

G52AIM CW5 REPORT

QUESTION 1.

Multimeme memetic algorithm contains a meme together with genetic material. GA, and MA only contains genetic material.

QUESTION 2.

Self-Adaptive parameter decides which operators and settings to use on the fly whenever needed receiving feedback during the evolutionary search process. Non-self-adaptive parameter control doesn't allow for on the fly parameter changing depending on the feedback from the algorithm.

QUESTION 3.

Mutation operator, crossover operator and where to apply local search.

QUESTION 4.

Q4A.

Memes are inherited from the parents with the most optimal solution value. However, if the parents have the same solution value a random parent will be selected and for the children, more poor memes will be passed due to the randomly selected parent with poor memes. As generations progress, poor meme concentration will decrease and at some point, the concentration will be small enough to be non-significant, hence it wouldn't affect the algorithm. If the innovation rate is set optimal, the poor meme will be reintroduced occasionally due to randomness, but the concentration will decrease again, and the meme won't be adopted.

Q4B.

A bad meme is introduced to determine if the algorithm could find a good meme, which enables the testing of the power of the multimeme memetic algorithm.

QUESTION 5.

Q5A.

If the innovation rate is set to 0.0 the mutation of the memes will stop (there will be no innovation). Memes that are not in the initial solution will not be introduced. Therefore, the concentration for a few certain memes would be extremely high and concentration for most of the memes will be low. If there is no innovation, the good parents from the first generation will be adopted and never mutate. So, the same memes will keep growing. The memes that weren't introduced from the start or adopted from the start will not be reintroduced and they will struggle to be adopted and the number will decrease.

Q5B.

If the innovation rate is set to 1.0 then memes will keep mutating and strategies for selecting memes will be equally used across the memes. This will cause algorithm to not being able to affectively identify good memes and decrease the concentration of bad memes.

QUESTION 6.

Q6A.

Please provide the output from the console/terminal in the following table for the **best trial** for each instance using innovation rate = 0.2.

In st a n c e ID	Allele frequencies as printed in the console for best trial
1	<p>Heuristic: Multimeme Memetic Algorithm Run ID: 0 Best Solution Value: 26.0 Best Solution: 0100000111010100000000011101111111010111011111101010110101111001011000110100 1100100000000101000011100000100100110010101011101110000100110100110100101001 0011010101110101001000110111101001000000000001000000100001010101101110001010 0100101110111100001100001100100010100000000100011101110000011010010101111110 1001000110111010101011011111000011110100001100100101010010001101001101101010 0010011100111111100010001110001101100011001111010001101100111110111111001110 1000100011110001100010111101100011010010011101111011011010100100100101101110 0001110101011101100111001100011011000010010000010101100101101111100100110011 0011101011101011111000001101110110101111011100101101010001011000101010101001 0011100101001001</p> <p>MEME 0: Allele 0 = 1206 Allele 1 = 4 Allele 2 = 0 Allele 3 = 2 Allele 4 = 4</p> <p>MEME 1: Allele 0 = 0 Allele 1 = 1204 Allele 2 = 12 Allele 3 = 0</p> <p>Heuristic: Multimeme Memetic Algorithm Run ID: 2 Best Solution Value: 26.0 Best Solution: 0011100111000100001001010100111010001111001100001010111000010010011001101111 1100001010000111011010100000001110010001010011011110001000101101100001110010 0001010110110111001000110011101011000000010001110010000110010100101000000010 011000010011111110000010110100011010000000110011001110100010000110101101011 1001100111101101000010010111100001111000011100010001011111001000101110111000 1010000001011110010010001111001000101011011111011111011110100111000111010 1011100111100000100010111101100010000001001101001001011011110000110000000110 110011010111101101101001100110010001101011001110000011000001110000000010011 101111011001000010000000001110100111100011000111101110001001101101000001100 0001010010001010</p> <p>MEME 0: Allele 0 = 0 Allele 1 = 0 Allele 2 = 2 Allele 3 = 8 Allele 4 = 1206</p>

	MEME 1: Allele 0 = 0 Allele 1 = 1202 Allele 2 = 10 Allele 3 = 4
7	Heuristic: Multimeme Memetic Algorithm Run ID: 1 Best Solution Value: 10.0 Best Solution: 1010100001100011101011110110111100000011111001110111100100010000001110011011 1001111110001011000011110001101000100000000011110011010010001111011000111110 1101111001111101101000101101110000000101111001110011010011000100010010000011 1101010011110101011000 MEME 0: Allele 0 = 12 Allele 1 = 0 Allele 2 = 1204 Allele 3 = 0 Allele 4 = 0 MEME 1: Allele 0 = 0 Allele 1 = 1212 Allele 2 = 2 Allele 3 = 2
9	Heuristic: Multimeme Memetic Algorithm Run ID: 4 Best Solution Value: 211.0 Best Solution: 0101100110100101011101011111001100011100000101110110001100100001000000100001 1111010011100111001110001101000111111111110110101010000001110001111010110110 0101001001100001001100110100111100110110011011100111001010100110011011101110 1011110101100010001000101000101101001000001100111111001000111010110000000010 100001111101000000110001010011001100111 MEME 0: Allele 0 = 4 Allele 1 = 0 Allele 2 = 1206 Allele 3 = 6 Allele 4 = 0 MEME 1: Allele 0 = 0 Allele 1 = 1198 Allele 2 = 18 Allele 3 = 0

Q6B.

Allele 1 is the best local operator for instance 1, which is DBHC_IE. DBHC_IE only accepts improving or equivalent moves and for this case it is proven to be the best solution since it is more frequently used throughout the population. (1204 for Run ID 1 and 1202 for Run ID 2)

Q6C.

With respect to every single instance, Allele 1 (which is DBHC_IE) is the best performing local search heuristic.

For Instance 1, the Allele 1(DBHC_IE) was the best local search operator (as explained above). DBHC_OI, SDHC_OI and SDHC_IE weren't good at solving instance 1 of Max-Sat Problem.

For Instance 7, the Allele 1(DBHC_IE) was the best local search operator with the frequency of 1212 on the best run. DBHC_OI, SDHC_OI and SDHC_IE weren't good at solving instance 7 of Max-Sat Problem.

For Instance 9, the Allele 1(DBHC_IE) was the best local search operator with the frequency of 1198 on the best run. DBHC_OI, SDHC_OI and SDHC_IE weren't good at solving instance 9 of Max-Sat Problem.