Binomial distribution: short example

$Y \sim Bin(n, \pi)$ then

$$\ell_{n,\pi}(y) = \frac{n!}{y!\,(n-y)!} \pi^y (1-\pi)^{n-y} \quad, \quad y = 0, 1, 2, \ldots, n$$

Also we have:

$$E[Y] = n\pi, \quad var(Y) = n\pi(1-\pi)$$

Example: An unprepared student must randomly answer a 10-question quizz with 5 possible answers for each. Let Y denote the number of correct responses. $\pi = 0.2$.

$$P(Y=0) = \frac{10!}{0!\,10!} \, 0.2^0 0.8^{10} = \underline{0.107}$$

$$P(Y=5) = \frac{10!}{5!\,5!} \, 0.2^5 0.8^5 = \underline{0.026}$$

$$E[Y] = 10 \cdot 0.2 = \underline{2}$$

$$var(Y) = 10 \cdot 0.2 \cdot 0.8 = \underline{1.6}$$

Reference: An Introduction to Categorical Data Analysis, A. Agresti, 2016