Fall 2019

- 1. Compare the following pairs of concepts:
- a) Individual and Population: Individual is a single candidate solution, while population is a group of individuals that collectively explore the solution space.
- b) Chromosome and Gene: Chromosome encodes an entire candidate solution (individual), while gene only an allele at a particular locus in a chromosome.
- c) Genotype and Phenotype: Genotype is the genetic makeup of an individual (inside), while phenotype represents its actual physical properties (outside).
- d) Crossover and Mutation: Sexual reproduction (combination of at least two individuals) vs. asexual reproduction (variation of a single individual).

Selection

Consider the following population of 10 individuals in GA:

[001010, 010000, 011100, 011000, 110010, 100001, 111101, 000101, 000010, 100011]

that encode value of single variable x using binary code. The fitness function $f(x)=1/[1+(x-32)^2]$ should be maximized. Further, assume that random number generator provided the following sequence of 10 numbers [0.2319, 0.2393, 0.0498, 0.0784, 0.6408, 0.1909, 0.8439, 0.1739, 0.1708, 0.9943]

Determine the intermediate population (i.e. population after selection but before crossover and mutation) using fitness proportional and ranked selection.

Fitness proportional

1 1111000	DE	fitnes		oumm	0.231	0.239	0.049	0.078	0.640	0.190	0.843	0.173	0.170	0.994
 		1111165		cumm										
BIN	С	S	norm	ul	9	3	8	4	8	9	9	9	8	3
10000														
1	33	0.500	0.728	0.728	*	*	*	*	*	*		*	*	
10001														
1	35	0.100	0.146	0.873							*			
11100	28	0.059	0.086	0.959										
11000	24	0.015	0.022	0.982										
10000	16	0.004	0.006	0.987										
11001														
0	50	0.003	0.004	0.992										
1010	10	0.002	0.003	0.995										*
101	5	0.001	0.002	0.997										
11110														
1	61	0.001	0.002	0.998										
10	2	0.001	0.002	1.000										

Ranked

	DE	fitnes		cumm	0.231	0.239	0.049	0.078	0.640	0.190	0.843	0.173	0.170	0.994
BIN	С	S	rank	ul	9	3	8	4	8	9	9	9	8	3
10000			10.00											
1	33	0.500	0	0.182			*	*				*	*	
10001														
1	35	0.100	9.000	0.345	*	*				*				
11100	28	0.059	8.000	0.491										
11000	24	0.015	7.000	0.618										
10000	16	0.004	6.000	0.727					*					
11001														
0	50	0.003	5.000	0.818										
1010	10	0.002	4.000	0.891							*			
101	5	0.001	3.000	0.945										
11110														
1	61	0.001	2.000	0.982										
10	2	0.001	1.000	1.000										*

Discussion: The problem of a strong individual (100001) taking over the population is alleviated by using ranked selection taking over the population is alleviated by using ranked selection.