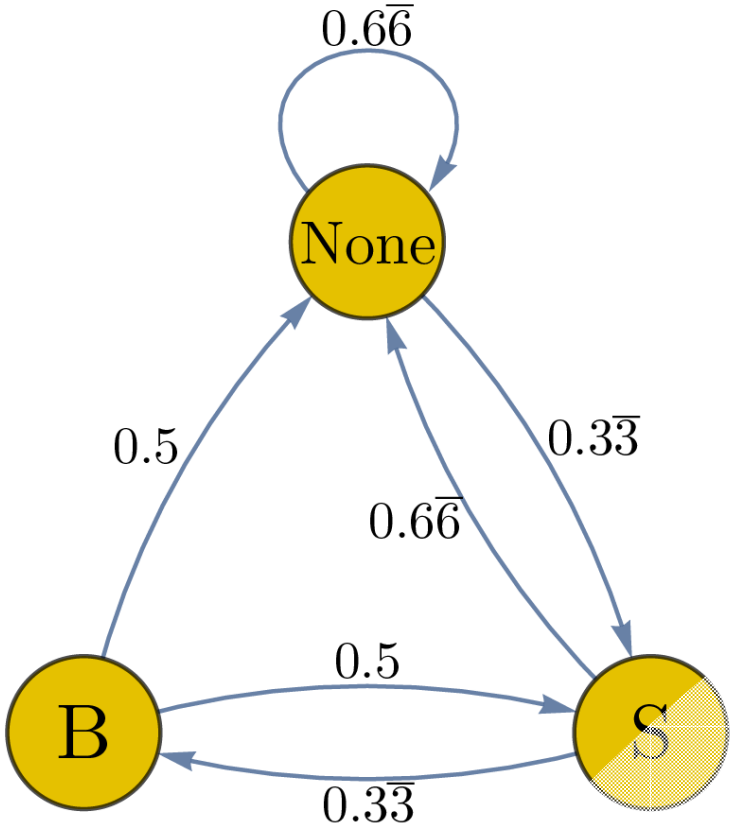
Day 13 (July 19, 2016)

Markov property

Markov models are probabilistic models in which future states only depend on the current state and not on events that occurred before it.
Markov chains are Markov models with a discrete "time".



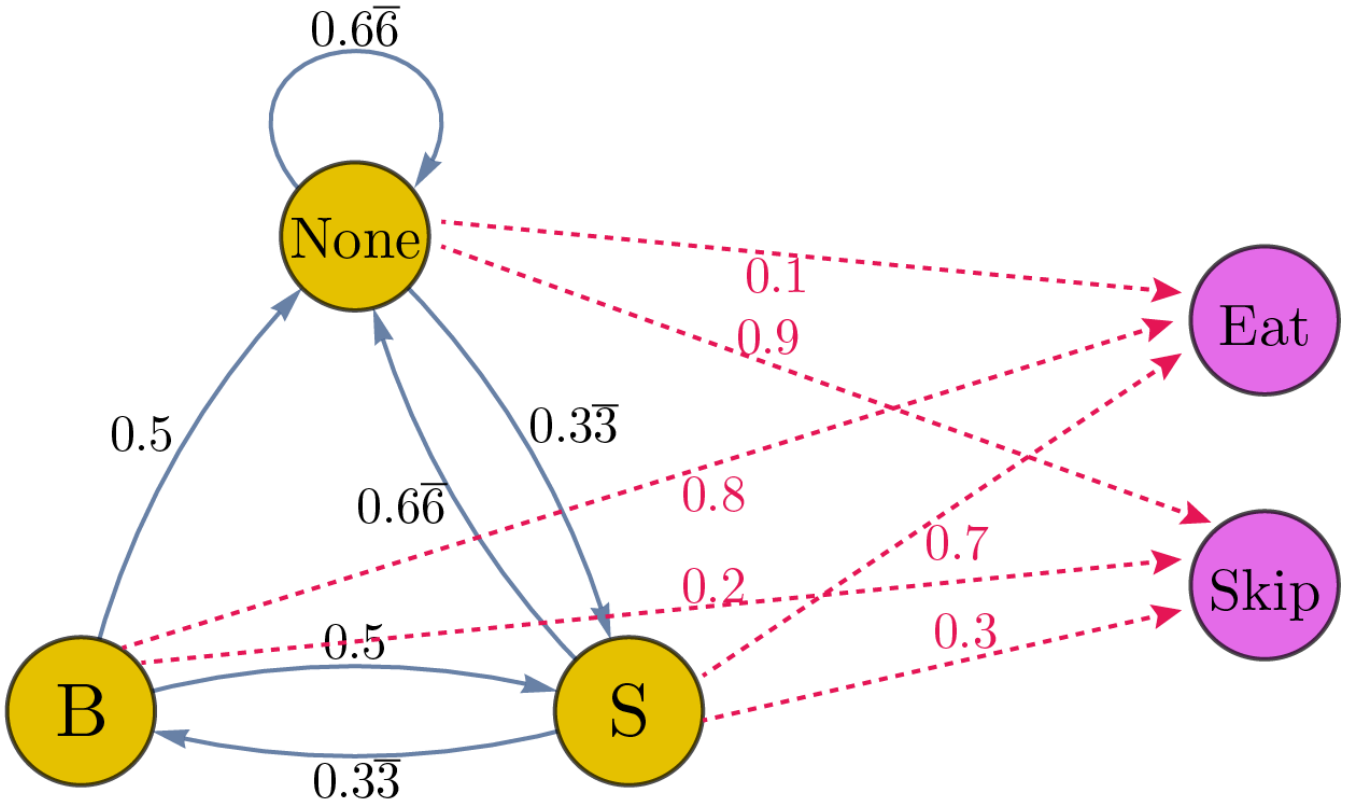
Breakfast meat example from Day 12, Problem 15.

We learned

- how to draw ***transition diagrams***,
- how to construct ***transition matrices***,
- how to calculate ***long-term behaviors***,
- how to calculate the ***expected length*** of Markov chains with ***absorbing states***.

Hidden Markov models are Markov models with hidden (unobservable) states. They are often used in data science.

Example: Darryl never goes to breakfast at Zermatt, so he doesn't observe what kind of meat is served each day. But, when he sees Bowen in class he knows whether Bowen ate breakfast or skipped breakfast.



What kinds of questions can this HMM answer?

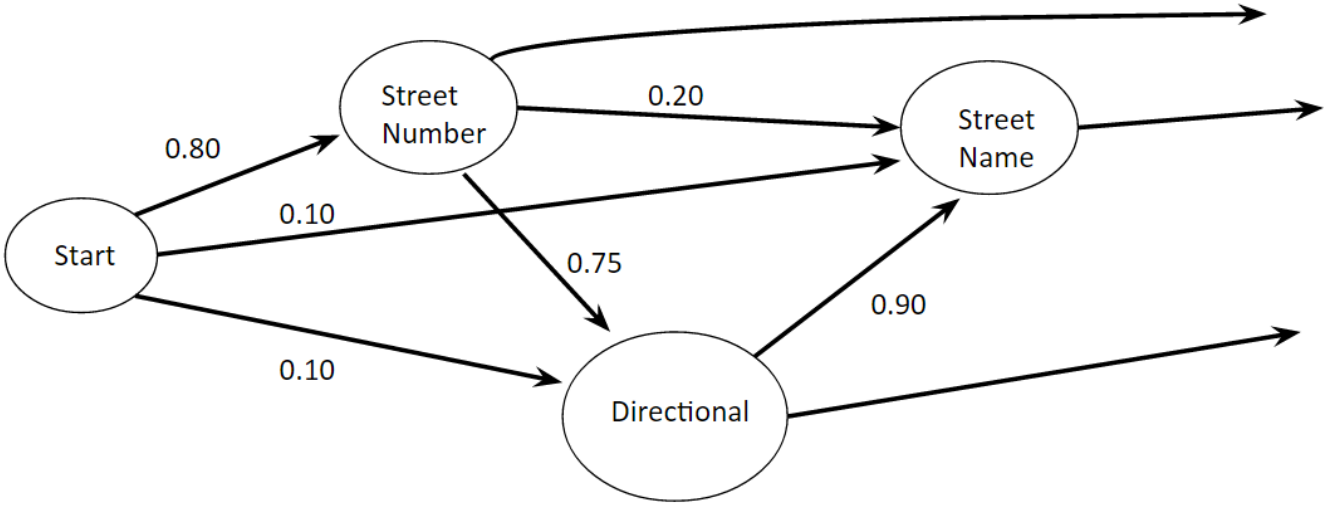
Q1: If the probabilities above are known, use a sequence of observed states to determine what Zermatt served each of those days.

Q2: Use a sequence of observed states to determine the best set of probabilities above using ***statistical machine learning*** that explain the observed states. Then, use that information to predict future behavior.

Example: Automated segmentation of street addresses

7366 East Court Road #112

7366	East	Court	Road	#112
NUM	DIR	NAME	TYPE	UNIT



	7366	East	Court	Road	#112
Observed Tokens (Lookup Table)	NUM	DIR	TYPE	TYPE	UNIT
Most Likely Seq. of Hidden States	NUM	DIR	NAME	TYPE	UNIT

O'Keeffe, Sean, Michael Libucha, Ben Lowenstein, Bo Zhang. "Algorithms for property search and identification." Final clinic report for EDR Inc., Harvey Mudd College Department of Mathematics 2016.

Churches, Tim, Peter Christen, Kim Lim, and Justin Xi Zhu. "Preparation of name and address data for record linkage using hidden Markov models." BMC Medical Informatics and Decision Making 2, no. 1 (2002).