We can use the cumulative binomial table \( G \) to find simple binomial probs.

**Ex:** \( P(X = 6) = P(X \leq 6) - P(X \leq 5) \)

Why does this work?

\[
P(X \leq 6) - P(X \leq 5) =
\]
\[ P(x=0) + P(x=1) + P(x=2) + P(x=3) + P(x=4) + P(x=5) + P(x=6) \] 
\[ \] 
\[ - \] 
\[ P(x=0) + P(x=1) + P(x=2) + P(x=3) + P(x=4) + P(x=5) \] 

Removing the square brackets and combining similar terms yields

\[ P(x=6) \]
EX: \( n = 10 \quad p = .5 \)

\[
P(x = 6) = P(x \leq 6) - P(x \leq 5)
\]

\[
= .8281 - .6230
\]

\[
= .2051
\]

EX: \( n = 20 \quad p = .4 \)

\[
P(x > 10) = 1 - P(x \leq 10)
\]

\[
= 1 - .8725
\]

\[
= .1275
\]
The previous example uses the idea of complementary events:

\[ P(E) = 1 - P(\text{not} E) \]

where

\[ E = \{ x > 10 \} \]
\[ = \{ x = 11, 12, 13, \ldots, \text{or} 20 \} \]

and

\[ \text{not} E = \{ x \leq 10 \} \]
\[ = \{ x = 0, 1, 2, \ldots, \text{or} 10 \} \]

Similarly, for the next example
\( n = 10 \quad p = .3 \)

\[
P(x \geq 2) = P(x > 1) = 1 - P(x \leq 1) = 1 - .1493 = .8507
\]

Other examples in Sec 6.1
what if \( p > 0.5 \)?

Change the roles of Success and Failure

**Ex:** 70% of male students eventually marry. A random sample of 25 male students is selected. Find the probability that at least 20 of these students will eventually marry.

\[
\text{Success} = \text{Marry} \\
p = P(\text{Success}) = P(\text{Marry}) = 0.7
\]
\[ X = \# \text{ Successes} = \# \text{ Marry} \]

Find \( P(X \geq 20) \)

Can't use table \( G \)

since \( p = .7 \)

Reverse roles of Success and Failure:

Success = Not marry

\[ p = P(\text{Success}) = P(\text{not marry}) \]

= .3

\[ y = \# \text{ Successes} = \# \text{ Not Marry} \]

Then
\[ P(x \geq 20) = \]
\[ P(y \leq 5) = 0.1935 \]
using table C
with \( n=25 \), \( p=0.3 \)
and \( r=5 \)

Ex: Example 6.7 Textbook
Recall: Sample mean $\bar{X}$ estimates the population mean $\mu$. The sample std. dev. $s$ estimates the pop. std. dev. $\sigma$.

If we know the distribution of random variable $X$, we can calculate $\mu$ and $\sigma$ directly — no need to estimate $\mu$ and $\sigma$. 
Mean and Standard Deviation of a Binomial Dist.

\[ E(X) = \text{mean} = \mu = n \times p \]

\[ \text{std. dev} = \sigma = \sqrt{n \times p \times (1-p)} \]

**EX:** Couple with 2 children (cont.)

- \( n = 2 \)
- \( p = 0.5 \)

\[ \mu = n \times p = 2 \times (0.5) = 1 \]

10. the mean number of Males in a family of two children is 1 male.
\[ \sigma = \sqrt{n \cdot p (1-p)} \]
\[ = \sqrt{2 \cdot (.5)(1-.5)} \]
\[ = \sqrt{2 \cdot (.5)\cdot (.5)} \]
\[ = \sqrt{.5} \]
\[ \approx 0.7 \]