A = 10
B = 15
C = 17

Always try to think of a smaller problem, to clarify your thinking!

Let imagin A, B, and C playing Four Matches in total.

In one scenario, another scenario

| | | | |
|---|---|---|---|
| (A, B) | A = 3 | (C, B) | A = 2 |
| (A, C) | B = 3 | (C, A) | B = 3 |
| (C, B) | C = 2 | (A, B) | C = 3 |
| (B, A) | 8 | (B, C) | 8 |

AHA

Hence for the original example the total number of matches is $\frac{42}{2} = 2$

For a bad Player...

1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21

$\underbrace{2, 4, 6 \ldots 20}_{10}$

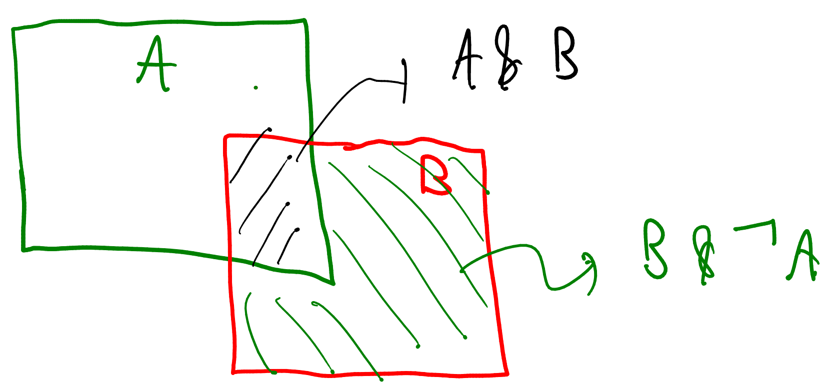
$$P(X_1 = 1 \text{ and } X_2 = 2)$$

$$P(A \text{ and } B) = P(A)\,P(B|A)$$
$$= P(B)\,P(A|B)$$

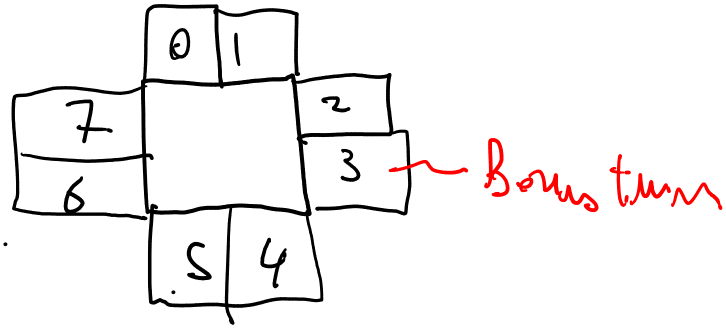
$$P(A|B) = \frac{P(A)\,P(B|A)}{P(B)}$$ Bayes rule

$$P(A|B) = \frac{P(A)P(B|A)}{P(A)P(B|A) + P(\text{not } A)P(B|\text{not } A)}$$

$$P(B) = P(A \text{ and } B) + P(\text{not } A \text{ and } B)$$



# Board game




Think of the ways that a dice role will not let me complete the board.

I can roll

1, 2, 4, 5, 6

$$P(\text{any role but } 3) = \frac{5}{6}$$

The other way is to roll 3 and for the bonus roll to be less or equal to 4

$$P(\text{Rolled } 3 \text{ AND rolled} \leq 4) = \frac{1}{6} \times \frac{4}{6} = \frac{1}{9}$$

$$P(\text{Not completing the board}) = \frac{1}{9} + \frac{5}{6} = \frac{17}{18}$$

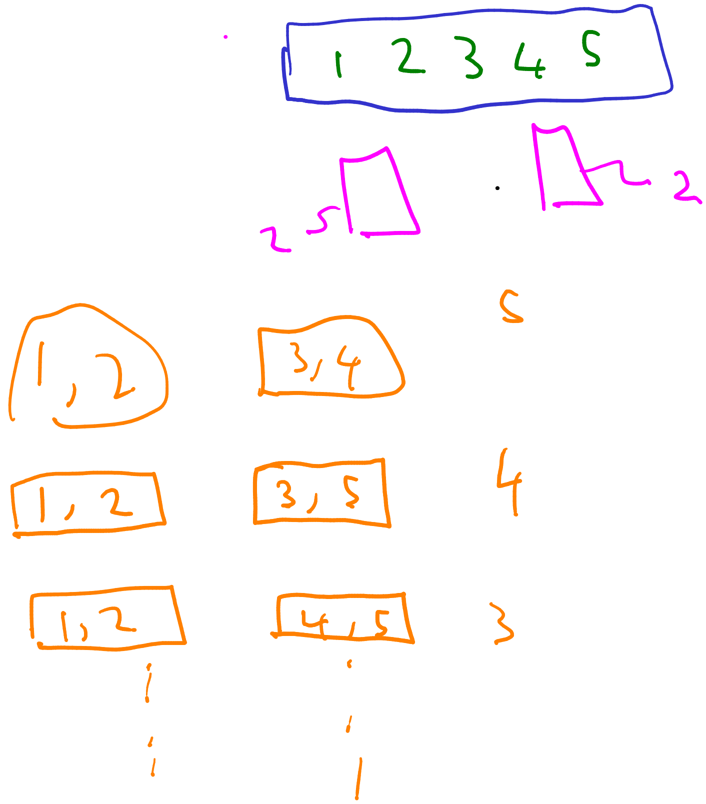
Another

What is the probability of completing the board?

$$P(\text{Rolled } 3 \text{ and rolled} > 4) = \frac{1}{6} \times \frac{2}{6} = \frac{1}{18}$$

but $1 - \frac{1}{18} = \frac{17}{18}$

# Multinomial Coefficients




## Permutation

How many way I can arrange my 7 students on seven chairs?

$7!$.

If I have to numbered chairs who many way can I arrange my students there

$$7\times 6 = \frac{7!}{(7-2)!} = \frac{n!}{(n-r)!}$$

If I don't care about the chair lables. If I have 3 chairs.

$$\frac{7\times 6\times 5}{3\times 2\times 1} = \frac{n!}{r!\,(n-r)!} = \binom{n}{r}$$

The book example:-

$$\frac{13!}{6!\cancel{7!}} \cdot \frac{\cancel{7!}}{5!\cancel{2!}} \cdot \frac{\cancel{2!}}{2!0!} = \frac{13!}{6!\,5!\,2!}$$

$$\binom{13}{6}\binom{7}{5}\binom{2}{2}$$