 | |
| **Tc30(100,96,100)** | 3,6,9,10,16 | | 7,8,14,15,20 | 1,2,5,6 | |  | | 14/42=33 | |
| Tc31(66,77,2) | 2,5,13,14,16 | | 10 |  | |  | | 6/42=14 | |
| Tc32(16,77,2) | 2,5,13,14,16 | | 10 |  | |  | | 6/42=14 | |
|  |  | |  |  | |  | |  | |
| **live mutants= = opr(5,9,17,18)**  **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20,tc23,tc28,tc30 are new selected population as non-redundant.**  **Perform crossover(10) high= (88,100,100) (100,100,100)**  **low(7) crossover= (82,77,2)(0,77,2) same child, mutated(22) =(88,100,96)(100,100,96) Iteration 8** | | | | | | | | | |
| Tc33(88,100,96) | 3,6,8,11,16 | | 8,11,12 | 2,3,4 | |  | | 11/42=26 | |
| **Tc34(100,100,96)** | 3,6,9,10,16 | | 11,12,14,15,**17,18** | 3,4,5,6 | |  | | 15/42=36 | |
| Tc35(82,77,2) | 2,5,13,14,16 | | 13 |  | |  | | 6/42 | |
| Tc36(0,77,2) | 1,4,5,12,15,16 | | 1 |  | |  | | 7/42 | |
|  |  | |  |  | |  | |  | |
| **live mutants= = opr(5,9)**  **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20,tc23,tc28,tc30,tc34 are new selected population as non-redundant.**  **Perform crossover(22) high= (88,100,96) (100,100,100)**  **low(3) crossover= (66,77,2)(16,77,2) Iteration 9** | | | | | | | | | |
| Tc37(88,100,96) | 3,6,8,11,16 | | 8,11,12 | 2,3,4 | |  | | 11/42=26 | |
| Tc38(100,100,100) | 3,7,16 | | 7,8,11,12,14,15 | 1,2,3,4,5,6 | |  | | 15/42=36 | |
| Tc39(66,77,2) | 2,5,13,14,16 | | 10 |  | |  | | 6/42 | |
| Tc40(16,77,2) | 2,5,13,14,16 | | 10 |  | |  | | 6/42 | |
|  |  | |  |  | |  | |  | |
| **live mutants= opr(5,9)**  **no new mutant killed or tc added, perform 2 point mutation (37,38,39,40)**  **= (24 36 96),(36,36,100),(2,13,2)(80,13,2)**  **Iteration 9 again** | | | | | | | | | |
| **Tc37(24,36,96)** | 2,5,13,14,16 | | 9 |  | |  | | 6/42=14 | |
| Tc38(36,36,100) | 2,5,13,14,16 | | 9 |  | |  | | 6/42=14 | |
| Tc39(2,13,2) | 2,5,13,14,16 | | 10 |  | |  | | 6/42=14 | |
| Tc40(80,13,2) | 2,5,13,14,16 | | 13 |  | |  | | 6/42=14 | |
|  | | | | | | | | | |
| **live mutants= = opr(5)**  **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20,tc23,tc28,tc30,tc34,tc37 are new selected population as non-redundant.**  **Perform crossover(12) high= (88,100,96) (100,100,100)**  **low(8) crossover= (80,77,2)(2,77,2) ,same child, mutated(17)= (80 77 -126),(** **2 77 -126) Iteration 10** | | | | | | | | | |
| Tc41(88,100,96) | 3,6,8,11,16 | | 8,11,12 | 2,3,4 | |  | | 11/42=26 | |
| Tc42(100,100,100) | 3,7,16 | | 7,8,11,12,14,15 | 1,2,3,4,5,6 | |  | | 15/42=36 | |
| **Tc43(80,77,-126)** | 1,4,5,12,15,16 | | 5 |  | |  | | 7/42=17 | |
| Tc44(2,77,-126) | 1,4,5,12,15,16 | | 5 |  | |  | | 7/42=17 | |
| All mutants killed, tc generated  **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20,tc23,tc28,tc30,tc34,tc37,tc43** | | | | | | | | | |

So total non-redundant with high mutation score test cases selected=>14 **tc2,tc4,tc6,tc10,tc11,tc13,tc17,tc20,tc23,tc28,tc30,tc34,tc37, tc43**

Live mutants=> 0

Killed mutants = 42, live =0, total=42

MS = 42/42=100%,

On mujava mutants=> live=26, killed =242, total=268, ms = 90%

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tc2(88,34,98)** | 3,6,**8**,**11**,16 | 7,8,15 | 1,2,6 |  | 11/42=26 |
| **Tc4(100,100,100)** | 3,**7**,16 | 7,8,11,12,14,15 | 1,2,3,4,5,6 |  | 15/42=36 |
| **Tc6(88,100,100)** | 3,6,9,10,16 | 7,8,11,12,16,**19** | 1,2,3,4 |  | 15/42=36 |
| **Tc10(108,100,100)** | 1,4,5,12,15,16 | **2** |  |  | 7/42=17 |
| **Tc11(0,77,2)** | 1,4,5,12,15,16 | **1** |  |  | 7/42=17 |
| **Tc13(80,100,108)** | 1,4,5,12,15,16 | **6** |  |  | 7/42=17 |
| **Tc17(88,116,100)** | 1,4,5,12,15,16 | **4** |  |  | 7/42=17 |
| **Tc20(80,77,2)** | 2,5,13,14,16 | **13** |  |  | 6/42=14 |
| **Tc23(2,77,2)** | 2,5,13,14,16 | **10** |  |  | 6/42=14 |
| **Tc28(82,-56,3)** | 1,4,5,12,15,16 | **3** |  |  | 7/42=17 |
| **Tc30(100,96,100)** | 3,6,9,10,16 | 7,8,14,15,**20** | 1,2,5,6 |  | 14/42=33 |
| **Tc34(100,100,96)** | 3,6,9,10,16 | 11,12,14,15,**17,18** | 3,4,5,6 |  | 15/42=36 |
| **Tc37(24,36,96)** | 2,5,13,14,16 | **9** |  |  | 6/42=14 |
| **Tc43(80,77,-126)** | 1,4,5,12,15,16 | **5** |  |  | 7/42=17 |

Random(14)=> live=81, killed=187, MS= 69

38 0 69

80 80 90

42 4 96

32 42 56

75 60 35

53 21 15

43 69 49

32 48 51

47 96 45

89 87 84

68 26 80

81 29 76

87 36 47

6 9 11

Boundary=> live=39, killed=229, MS=85