

TECNOLÓGICO DE MONTERREY

COMPUTATIONAL INTELLIGENCE

Homework 4

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Problems

1. Tournament selection

	Population	f
A	010111000	-1
B	011101001	4
C	111000110	-2
D	100001000	1
E	010101000	0

- How many copies of each chromosome are present in the mating pool?
 - A: 0
 - B: 3
 - C: 0
 - D: 2
 - E: 0
- What is the average fitness of the chromosomes in the mating pool?
2.8
- If the tournament size is reduced to one, what is the probability that the chromosome 100001000 appears in the mating pool?
100%
- If the tournament size is increased to five, and both crossover and mutation rate are set to zero, what is the probability that the chromosome 010111000 survives to the next population?
0%

2. Whole arithmetic crossover

$$x = \{0.18, 0.75, 0.92, 0.26, 0.44\}$$

$$y = \{0.36, 0.77, 0.62, 0.13, 0.51\}$$

$$c_{.5}^1 = \{0.27, .76, .77, .195, .475\}$$

$$c_{.1}^1 = \{0.342, 0.768, 0.65, 0.143, 0.503\}$$

$$c_{.5}^2 = \{0.27, .76, .77, .195, .475\}$$

$$c_{.1}^2 = \{0.198, 0.752, 0.89, 0.247, 0.447\}$$

3. Exponential ranking selection Sum: 5.4375

	Population	f	r	f'
A	6661166703	5	3.5	2.296875
B	3306772232	5	3.5	2.296875
C	0489794549	4	1.5	0.421875
D	2660088784	4	1.5	0.421875
E	3578647359	3	0	0

- A: $\frac{2.29}{5.4375} = 0.4224$
- B: $\frac{2.29}{5.4375} = 0.4224$
- C: $\frac{0.42}{5.4375} = 0.0775$
- D: $\frac{0.42}{5.4375} = 0.0775$
- E: 0

4. Schemata

- Given two schemata, $1^*001^*1^*$ and 00^*11^*11 , which schema corresponds to more solutions?

$$1^*001^*1^* \rightarrow 8$$

$$- 11001111$$

$$- 11001110$$

$$- 11001011$$

$$- 11001010$$

$$- 10001111$$

$$- 10001110$$

$$- 10001011$$

$$- 10001010$$

$$00^*11^*11 \rightarrow 4$$

$$- 00111111$$

$$- 00111011$$

$$- 00011111$$

$$- 00011011$$

- What is the order of the schemata 01101001 , $****1**0$ and 1^*0^*0010 ?

$$- 01101001 \rightarrow 8 \rightarrow 2$$

$$- ****1**0 \rightarrow 2 \rightarrow 0$$

$$- 1^*0^*0010 \rightarrow 6 \rightarrow 1$$

- What is the defining length of the schemata $00^{**}1010$, $**0^{**}111$ and $*0^{***}1^*0$?

$$- 00^{**}1010 \rightarrow 7$$

$$- **0^{**}111 \rightarrow 5$$

$$- *0^{***}1^*0 \rightarrow 6$$

- Given a population of five chromosomes: 100, 001, 111, 010, and 000, how many different schemata exist in such a population? As part of your answer, calculate the lower and upper bounds of schemata in the population.

Upper bound = $5 * 2^3 = 40$

Lower bound = $2^3 = 8$

– 000	– *0*	– 111	– 001
– 00*	– ***	– 11*	– 0*1
– 0*0	– 010	– 1*1	– *01
– *00	– 01*	– *11	– 100
– 0**	– *10	– 1**	– 10*
– **0	– *1*	– **1	– 1*0

5. Practical case

6. Analysis