

8803 MM, JAN 28

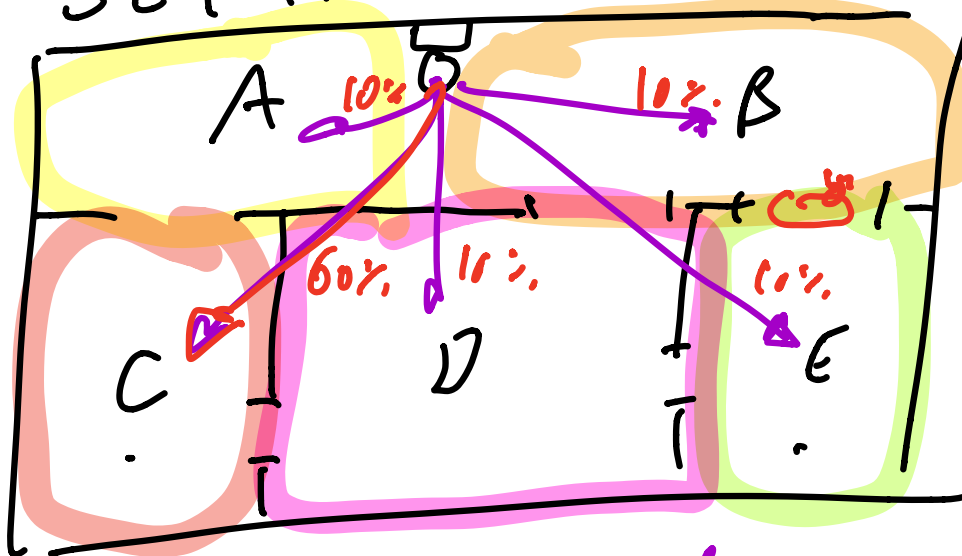
- ① States and Actions
- ② Adding Measurements
- ③ Simulation
- ④ Inference
- ⑤ Exact Inference

Markov Chains
Bayes Nets
Ancestral Sampling
Importance Sampling
Factor Graphs

① States and Actions



$S \in \{A, B, C, D, E\}$



$A \in \{G_A, G_B, \dots, G_E\}$

Discrete

Frequentist

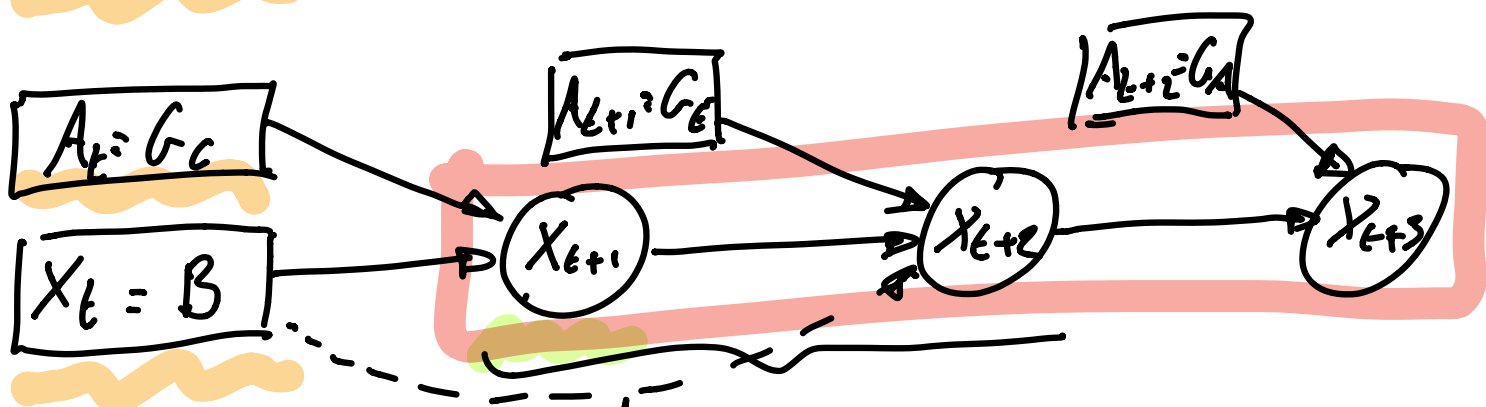
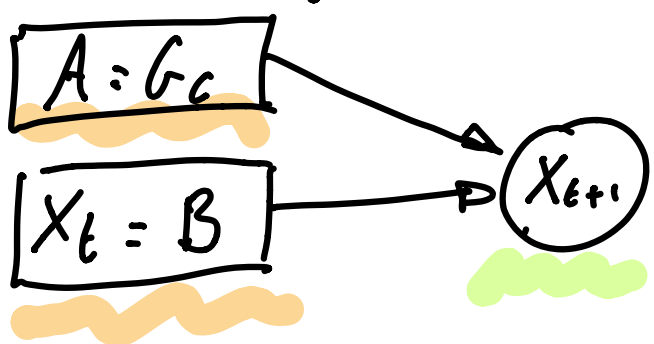
Bayesian

conditional prob.

$$P(X_{t+1} | X_t, A)$$

$\{P_i\}_{i=1 \dots 5}$
 $i=A \dots E$
 $\sum_i P_i = 1 = 100\%$

MARKOV Chains



	X_t	A	
A		G_A	
		G_B	
		G_C	
		G_D	
		G_E	
B		G_A	
		G_B	
		G_C	
		G_D	
		G_E	
	i		

5x5
25

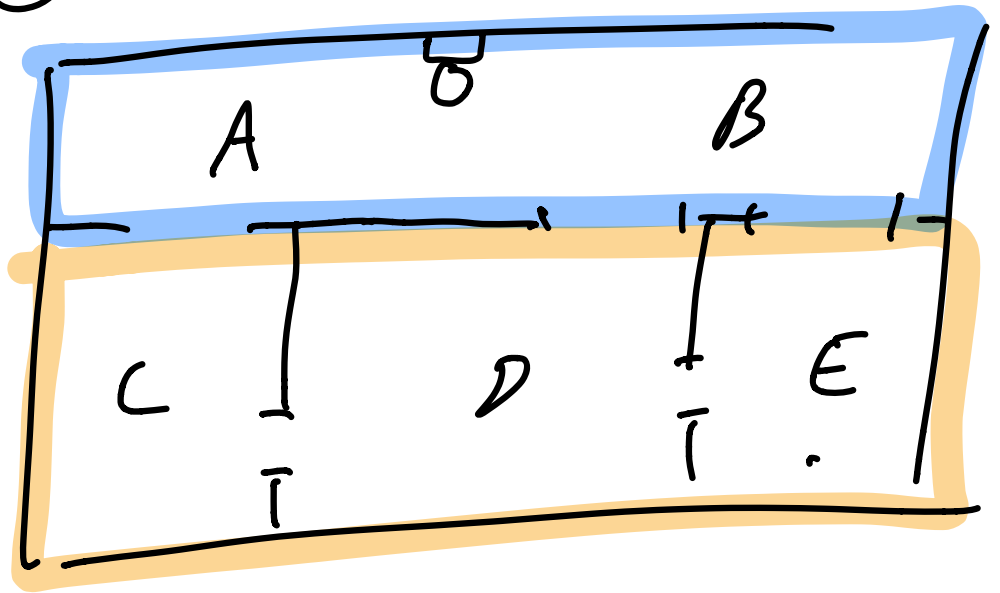
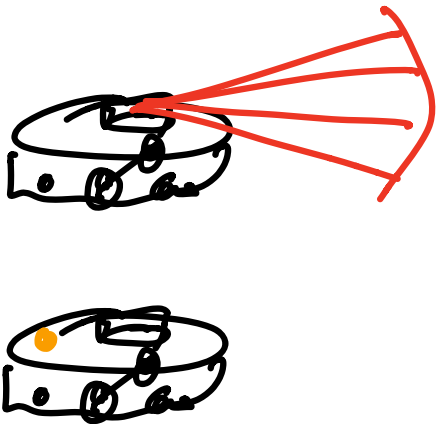
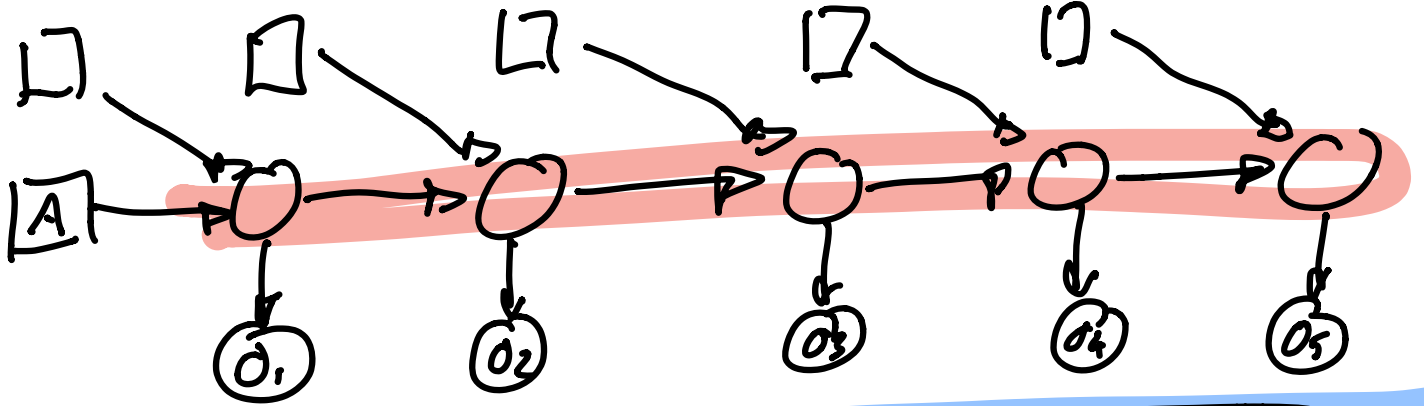
$= [0.1 | 0.1 | 0.1 | 0.1 | 0.1]$

125
Floats
Conditional
Probability
Table (CPT)

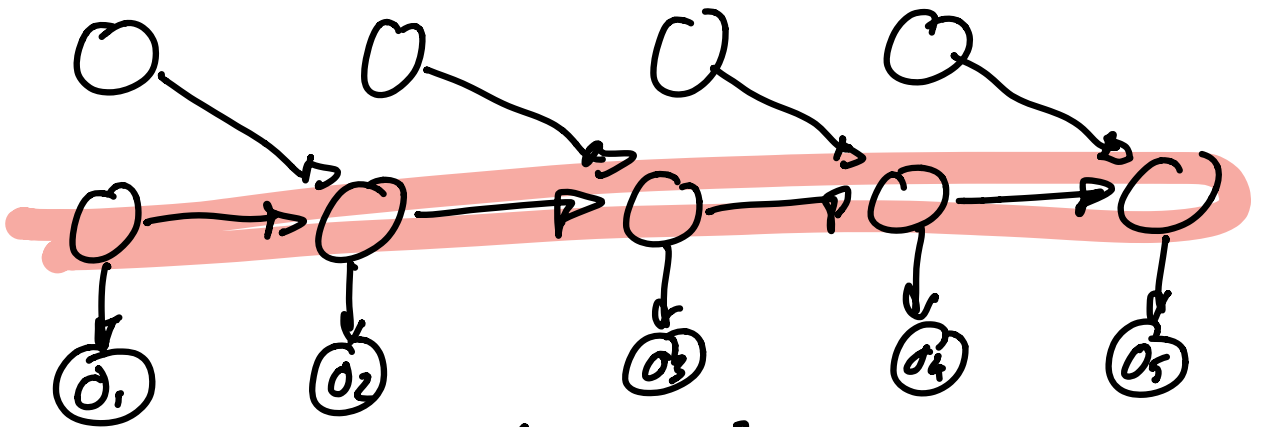
if Command = G_x , $X = G_x$, every hr, else 10%!

② Adding Measurements

MARKOV Chains → Bayes Nets



$$O \in \{N, S\}$$



$$P(A) = \{ \underbrace{G_{A1}, G_{A2}, G_{A3}, G_{A4}, G_{A5}}_{0.1, 0.1, 0.1, 0.1, 0.1} \} \quad \text{PMF}$$

$P(X_{t+1} | X_t, A)$ Transition Model / Dynamics

$P(O | X)$? Measurement Model

non S?

CPT or program...

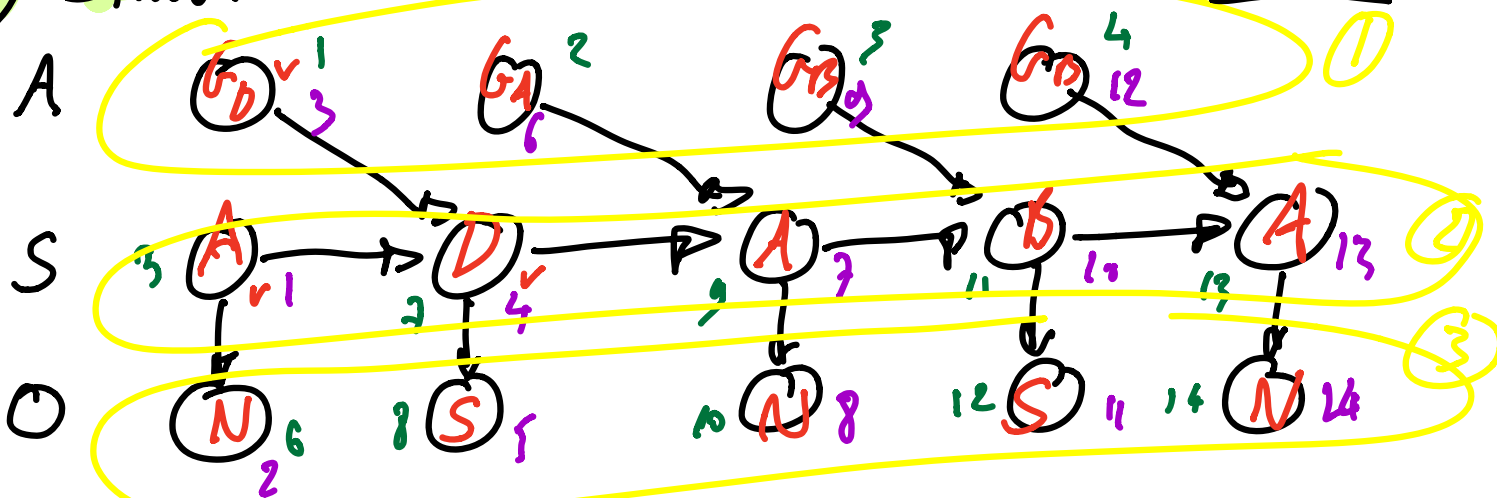
If $X \in \{A, B\}$ then $P(O=N|X) = 95\%$ | 5%
 $P(O=S|X) = 5\%$

If $X \in \{C, D, E\}$ then $P(O=N|X) = 7\%$ | 3%
 $P(O=S|X) = 93\%$

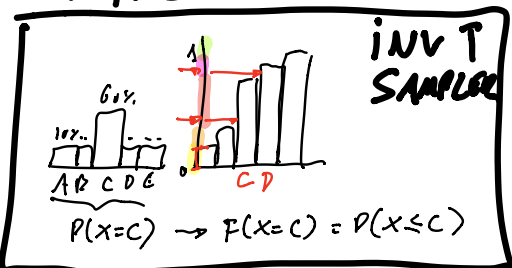
X	N	S
A	95%	5%
B	95%	5%
C	7%	93%
D	7%	93%
E	7%	93%

Simulation

DAG



Sidecar



PRIOR $P(X) =$

96%					
A	B	C	D	E	

- ANCESTRAL S.
- FIND TOP SORT
 - SAMPLE IN THAT ORDER

④ Inference

$$P(\underset{\equiv}{A}, \underset{\equiv}{S}, O) = \frac{P(A)P(S|A)P(O|S)}$$

$$P(\underline{S} | \underline{A}, O) = \frac{P(A, S, O)}{P(A, O)} = \frac{P(A, O | S)}{P(A, O)}$$
