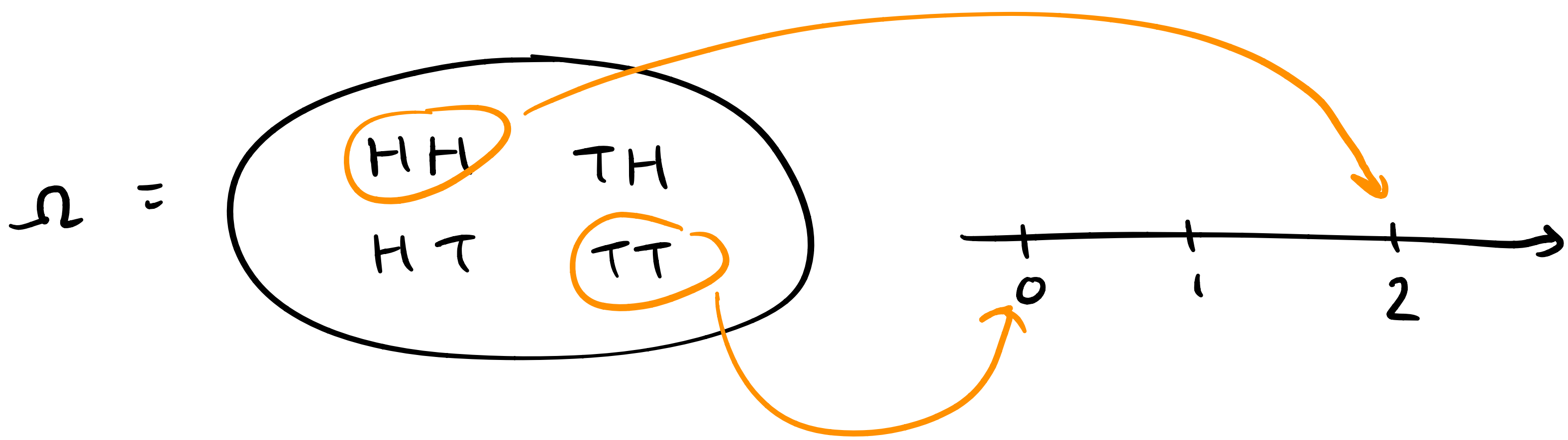
DIS 9B

RANDOM VARIABLES

a random variable (RV) is defined on a sample space and measures some property of sample points.

ex. 2 fair coin flips $\quad X$: # of heads



the distribution of a RV tells us the probability it will take on certain values

from above: $P(X=1) = 1/2$

SOME NAMED DISTRIBUTIONS

$X \sim \text{Bernoulli}(p)$

$$P(X=i) = \begin{cases} p & \text{if } i=1 \\ 1-p & \text{if } i=0 \end{cases}$$

$E[X] = p$

commonly used for indicator RVs of an event w/ probability p

indicator of a fair coin flip landing tails:

Bernoulli (1/2)

$X \sim \text{Binomial}(n, p)$

$$P(X=i) = \binom{n}{i} p^i (1-p)^{n-i}$$

for $i = 0, 1, \ldots, n$

$E[X] = np$

# of successes in n trials, given probability p of success in each

# of heads in 5 fair coin flips:

Binomial (5, 1/2)

NAMED DISTRIBUTIONS CONT.

$X \sim \text{Geometric}(p)$

$P(X=i) = (1-p)^{i-1}\, p$

for $i = 0, 1, \ldots, n$

# of trials until a success, given probability p of success in each trial

$E[X] = \frac{1}{p}$

rolls until we see a 3 on a fair die

Geometric(1/6)

$X \sim \text{Poisson}(\lambda)$

$P(X=i) = \frac{\lambda^i}{i!} e^{-\lambda}$

for $i = 0, 1, 2, \ldots$

# of occurences of an event within a time period, given an average frequency of λ

$E[X] = \lambda$

# of visitors to a website with an average of 5 hits per minute:

Poisson(5)