MileStone 3

Pseudo Code Correctness and

Complexity Analysis

University Of Engineering And Technology

Submitted To: Sir Samyan Wahla

Project ID: CS311S20PIDG34

Time complexity

Parameters:

The genetic algorithm depends majorly upon following parameters:

- Crossover
- Mutation
- Population size
- Number of generations

Calculation:

Assume size of population is P, number of generations is G, probability of crossover and mutation is PC & PM respectively and size of individuals is n.

The number of individual mutated is :

$$(PM \times P)$$

And we have to do it for each individual so the number of operations needed is:

$$(PM \times P \times n)$$

The crossover function works on two individuals and generate two individuals(children) ,while mutation function is unary works on one individual and generate one individual.Since, the number of crossovers that will be done is:

$$(2 \times PC \times P)$$

And we have to go along each individual .So, the number of operation needed to perform crossover is:

$$(2 \times PC \times P \times n)$$

All these operations were repeated for each generation thus G times. Thus the time complexity of whole genetic algorithm is

$$T = G((P \times log(P)) + (PM \times P \times n) + (2 \times PC \times P \times n) \tag{1}$$

Since, G and P were constant (ks) regardless of what the problem was, assuming that $m1 = G, m2 = P$, $m3 = PM\ x\ P$, $m4 = PC\ x\ p$ then theoretically $m = m1 = m2 = m3 = m4$, and therefore time complexity become:

$$T = k((k\ x\ log(k)) + (k\ x\ n) + (k\ x\ n) \tag{2}$$

$$= k^2\ log(k) + 2nk^2 \tag{3}$$

Since k was constant, then k^2 and $log(k)$ were also constants, which makes Eq.(2) As the following;

$$T = k + (kn) \tag{4}$$

Therefore, time complexity of the traditional genetic algorithms is linear i.e. T depended mojorly on population size as it is the only variable in the process:

$$T = O(n) \tag{5}$$