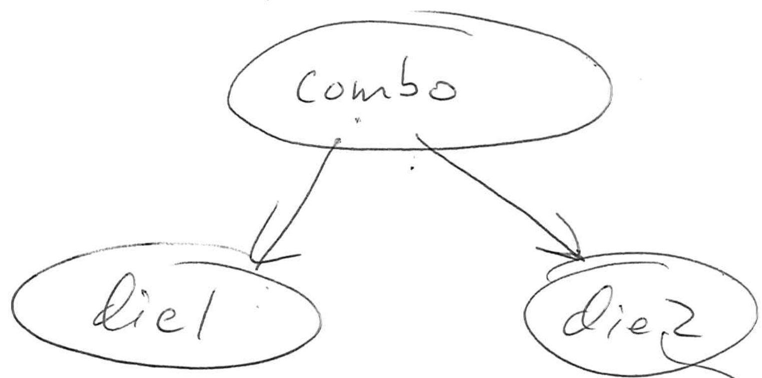


combo		
11	1/36	1/35
12	~~1/36~~	1/35
13	~~1/36~~	1/35
14	~~1/36~~	0
15	⋮	
16		
21		

combo	die2	val
11	1	1.0
12	2	1.0
13	3	
14	4	
15	5	
16	6	
21		
⋮		

evidenceList

Loop over evidenceList

Create a Variable object

add it to the BN

create a Factor object with die1, die2 and new variable

use set method 72 times on Factor using the ~~the~~ right numbers

add Factor to BN

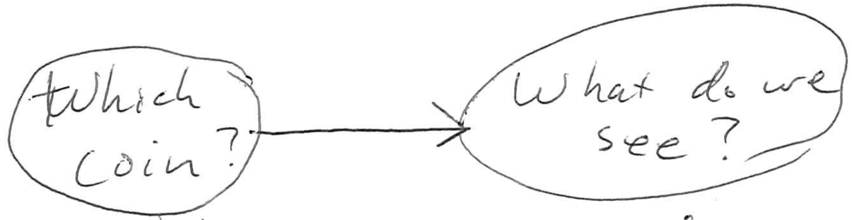
call observe method using current evidence bit

HMM Probabilities

Probability
Conditional Independence
Bayesian Networks
Algorithms
Markov Models
Markov Chains
Hidden Markov Models
HMM
▷ Probabilities

- To compute $P(S_i \mid O_0, \ldots, O_i, \ldots, O_k)$
  - Compute variable elimination forward. This computes $P(S_i \cancel{\mid}, O_0, \ldots, O_{i-1})$.
  - Compute variable elimination backward. This computes $P(O_i, \ldots, O_k, \cancel{\mid} S_i)$.
  - $P(S_i \cancel{\mid}, O_0, \ldots, O_k) \propto$
    $P(S_i \cancel{\mid}, O_0, \ldots, O_{i-1}) * P(O_i, \ldots, O_k \cancel{\mid}, S_i)$
- To compute most probable sequence of states:
  - Viterbi algorithm.
  - Idea: Find most probable sequence to S_i.
  - Use that information to extend sequence by one state, and repeat.

Three Coins Problem
Bayesian Network



Normal
Two Heads
Two Tails

Head
Tail

WC	P(WC=?)
N	1/3
TH	1/3
TT	1/3

P(WDWS=? | WC=?)

WC	WDWS	
N	H	1/2
N	T	1/2
TH	H	1.0
TH	T	0.0
TT	H	0.0
TT	T	1.0

Three Coins

Joint Probability Table

WC	WDWS	P(WC=?, WDWS=?)
N	H	$1/3 * 1/2 = 1/6$
N	T	$1/3 * 1/2 = 1/6$
TH	H	$1/3 * 1 = 1/3$
TH	T	$1/3 * 0 = 0$
TT	H	$1/3 * 0 = 0$
TT	T	$1/3 * 1 = 1/3$

$$P(WC=TH \mid WDWS=H)$$

$$= \frac{P(WC=TH \wedge WDWS=H)}{P(WDWS=H)}$$

$$= \frac{1/3}{1/6 + 1/3 + 0} = \frac{1/3}{1/2} = \frac{2}{3}$$