Probability distribution

Minimise Cost (Objective function ≡ Fitness Function)

Costs		Probabilities
c_1	$\longrightarrow$	p_1
c_2		p_2
$\vdots$		$\vdots$
c_n		p_n

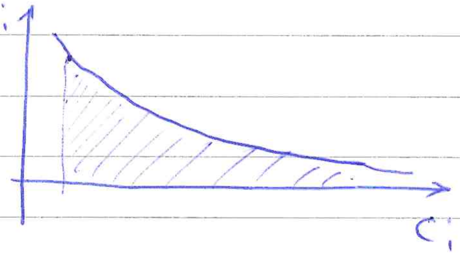
(1) $c_i < c_j \iff p_i > p_j$

(2) $\sum_{i=1}^{n} p_i = 1$

- We seek for a function that has properties (1) and (2)

One of these functions is

$$\boxed{p_i = e^{-b c_i}}$$



One extreme

$b = 0$

$\downarrow$

c_i^*: $p_i = \frac{1}{n}$

(uniform distribution)

$$\boxed{p_i = e^{-b \frac{c_i}{\frac{1}{n}\sum c_i}}}$$

$\frac{1}{n}\sum c_i \rightarrow$ average $\bar{c_i}$

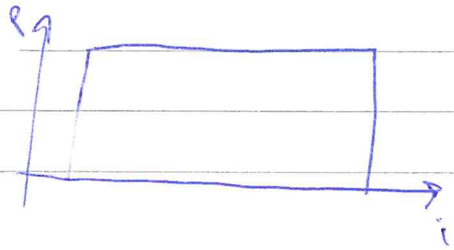
or

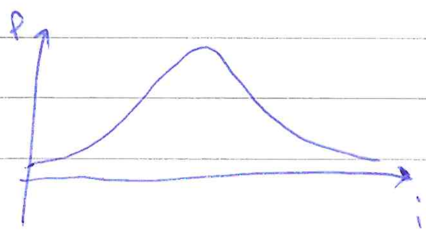
$$\boxed{p_i = e^{-b \frac{c_i}{\bar{c_i}}}}$$

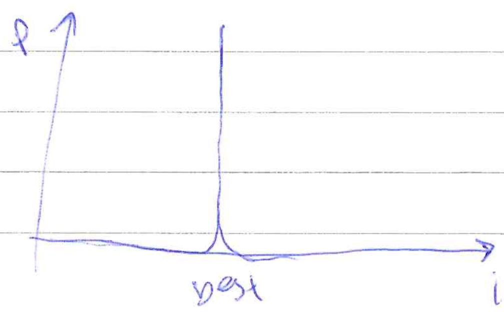
Other extreme

$b \rightarrow \infty$

$$p_i = \begin{cases} 1, & i = \text{best} \\ 0, & \text{otherwise} \end{cases}$$







position 1 position 2 position 3

Parent 1 : $\boxed{0}\,\boxed{0}\,\boxed{1}$ 1 0 1 0 1

Parent 2 : $\boxed{1}\,\boxed{0}\,\boxed{0}$ 1 1 0 0 1

Bit position 1

Random $z_1 = \boxed{1}$:

$p_1 \xrightarrow{=0} o_1 = 0$

$p_2 \xrightarrow{=1} o_2 = 1$

Bit position 2

Random $z_2 = \boxed{0}$:

$p_2 \xrightarrow{=0} o_1 = 0$

$p_1 \xrightarrow{=0} o_2 = 0$

Bit position 3

Random $z_3 = \boxed{0}$

$p_2 \xrightarrow{=0} o_1 = 0$

$p_1 \xrightarrow{=1} o_2 = 1$

Random z bit-string
10010101

parent 1 : 0 0 1 1 0 1 0 1
parent 2 : 1 0 0 1 1 0 0 1
random z bit string : 1 0 0 1 0 1 0 1

offspring 1 : 0 0 1 1 1 1 0 1
offspring 2 : 1 0 1 1 0 0 0 1