An example to illustrate a Monte Carlo technique to calculate a quantity.

- There are 100 men in a circle.
- Each person shoots to his left or right.
- What is the distribution of the number that remain alive ? What is the mean and variance ?

```
Ntrials = 10000; (* try the experiment 10000 times*)
Nmen = 100; (* number of men *)
Shootlist = Table[0, {i, 1, Nmen}];
MenRemaining = Table[0, {it, 1, Ntrials}];
(* initialize whether person shot left or right *)
(* men are in positions labeled i from 1 to 100 *)

Live[i_] :=
  Module[{ileft, iright}, (* Function to determine if person was shot *)
   ileft = i - 1;  (* index of person standing on left *)
   iright = i + 1; (* standing on right *)
   If[ileft == 0, ileft = Nmen];  (* fix for circular boundary condition *)
   If[iright == Nmen + 1, iright = 1];
   If[ Shootlist[[ileft]] == 1 || Shootlist[[iright]] == 0, Return[0], Return[1]]];
(* return 0 if shot , 1 if alive *)

For[ itry = 1, itry ≤ Ntrials, itry++,
 (* create random variable for each person's shooting direction *)
 Shootlist = Table[RandomVariate[BernoulliDistribution[0.5]], {i, 1, Nmen}];
 (* 1 means shot right, 0 means shot left *)
 remains = Table[Live[i], {i, 1, Nmen}]; (* how many remain alive *)
 HowMany = Total[remains];  (* sum up the total *)
 MenRemaining[[itry]] = HowMany
 (* create an array of answers for the trials *)
]
```

The answer should be that the mean is 25 remain alive. There are 4 possibilities for each person: shot from left, shot from right, shot from both, or not shot. This means on the average 1/4 chance of survival. But for small numbers the survival probabilities are correlated. For large numbers we could assume an uncorrelated Bernoulli PMF with 1/4 chance of survival and 3/4 chance of death. The Variance for each person would be 1/4**2. The variance for 100 people (considered independent) would be 100*(1/4)^2 => standard deviation of 10*0.25

= 2.5.   The PMF will be roughly Gaussian with the mean at 25 with sigma = 2.5. Minimum number of survivors is 0 and the maximum is 50. (This can be seen by considering 4 people at a time. This shows that the minimum number of dead must be 50.)

```
Mean[MenRemaining] // N
```

```
24.9894
```

```
StandardDeviation[MenRemaining] // N
```

```
2.51442
```

```
Histogram[MenRemaining, {0, 100, 1}, Frame → True]
```