

1/23/20 CS - 1

DECK OF CARDS

OUTCOME ~ ATOM

QUEEN OF HEARTS

EVENT ~ MOLECULE - QUEEN

Q - QUEEN

F - FACE

H - HEART

$$P[Q] = 1/13$$

$$P[F] = 4/13$$

$$P[H] = 1/4$$

$$P[Q \cap H] = 1/52$$

$$P[Q \cap F] = 1/13$$

$$P[H \cap F] = 4/52$$

$$P[Q \cap H \cap F] = 1/52$$

$$P[Q \cup H] =$$

$$P[Q] + P[H] - P[Q \cap H]$$
$$= \frac{1}{13} + \frac{1}{4} - \frac{1}{52} = \frac{16}{52}$$

$$P[Q \cup H \cup F] =$$

$$P[Q] + P[H] + P[F]$$

$$- P[Q \cap H] - P[Q \cap F]$$

$$- P[H \cap F]$$

$$+ P[Q \cap H \cap F]$$

$$= \frac{1}{13} + \frac{4}{13} + \frac{1}{4} - \frac{1}{52} - \frac{1}{13} - \frac{4}{52}$$

$$+ \frac{1}{52} = \frac{25}{52}$$

RANDOM EXPERIMENT:

2

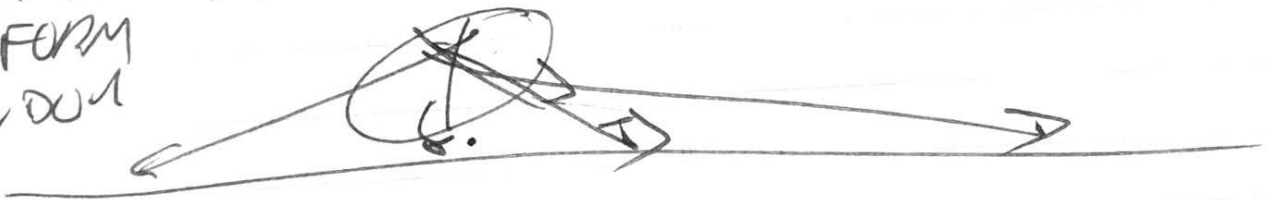
PICK A POINT UNIFORMLY IN

$[0, 1]$

$$P\left[\frac{1}{3} \leq x \leq \frac{3}{4}\right] = \frac{3}{4} - \frac{1}{3} = \frac{5}{12}$$

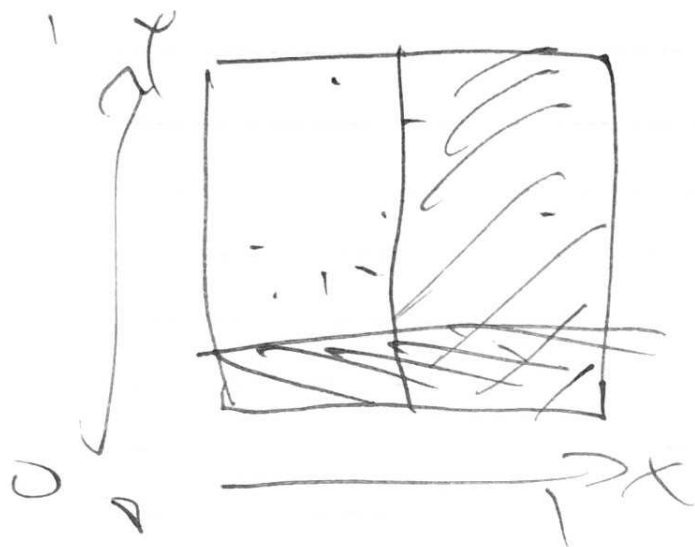
EXAMPLE OF NON UNIFORM:

SPINNER: ANGLE IT STOPS AT IS  
UNIFORM  
RANDOM



OUR RANDOM VAR IS POINT ON  $x$ -AXIS  
THE ARROW POINTS TO

$x$  IS NOT UNIFORM.  
CAUCHY DIST



$$P\left[x > \frac{1}{2}\right] = \frac{1}{2}$$

$$P\left[y < \frac{1}{10}\right] = \frac{1}{10}$$

$$P\left[x > \frac{1}{2} \text{ \& } y < \frac{1}{10}\right] = \frac{1}{20}$$

$$P[x > y] = \frac{1}{2}$$

PERMUTE 4 :  $4! = 24$  CHOICES

PERMUTE 6 :  $6! = 720$  CHOICES.

$N = N!$  CHOICES.

12 MONTHS: 1, 2, 3, ..., 12 [4]

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:  $12^{12}$

#WAYS WITH ~~EXACT~~ EXACT CRASH IN DIFF MONTH =

$12!$

PROB EACH CRASH IS IN A DIFF MONTH

$$= \frac{12!}{12^{12}} = \frac{1}{20000}$$

$$f(x) = \frac{e^{-x^2}}{\sqrt{1+x^2}}$$



$$\int_{-\infty}^{\infty} f(x) dx = 1$$

$$E[x] = \int_{-\infty}^{\infty} x f(x) dx \quad \text{DIVERGES}$$

CAUCHY DIST