Probability Review

Today’s Outline

- Introductory Probability
- Discussion Questions
- Introduction to R.V.s, Expectations, Conditional Probability
- Open Discussion

Probability

Objectivist:

- (Frequentist) The frequency with which an event occurs.
- (Propensity) Tendency of an event occurring, even if only sampled once.

Subjectivist:

- (Bayesian) The degree of belief that an event will occur.
- (Likelihood) The belief of a model given observed data.

Sets

$S = \{A, B, C\}$

$= \{A, B, C\}$

$S_1 = \{A, B\}$

$S_2 = \{B, C\}$

$S_3 = \{A\}$

$S_4 = \{B, C\}$

$S_1 \cup S_2 = \{A, B, C\}$ (or)

$= \{A, B, C\}$

$S_1 \cap S_2 = \{B\}$ (and)

$S_3 \cap S_4 = \phi = \{\}$ (and)

~~unions,~~

~~intersections,~~

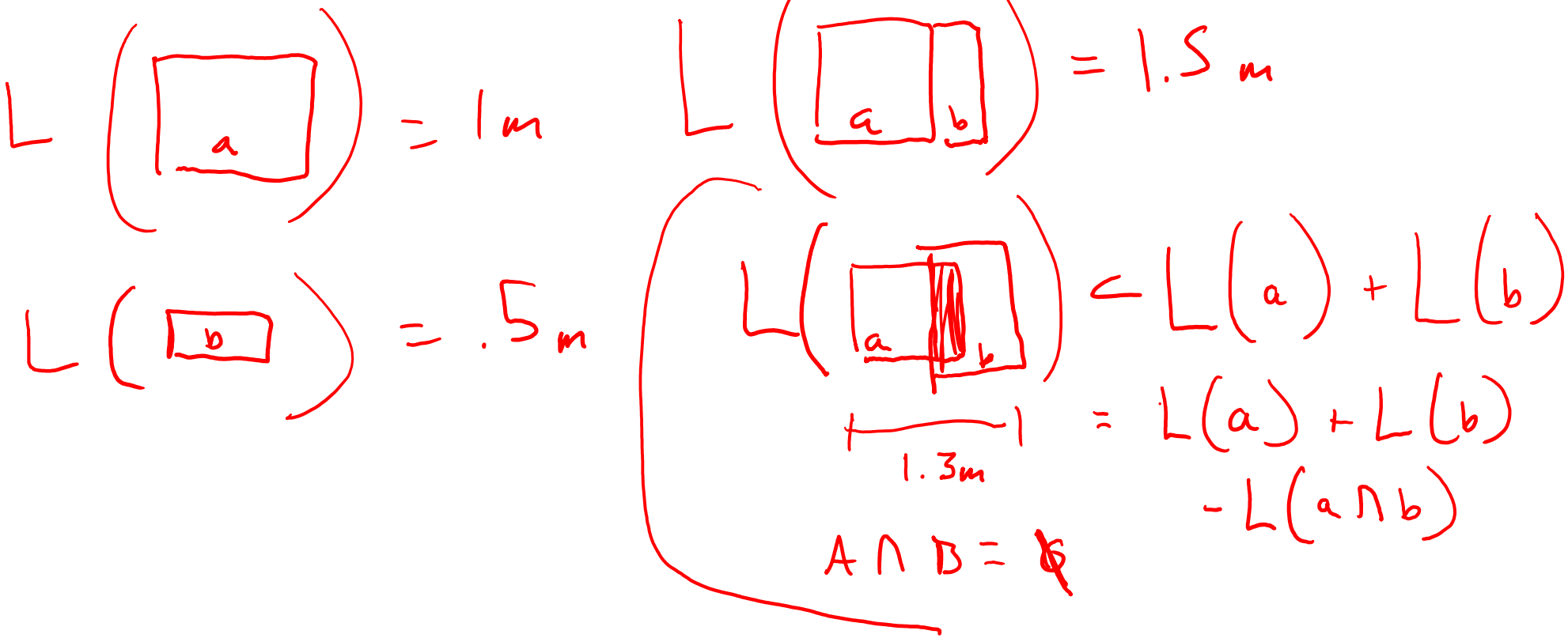
~~disjoint,~~

Taking Measurements

$L: 2^{\hat{}} \Rightarrow \mathbb{R}$

A is set all tables

L is a length



functions, measuring stick, finite additivity, countable additivity

Sample Space

$S = \{H, T\}$

$2^S = \{$

	1	2	3	4	5	6
$\{\}$,	0	0				
$\{H\}$,	1	0				
$\{T\}$,	0	1				
$\{H, T\}$.	1	1				

$\}$

$|2^S| = 2^{|S|}$

$= 4$

possible outcomes,
events,
power set (2^n),

Probability

$L : 2^S \to \mathbb{R}$

$P : 2^S \to [0, 1]$

pmf

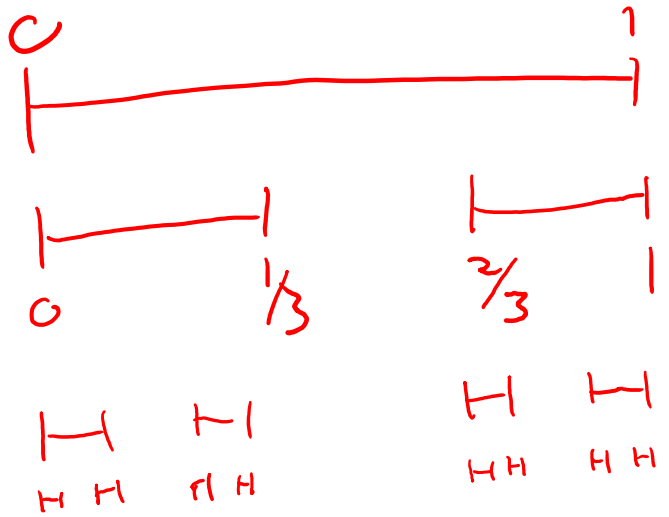
$f : \rho(S) \to \mathbb{R}$

pdf

$S = \{1, 2, 3, 4, 5, 6\}$

$E_1 = \{1, 2\}$

$E_2 = \{2, 3\}$



$f(\phi) = 0$

$f(S) = 1$

measuring stick,
additivity,
desired properties,
pmf and pdf,

Discussion Questions

- Is the MDP formulation too restrictive? Why did the RL community decide we want to solve MDPs? Is there something better?

- Meta-parameters are usually a function of the data (environment). How do we determine the correct values of a meta-parameter for a particular environment? (Example: choosing “c” for UCB as a function of the magnitude of the reward)

- Is the reward hypothesis sufficient to describe all problems? What types of problems can we **not** solve?

- Can we use RL algorithms outside of control systems? If so, what types of problems. If not, why?

- How do we satisfy the Markov property in more complex real-world problems?