Let $X_i \sim_{i.i.d.} Bin(n, p)$. Find the MMEs for n and p.

We solve this system of equations:

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Which simplifies to:

$$\bar{X} = np \tag{3}$$
$$s^2 = np(1-p) \tag{4}$$

To solve this, set $n = \bar{X}/p$ and plug into the variance equation, solving for p:

$$s^2 = \bar{X}(1 - p) \tag{5}$$

$$s^2 - \bar{X} = \bar{X}p \tag{6}$$

$$\widehat{p} = \frac{\bar{X} - s^2}{\bar{X}}. \tag{7}$$

And then:

$$\widehat{n} = \frac{\bar{X}}{p} \tag{8}$$

Code to test this:

```
n <- 15
p <- 0.3
x <- rbinom(100, prob = p, size = n)
xbar <- mean(x)
s2 <- mean((x - xbar)^2)

p_hat <- (xbar - s2) / xbar
n_hat <- xbar / p_hat

p_hat
n_hat
```