# Warm-Up for Day 14

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## 1 Formula Area

- Expectation value of a discrete random variable X: $E[X] = \sum_i p_i x_i$, where $p_i$ is the probability of $X$ taking a value $x_i$. For a population, we refer to the expectation value or $\mu$.
- $E[X] = np$, where $X$ is a binomially-distributed discrete random variable, the number of successes $x$ in $n$ trials.
- Variance of a discrete random variable X: $Var[X] = \sum_i (x_i - \mu)^2 p(x_i)$
- $Var(X) = npq$, where $X$ is a binomially-distributed discrete random variable. The standard deviation is $\sigma = \sqrt{npq}$.

## 2 Concepts from Chapter 4

1. Suppose a psychologist is studying whether or not babies have the concept of morality. Specifically, she wants to know if babies choose a puppet shown to behave "badly," or one that behaves "well." The babies can choose either bad puppet, or good puppet, and there is a run of 100 babies. (a) What would you expect for the results $N_{good}$ and $N_{bad}$ if the babies were choosing randomly? (b) For our discrete random variable $N_{good}$, the number of babies in a run that chose the good puppet, what is $p$ for random selection? (c) Consider Tab. 1 below. Determine the expectation value for the number of babies in a given run that choose good puppet. The data is based on 10 runs of 10 babies each. (d) Is this data binomially distributed? Why or why not?

| $x$ | $N_{good}$ | $p(x)$ | $x * p(x)$ |
|---|---|---|---|
| 0 | 0 | | |
| 1 | 0 | | |
| 2 | 0 | | |
| 3 | 1 | | |
| 4 | 0 | | |
| 5 | 1 | | |
| 6 | 2 | | |
| 7 | 5 | | |
| 8 | 1 | | |
| 9 | 0 | | |
| 10 | 0 | | |

Table 1: A table displaying the number of babies that chose the good puppet.