Project 4

Exploring GA for QC by modifying parameters and settings

GOAL: A detailed exploration of results obtained using different parameters and setting for a GA

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You are to use the GA algorithm that will be provided to you and you are asked to make a search through all below listed options and parameters. You are to establish an extensive search of the results provided by the GA and your results in a tabular form. You will be provided a set of gates to search for, as well as a set of gates to be used for this problem. You will have to go through all required parameters to be modified and make selections about which one to use now and which one to use later. A closer look to the table below shows that there are four sections proposed you and those are : Probabilities, Selection pressure, Mixed generations and Genetic operators. Assume you take the GA with roulette wheel, a population of 100, and you make experimentations by modifying parameters such as mutation, crossover and selection threshold probabilities (GA probability parameters to be selected), i.e. you are exploring the first section. Then with some fixed (or with small number of possible variations of mutation, crossover) values go to the next Section of your choice and experiment on different modes of reproduction or on different genetic operators. And so on. Report all results good or bad, especially the time of a run (in generation number), if the result was found and all technical tuning of the GA you was doing. All tests should be done over a set of 20 runs. Report all results in a statistical tabular form in order to report in a special section the best results you have found. Do not expect to find a good result for each run!!!!

- Parameters to modify
  - Probabilities
    - Mutation
    - Crossover
    - Selection threshold
  - Selection pressure
    - Roulette wheel
    - Universal Stochastic Sampling
    - Tournament
    - Threshold
  - Mixed generations
    - Comparing children with parents
    - Shared fitness
  - Genetic operators
    - Mutation
      - Normal, bitwise
    - Crossover
      - Normal, Multi-point

Detailed information about some mode of selections and specifications:

TOURNAMENT:

Each individual is compared to all individuals in the population and its fitness is based on the fact how many times it is better than all others. (not yet functional)

THRESHOLD:

Make selection among individuals that have all fitness higher than Δ (you are the one who is selecting Δ)

UNIVERSAL STOCHASTIC SAMPLING:

Select a number N of individuals you want to select at once. Distribute all individuals over a scale where the proportion of the allocated space is proportional to their fitness. Place N pointers equally spaced on this scale and select individuals where the pointers are.

MUTATION:

Bitwise: apply mutation to each bit of the string

Expected results:

- A detailed description of your experimental approach
- Arguments for or against the use of different configuration of GA in quantum circuit synthesis
- Graphical representation of the results
- Analysis of the results
- Report structured results with comparison, analysis, and statistical approximations