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1. Textbook 4-4

Since the number added to x is drawn from a normal distribution with mean setting 0 and a fixed standard deviation. It is equally possible that the number would be positive as would be negative. Therefore, the interpretation is incorrect

2. Textbook 8-1

The mutation strength should be increased during the initial stage of the evolutionary strategy in order to extend the jump distance, reaching optimal result. However, during the final stage, search with finer granularity should be achieved to fine tune the optimum searching process. Namely, mutation strength should be decreased.

3. Textbook 8-3

Since self-adaptation works best with finer granularity, it takes effect at the individual level. According to formula.

4. Textbook 11-1

$$S1 = *0**11***0** \quad S2 = *****0*1*****$$

A. $o(S1) = 4$

$$o(S2) = 2$$

$$\text{Defining length of } S1 = 8$$

$$\text{Defining length of } S2 = 2$$

B. $p_{survive} \geq 1 - p_{crossover} \cdot \frac{\delta(H)}{l-1}$

$$\text{For } S1, \delta(S1) = 8, l = 12$$

$$p_{survive} \geq 1 - p_{crossover} \cdot \frac{\delta(H)}{l-1} = 1 - p_c * 0.727$$

$$\text{For } S2, \delta(S1) = 2, l = 12$$

$$p_{survive} \geq 1 - p_{crossover} \cdot \frac{\delta(H)}{l-1} = 1 - p_c * 0.1818$$

C. According to $(1 - p_{mutation})^{o(H)}$

$$\text{For } S1, p_{mutation} = p_m, o(S1) = 4$$

Therefore, $p_{survive} \geq (1 - p_{mutation})^{o(H)} = (1 - p_m)^4$, while p_m is so small, $p_{survive} \approx 1 - 4p_m$

$$\text{For } S2, o(S2) = 2$$

$$p_{survive} \geq (1 - p_{mutation})^{o(H)} = (1 - p_m)^2 \approx 1 - 2p_m$$

C. To survive, for S1:

$$p_{survive} \geq 1 - 0.727p_c - 4p_m \text{ by summing up two probabilities above.}$$

For S2

$$p_{survive} \geq 1 - 0.1818p_c - 2p_m$$

D. The definition of building block is (1). Short defining length (less likely to be cut in half) and (2). Lower-order schema. Schemas which meet these two requirements have higher chance to be transmitted to their offspring. Therefore, S2 can be seen as the “building block”.

5. Textbook 4-5

The following statistical numbers are from 100 runs of my program without setting the seed.

Mean = 5.163978444855388e-08

Standard deviation: 3.45954e-09