Design & Analysis of Algorithm

# Probability Review

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# Probability Review

- Experiments
- Outcomes
- Events
- Random variables

# Probability experiments

**Experimental probability is based on actual experiments and adequate recordings of the happening of events.  Experiments which do not have a fixed result are known as random experiments.**

# Outcomes, Sample space & Events

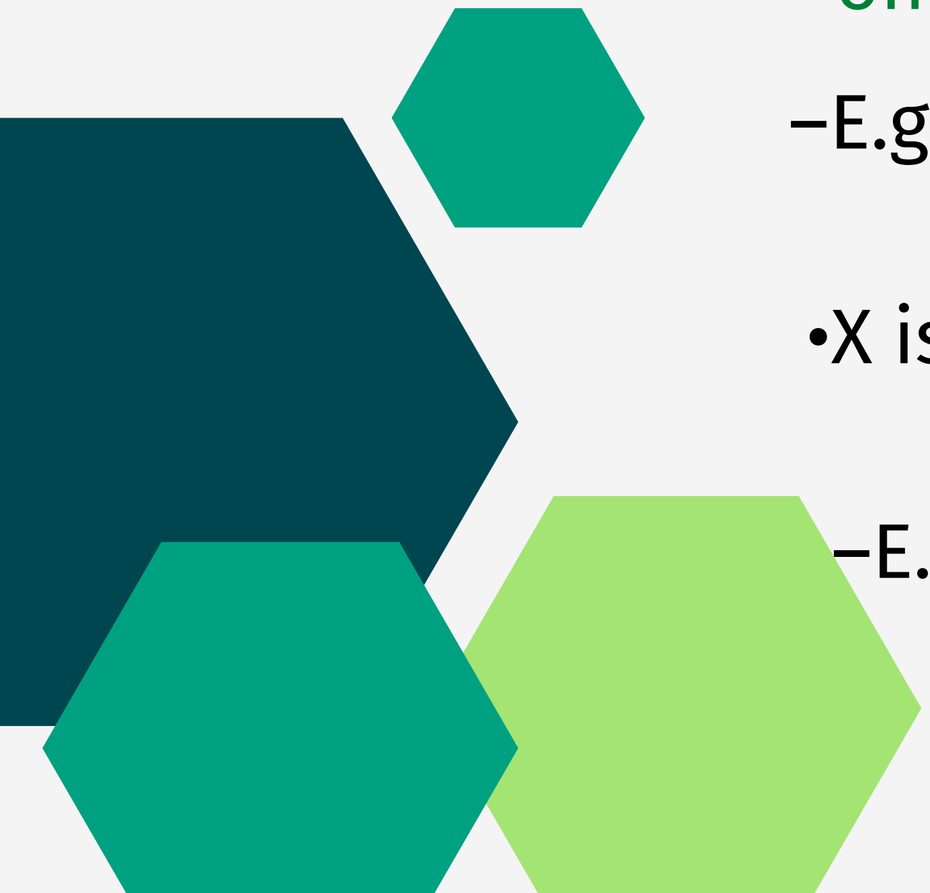
- W : Sample Space, result of an experiment
- If you toss a coin twice W = {HH,HT,TH,TT}
- Event: a subset of W
- First toss is head = {HH,HT}
- S: event space, a set of events:
- Closed under finite union and complements
- Entails other binary operation: union, diff, etc.
- Contains the empty event and W

- P(event) >= 0
- P(sample space) = 1
- If a, b are disjoint, then
  $P(a \cup b) = p(a) + p(b)$
- P(a U b) for non-disjoint event
  $P(a \cup b) = p(a) + p(b) - p(a \cap b)$

# Random variable

A random variable is a variable whose value is unknown or a function that assigns values to each of an experiment's outcomes. A random variable can be either discrete (having specific values) or continuous (any value in a continuous range)

# Discrete Random Variables



- Random variables (RVs) which may take on only a countable number of distinct values
  - E.g. the total number of tails X you get if you flip 100 coins
- X is a RV with arity k if it can take on exactly one value out of {x1, …, xk}
  - E.g. the possible values that X can take on are 0, 1, 2, …, 100

# Continuous Random Variables

- Probability density function (pdf) instead of probability mass function (pmf)
- A pdf is any function f(x) that describes the probability density in terms of the input variable x.

Actual probability can be obtained by taking the integral of pdf

- E.g. the probability of X being between 0 and 1 is

$$P(0 \le X \le 1) = \int_0^1 f(x)dx$$

# THANK YOU