# **Genetic Algorithm Assignment**

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1. Consider three strings A1=11101111, A2= 00010100, A3= 01000011 and six schemata H1=1\*\*\*\*\*\*\*, H2=0\*\*\*\*\*\*\*, H3= \*\*\*\*\*\*11, H4= \*\*\*0\*01\*, H5= 1\*\*\*\*\*1\*, and

H6=1\*\*\*\*\*1\*.

* 1. Which schemata is matched by which string?
  2. What are the order and defining length of each of the schemata?
  3. Estimate the probability of survival of each schema under mutation when the probability of a single mutation is pm=0.001.
  4. Estimate the probability of survival of each schema under crossover when the probability of crossover pc=0.85.

**Sol: Given pm = 0.001 and pc = 0.85, the calculation table is given below:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Schema(H) | Order (o(H)) | Defining length (δ(H)) | Strings matching to schema | (Survival under mutation) | (Survival under Crossover) |
| H1 = 1\*\*\*\*\*\*\* | 1 | 0 | A1 | 0.999 | 1 |
| H2 = 0\*\*\*\*\*\*\* | 1 | 0 | A2, A3 | 0.999 | 1 |
| H3 = \*\*\*\*\*\*11 | 2 | 1 | A1, A3 | 0.998 | 0.8780 |
| H4 = \*\*\*0\*01\* | 3 | 3 | A3 | 0.997 | 0.6357 |
| H5 = 1\*\*\*\*\*1\* | 2 | 6 | A1 | 0.998 | 0.2714 |
| H6 = 1\*\*\*\*\*1\* | 2 | 6 | A1 | 0.998 | 0.2714 |

1. A population contains the following strings and fitness values at generation 0:

# String Fitness

1. 10001 20
2. 11100 10
3. 00011 5
4. 00011 15

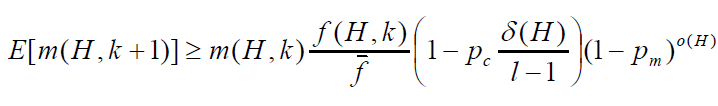
The probability of mutation is pm=0.01 and the probability of crossover is pc=0.7. Calculate the expected number of schemata of the form 1\*\*\*\* in generation 1. Estimate the expected number of schemata of the form 0\*\*1\* in generation 1.

|  |  |
| --- | --- |
| String (Si) | Fitness(fi) |
| S1 = 10001 | 20 |
| S2 = 11100 | 10 |
| S3 = 00011 | 5 |
| S4 = 00011 | 15 |
| Total Fitness | 50 |
| Avg. Fitness () | 12.5 |

**Sol.** Let H­1= 1\*\*\*\* and H­2= 0\*\*1\*. Let the given strings be denoted by S1, S2,S3,S4 respectively.

Now,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Schema(H) | Order (o(H)) | Defining length (δ(H)) | Strings matching to schema | m(H,0) | f(H,0) = |
| H1 = 1\*\*\*\* | 1 | 0 | S1, S2 | 2 | 15 |
| H2 = = 0\*\*1\* | 2 | 3 | S3, S4 | 2 | 10 |

**The expected number instance for Schema(H) at next generation is given by :**

**Given, pm = 0.01, pc = 0.7, Now,**

**Similarly,**

**So, Expected number of schemata for H1 and H2 in generation 1.**