Evolutionary Algorithms: Peer review report

For the group of Alessandro Marchese, Paul van Tieghem, and Sérgio Pinto

Orestis Lomis, Thibeau Wouters and Jingyu Zhang

November 15, 2022

1   One strong aspect

We believe it is a very good idea to convert the infs to a constant value. It gives a distinction between two individuals, one of which may have nearly all of its roads giving infs, while the other can be nearly optimal, with just 2 roads mixed up giving a single inf. In fact we also do not think the fact that this *validates* invalid solutions is necessarily too bad. That is, if the evolutionary algorithm performs well enough and the punishment for taking roads with infinite values is harsh enough, this should not be too much of an issue. However, we do think that multiplying the average value by 100 is a bit arbitrary. Perhaps it is better to take the maximum value rather than the average value, because otherwise the possibility arises that the replacement value for the inf could actually be better than the actual value of some of the more costly roads, which is clearly against the intent of the replacement. The multiplicative factor, which is equal to 100 right now, could also be changed into a hyperparameter and finetuned later on.

2   Two weak aspects

The two weak points we identified are that the choice of fixing the starting city was brushed aside. The report mentions that this can make the other operators less intuitive, but we disagree. We also believe that the recombination operator as a whole could be revisited.

2.1   Representation

Fixing the start city can decrease the searching space from $n!$ to $(n-1)!$, which indeed eliminates the duplicated cyclic permutation. We also do not see why it would be less intuitive to implement the mutation and recombination operators. We go deeper into this when suggesting the change below. But in general, we think this is an easy change that offers a couple of benefits, without any true disadvantages.

2.2   Recombination

We believe the recombination operator is not a terrible choice at all. We agree with the points given in the report. However we also think that the preserving around half of the roads in the first parent might not always be a good thing. It is heavily biased towards the first parent, which might be a terrible individual. Maybe the order of the parents can be chosen based on their fitness values.

On top of that we think that allowing the same parents to create multiple children can be harmful. Instead, one can select other, unique parents and in this way generate more unique children allowing for more exploration. We believe that the effect of allowing the same parents to produce more children is equivalent to selecting these parents multiple times, which seems redundant given that this is the intent of the selection operator.

3   One suggestion

We definitely suggest to fix the first city. We do not see a clear disadvantage here, but do see plenty of advantages. It would be rather easy to implement as well, for example by picking $city_n$ as the starting city and then appending it by a permutation over cities 0 to $n-1$. As said earlier this would decrease the search space by a factor n, which is not insignificant especially for larger n. Contrary to what was written in the report, we actually think it would make the operators even more intuitive. Specifically looking at the recombination operator, the crossover point is more clear and it is easier to see how it applies to both parents. Moreover, it might help with the modification aspect of the representation. That is, if representations always start (and end) in the same city, the wrap-around aspect might not be as big of issue compared to the current representation. Removing this might make the code more efficient for the larger tours. As for the mutation operator you would of course have to exclude the first city from the selection, but that again is rather easy to fix. Besides, this will not impact the randomness in generating

the population too much. Also to compare individuals it is probably easier to look at two individuals that start with the same city, because similar parts of the tour are likely to overlap and will be easy to spot.