Example 1:
We are flipping 3 loaded coins. With these coins, the probability of getting tail is 0.3. Let X be the number of heads we get.

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
<th>E(X) = 2.1</th>
<th>V ar(X) = 0.63</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.027</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.189</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.441</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.343</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

S = { TTT, TTH, THT, THH, HTT, HTH, HHT, HHH }

Binomial Distribution
1. The number of trials, n, is fixed.
2. Each trial has two possible outcomes: “success” and “failure.”
3. The probability of “success”, p, is the same from trial to trial.
4. The trials are independent.
5. X = the number of “successes” in n independent trials.

Then,

\[ P(X = k) = \binom{n}{k} \cdot p^k \cdot (1 - p)^{n-k} \]

where \( k = 0, 1, \ldots, n \)

with \( \binom{n}{k} = \frac{n!}{k!(n-k)!} \)

\[ E(X) = n \cdot p. \quad V ar(X) = n \cdot p \cdot (1 - p) \]

Example 1:
We are flipping 3 loaded coins. With these coins, the probability of getting tail is 0.3. Let X be the number of heads we get.

a) What is the probability of getting 2 heads?

b) On average, how many heads will we get each time?

c) Find the variance and the standard deviation of X?
Example 2:
An automobile salesman thinks that the probability of making a sale is 0.30. If he talks to five customers on a particular day, what is the probability that he will make exactly 2 sales? (Assume independence.)

Example 3:
*Often On-time Parcel Service (OOPS)* delivers a package to the wrong address with probability 0.05 on any delivery. Suppose that each delivery is independent of all the others. There were 7 packages delivered on a particular day.

a) What is the probability that at least 1 of them was delivered to the wrong address?

b) What is the probability that exactly 2 of them were delivered to the wrong address?

c) What is the probability that at most 2 of them were delivered to the wrong address?

d) What is the probability that at least 2 of them were delivered to the wrong address?

Computing Binomial Distribution Probabilities using scipy.stats in Python

```python
from scipy.stats import binom

binom.pmf(k=0, n=7, p=0.05)  # P(X=0) when X ~ Binom(n=7, p=0.05)
binom.cdf(k=2, n=7, p=0.05)  # P(X<=2)
binom.mean(n=7, p=0.05)      # E(X)
binom.var(n=7, p=0.05)       # Var(X)
```