1. **Small dataset:**
   1. **Genetic Algorithm:**

Table 1 shows the result of 10 run for genetic algorithm, population size is 100, max generation is 2000, and muting rate is 1/100.

Table 1 Table2

 

The APFD of the permutation we can find with GA is 0.688, exactly the same in 10 runs. In average it takes 240 generations or 24000 search length to find the best solution.

* 1. **Hill Climber**

Table 2 shows the result of 10 run for hill climber algorithm, in this basic Hill Climber implementation the neighbours are generated by swapping two adjacent tests. The number of neighbourhood is too small, only one or two iterations is done in this test, we can generate more neighbours by swapping each pair of tests in the permutation to get a better solution.

* 1. **Comparison with random solution**

In the small dataset, GA can find the best solution in 240 generations or 24000 search length, the best APFD is always 0.68, so we can think that 0.68 is the highest APFD we can get, if we search the permutations randomly, there will be A(n,n) or n! permutaions, in the small test, this number is 216!, the ASL for a random solution is (216! + 1) / 2, which is far more than 24000, in this case, GA is a better choice to search permutations.

* 1. **Is this permutation sensible?**



By choosing the initial 5 test case of the best permutations in 10 runs, 4.2 faults were involved in average.

The 9th fault can not be found in this small dataset and the 5th fault only appeared once, which makes it a little confusing for the genetic algorithm to find the best individual with APFD.

1. **Big dataset**
   1. **Genetic Algorithm:**

Table 3 shows the result of 10 run for genetic algorithm, population size is 100, max generation is 2000, and muting rate is 1/100.

Test cases in the big dataset is better than the small dataset in coverage of faults, so GA can find a good solution with very high APFD.

Table 3 Table 4

 

The APFD of the permutation we can find with GA is 0.9577, and the result in 10 runs is very close (std is 5.03E-5), average search generations is 1060.

* 1. **Hill Climber**

Table 4 shows the result of 10 run for hill climber, the iteration times is still one or two, but the average APFD is 0.66 because the test cases in the big dataset covers a higher proportion of faults than the small dataset.

* 1. **Comparison**

When applied to the big dataset, the ASL of random search is , and the ASL of GA is 106060, so GA is always a better choice.

* 1. **Is this permutation sensible?**



By choosing the initial 25 test case of the best permutations in 10 runs, 12.7 faults were involved in average, 1/40 tests for 1/3 faults.