random variable: function from sample space to real #

$X: S \to R$

ex: $S = \{1, 2, 3 \ldots 6\}$

$X(1) = 1$

$X(2) = 4$

$X(3) = 9$

capital letters

ex 2: could assign 1 to evens & 2 to odds

ex: coin flipped 5X's.

sequence of H/T a random variable

{(HHHTHH), (HTTTT) ...}

$X(HTTTH) = 3$

$X(HHHTH) = 1$ } # Tails

number of sets or subsets

ex 2: {rat1, rat2, rat3 .. ratn}

$X(r_i)$ = number of tails - discrete

$y(r_i)$ = length of tail } continuous

$z(r_i)$ = weight

$T(r_i)$ = number of offspring - discrete

discrete - only countable list of values "staircase"

continuous - use calculus "escalator"

Discrete Random variables

every random var has a probability distribution

- assigns prob of getting that #

ex: flip 2 coins

$S = \{HH, HT, TH, TT\}$

$X(w)$ = # tails

$X: S \to \mathbb{R}$ (little p: $\mathbb{R} \to [0,1]$)

$P(x) = P(X = x)$

$X(S) = 0, 1, 2$ ← possibilities for $X(w)$

support of X

no tails, 1 tail, 2 tails

$P(0) = P(X=0) = 1/4$

$P(1) = P(X=1) = 1/2$

$P(2) = P(X=2) = 1/4$

P(value of random var is 2)

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ex: 3 machines

P(X working given random thing)

so w's associated w/ #'s here

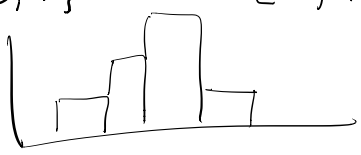
$\sum_{x \in X(S)} P(x)$

$S = \{WWW, WWF, WFW, \ldots\}$

associate w/ 2

$X(S) = \{0, 1, 2, 3\}$ → $[0, 1]$

ex:	0	1	2	3
P(x)	0.12	0.27	0.46	0.15



P(at least 1) $1 - 0.12$

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population mean:

$$\mu = E(X) = \sum_x x p(x)$$

* long-term average of X

ex: Die roll

$P(x) = 1/6$ $X \in \{1, 2 \ldots 6\}$ →

$$E(X) = \sum_{X \in X(S)} x\, P(x)$$

$= 1 \cdot 1/6 + 2 \cdot 1/6 + 3/6 + 4 \cdot 1/6 + 5 \cdot 1/6 + 6 \cdot 1/6$

$= \frac{1}{6}(1+2+3+4+5+6)$

ex: machines

0	1	2	3
0.12	0.27	0.46	0.15

1 = one working

$\sum x p(x) = 0(0.12) + 1(0.27) + 2(0.46) + 3(0.15)$

$= 1.64$

2 = two working
3 = three working