

## 19- The different selection operators

There are several ways to implement the selection step

### (1) Fitness proportional

Draws with replacement, we choose randomly  $n$  times an individual from the current population. The individual is chosen proportional to its fitness

More chance to choose a high fitness individual

There can obviously be copies of individuals

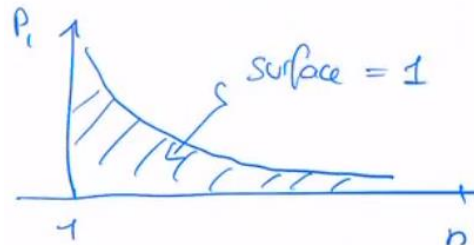
Il faut faire attention à s'il y a des individus avec une fitness négative

$$p_i = \frac{f(s_i)}{\sum_{k=1}^n f(s_k)}$$

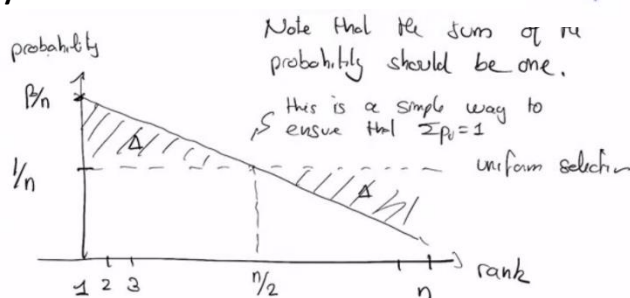
### (2) Selection by rank

We set the individuals in an order depending on their fitness value (by rank), this works with negative fitness results, as well as for minimization problems

For each rank we assign a probability of the individual being chosen, by having higher probability for higher ranked individuals



### (3) Selection by linear rank



This is called linear rank selection and the function above is

$$p_i = \frac{1}{n} \left[ \beta - 2(\beta-1) \frac{i-1}{n-1} \right] \quad i=1, \dots, n.$$

$$\begin{cases} \beta > 1 \leadsto p_1 > p_n \\ \beta < 2 \leadsto p_n > 0 \end{cases}$$

### (4) Selection by tournament

$k$ -tournament selection  $\rightarrow$  draw  $k$  random elements from the population, each individual having  $1/n$  probability of being chosen

from the  $k$  chosen individuals, select the one with the highest/lowest fitness depending on the problem

do this process  $n$  times

$\rightarrow$  One doesn't need to define a fitness function, just needs to be able to compare individuals