ASSESSED

G52AIM Lab 5 – Multimeme Memetic Algorithms

1 REPORT [50 MARKS]

These questions are designed to test your knowledge and intuition. We are only looking for short 1 or 2-line answers. You may include drawings of the search landscape to illustrate your explanations.

Question 1

Memetic algorithms are an extension of genetic algorithms and can apply local search during the evolutionary cycle. Both GA's and MA's evolve a population of individuals comprised of genetic material. In addition to genetic material, what other material does a **multimeme memetic algorithm** have compared to a genetic/memetic algorithm? **[5 marks]**

Question 2

How does self-adaptive parameter control, as used in multimeme memetic algorithms, differ from (non-self) adaptive parameter control? **[5 marks]**

Question 3

List three components of a multimeme memetic algorithm, not including those used in the lab, which could be self-adapted by encoding them in a memeplex. **[6 marks]**

Question 4

This question concerns a hypothetical set of local search operators that are encoded as a meme that are known to work well for solving some problem instance 'A'.

Q4A.

Thinking about the co-evolution of memes within an MMA, if the innovation rate was set optimally, why should the introduction of a useless local search operator (assume it really is useless) in a meme embedding the choice of local search operators **not** adversely affect the search process for solving instance 'A'? **You should explain the process of co-evolving memes in your answer and relate this to the effect of choosing the "useless" operator.** **[10 marks]**

Q4B.

If we know that an operator (heuristic) is not as good as others for solving a known problem instance 'A', why might we still want to include it in the set of operators as encoded by our memes? **[5 marks]**

Question 5

This question concerns the setting of the innovation rate parameter within a multimeme memetic algorithm using the simple inheritance method.

Q5A.

If the innovation rate setting of a multimeme memetic algorithm is set to 0.0, what would you expect would happen and why with respect to the values of each meme over the entire population after the first few generations when using the simple inheritance method? **[5 marks]**

Q5B.

Why is it a bad idea to have an innovation rate setting of 1.0 in a multimeme memetic algorithm using the simple inheritance method? **[5 marks]**

Question 6

You should perform some experimentation using the aid of the Lab05Runner class to observe the allele frequencies of the local search options across different MAX-SAT problem instances (#1, #7, and #9). In the interest of reducing computation time, you should change the number of trials to 5 for this question.

6A. Record the allele frequencies in the template table in the report template. **[0 marks]**

6B. Which local search operator seems to be the most beneficial for solving MAX-SAT instance #1? **[3 marks]**

6C. Looking at the allele frequencies across the three problem instances, what can you say about the performance of the different local search heuristics for solving the different instances? **[6 marks]**

2 SUBMISSION

Deadline: Tuesday 13/03/2018 – 15:00

You should submit a single PDF file called **[username]-lab05-report.pdf** to Moodle under CW5b.