DECK OF CARDS
OUTCOME = ATOM - QUEEN OF HEARTS
EVENT = MOLECULE - QUEEN

(Q = QUEEN
F = FACE
H = HEART)

P(Q) = 1/13
P(F) = 4/13
P(H) = 1/4

P[Q|H] = 1/52
P[Q|F] = 1/13
P[H|F] = 4/52
P[Q|H|F] = 1/52

P(Q|F) = P(Q) + P(H) - P(Q|H)
= 1/13 + 1/4 - 1/52 = 16/52

P(Q|H|F) = P(Q|F) - P(Q|H)
= 16/52 - 1/52 = 15/52

P(Q|H|F) = P(Q|F) - P(Q|H)
= 16/52 - 1/52 = 15/52

P(Q|H|F) = P(Q|F) + P(H) - P(Q|H)
= 16/52 + 1/4 - 1/52 = 25/52
Random Experiment:

Pick a point uniformly in $[0, 1]$

$P\left(\frac{1}{3} \leq x \leq \frac{3}{2}\right) = \frac{3}{4} \frac{1}{3} = \frac{1}{2}$

Example of non uniform:
Spin an angle if spots are uniform random

Our random var is point on $x$-axis
The arrow points to

$x$ is not uniform
Cauchy Dist
\[
\begin{align*}
\Pr(x > \frac{1}{2}) &= \frac{1}{2} \\
\Pr(c \leq \frac{1}{10}) &= \frac{1}{10} \\
\Pr(x \geq \frac{1}{2} \text{ and } c < \frac{1}{10}) &= \frac{1}{20} \\
\Pr(x > y) &= \frac{1}{2}
\end{align*}
\]

**Permute 4:** 4! = 24 choices

**Permute 6:** 6! = 720 choices.

\[N = N! \text{ CHOICES.}\]
12 MONTHS: 1, 2, 3, ..., 12

12 CRASHES: A, B, C, ..., L

We want prob each month has exactly 1 crash.

How many ways can we assign crashes to months?

A has 12 choices

B

C

#Ways to assign crashes to months: \( \frac{12!}{12!} \)

#Ways with each crash in a different month: \( \frac{12!}{12!} \)

Prob each crash is in a different month:

\[
= \frac{12!}{12!} = \frac{1}{20000}
\]
\[ f(x) = \frac{c}{\sqrt{1 + x^2}} \]

\[ \int_{-\infty}^{\infty} f(x) \, dx = 1 \]

\[ EV[a] = \sum_{x} x f(a) \, dx \quad \text{DIVERGES} \]

\[ \text{CAUCHY DIST} \]