A natural representation of the content in the image could be:

\[
P(E/F) = \frac{P(EF)}{P(F)}
\]
$S' = \{ (H,H), (H,T), (T,H), (T,T) \}$

* "both" $B = \frac{1}{2} (H,H)$

* "first" $F = \frac{1}{2} (H,H), (H,T)$

* "any" $A = \frac{1}{2} (H,H), (H,T), (T,H), (T,T)$

\[
P(B|F) = \frac{P(BF)}{P(F)} = \frac{P(\frac{1}{2} (H,H))}{2/4} = \frac{1/4}{2/4} = \frac{1}{2} 
\]

\[
P(B|A) = \frac{P(BA)}{P(A)} = \frac{P(\frac{1}{2} (H,H))}{3/4} = \frac{1/4}{3/4} = \frac{1}{3} 
\]
(1) \( \binom{b+2}{n} \) compute first 3 cases:

- \( n \leq r+b \)
- \( n \geq r+b \)

The 3rd case needs a correction. It's not exactly given.

1. Case when \( n \leq r+b \): \[ P(B_k) = \frac{\binom{b-k}{n-k}}{\binom{k}{n}} \]
2. Case when \( n \geq r+b \): \[ P(B_k) = \frac{\binom{b-k}{n-k}}{\binom{r+b-k}{n-k}} \]

\[ P(B_k) = \frac{\binom{b}{n}}{\binom{r+b}{n}} \]

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P(B | B_k) = \frac{P(B \cap B_k)}{P(B_k)} = \frac{P(B_k | B) P(B)}{P(B_k)}

P(B_k | B) = \frac{\binom{b-k}{n-k}}{\binom{k}{n}}

P(B) = \frac{b}{r+b}

P(B_k) = \frac{\binom{b}{n-k}}{\binom{r+b}{n-k}}
\[ P(E, E_2, \ldots, E_n) = P(E_1)P(E_2|E_1)P(E_3|E_1, E_2) \ldots P(E_n|E_1, \ldots, E_{n-1}) \]

Bayes' theorem

\[ P(E) = P(EF) + P(EF^c) \]

\[ = P(E|F)P(F) + P(E|F^c)P(F^c) \]

\[ = P(E|F)P(F) + P(E|F^c)(1 - P(F)) \]

Bayes' theorem
\[ P(A) = P(A|A)P(A) + P(A|A^c)P(A^c) \]
\[ = 0.4 \cdot 0.3 + 0.2 \cdot 0.7 \]
\[ = 0.26 \]

\[ P(A|A) = \frac{P(A|A)}{P(A)} = \frac{P(A)P(A|A)}{P(A)} = \frac{0.3 \cdot 0.4}{0.26} = \frac{6}{13} \]

\[ P(A|A^c) = 1 - P(A|A) = \frac{7}{13} \]

\[ P(A|A) > P(A|A^c) \text{ or } P(A)^2 > 0.26 \]