Exercice 5.1-2

$n = b - a + 1$: The width of the selection interval
$p = E[ln_2(n)] + 1$: The nearest power of 2 bigger than n

Example:

$Random(3, 7)$
$n = 5$
$p = 3: 2^3$
There are 8 different combinations for a 3 run sequence of Random(0,1) each with equal probability.

Pseudocode:

Random(a, b):

- n = b - a + 1
- p = E[ln_2(n)] + 1
- Generate a list L of the first **n** permutations in {0, 1} of size **p**
- Do:
    - Generate a random permutation P of size p
- $While\ (P\ not\ in\ L)$
- Getindex i of the permutation in L
- **Return** Integer with index i in the {a, …, b}

Exercice 5.1-3

Runtime ~= 1/p x BIASED-RANDOM time
Explanation:

- We wish to have a balanced dice from an unbalanced one.
- We need to run the dice 1/p times to record a fair measurement of the minority class.
- For each call of UNBIASED-RANDOM we run BIASED-RANDOM 1/p times

Exercice 5.2-5

N total number of customers
X_n: Customer n gets his correct hat
$E[X_n] = 1/n$
S: sum of customer receiving their correct hats

$S = E[\sum X_n] = \sum E[X_n] = \sum 1/n \approx ln(N)$