In order to answer exercises 1 to 4, you should start with $N = 1$ and then adapt your program to $N \in \mathbb{N}^\star$. The "normal" way would be to use a for loop, but the "scilab" way is to use arrays and functions such as `cumsum` and/or `sum`.

1 Using only the `rand` function, create a function `bernoulli(p,N)` that outputs the result of N independent Bernoulli experiments with parameter p.

2 Using only the `rand` function, create a function `binom(n,p,N)` that outputs the result of N independent binomial experiments with parameters n and p.

3 Using only the `rand` function, create a function `geometric(p,N)` that outputs the result of N independent geometric experiments with parameter p.

4 Using only the `rand` function, create a function `die(N)` that outputs the result of N independent fair six-sided die rolls.

5 Write a program that will play tic-tac-toe against you by choosing its moves randomly. You can use the `input` function and a `matrix` to display the gameboard.

6 *Hint : `help tabul`.* When rolling two dice, the probability that the sum will be equal to 7 is 1/6.

1. Using the `die` function from exercise 4, simulate 10,000 sums of two dice rolls.
2. Compute the frequency of 7 : is this result surprising ?
3. Give an approximation of the probability mass function for the sum of two independent dice rolls.
4. Compute the distribution and check that your approximation is good.

7 A deck of 52 cards can be represented by the integers between 1 and 52.

1. Write a program that randomly picks 5 "cards" in the set $[\![1;52]\!]$.
2. Repeat the experiment 100,000 times and compute the frequency of "hands" with one queen and two kings.
3. Compute the probability that, when picking 5 random cards in a deck of 52 cards, there will be exactly one queen and two kings.

8 The law of large numbers states that, in layman's terms, if you repeat a random experiment an infinite number of times, then the average result will be equal to the expected value of the underlying random variable.

1. Simulate 100,000 Bernoulli experiments with a parameter p of your choice.
2. Compute the corresponding average value.
3. Compare it to the expected value of the Bernoulli distribution.

Repeat questions 1 to 3 with the other distributions from the course.

9 Consider the following experiment; an urn contains 5 marbles, 4 blue ones and 1 green one. Someone picks a marble at random : if it's blue, he puts 4 blue marbles back, otherwise he puts back 2 green ones. After 100 trials, the person wins $\$n$ where n is the proportion of green marbles.

1. Using the `grand` function with the `'uin'` parameter, write a function that takes a number of green and blue marbles as an argument, simulates the experiment and then outputs the new number of green and blue marbles.
2. Write a function that "plays" 100 times.
3. Simulate a "large number" of games (for example 100,000) and compute the average winnings.

10 Take a random exercise from the first page of the exercise sheet and write a `scilab` function that simulates the corresponding experiment.