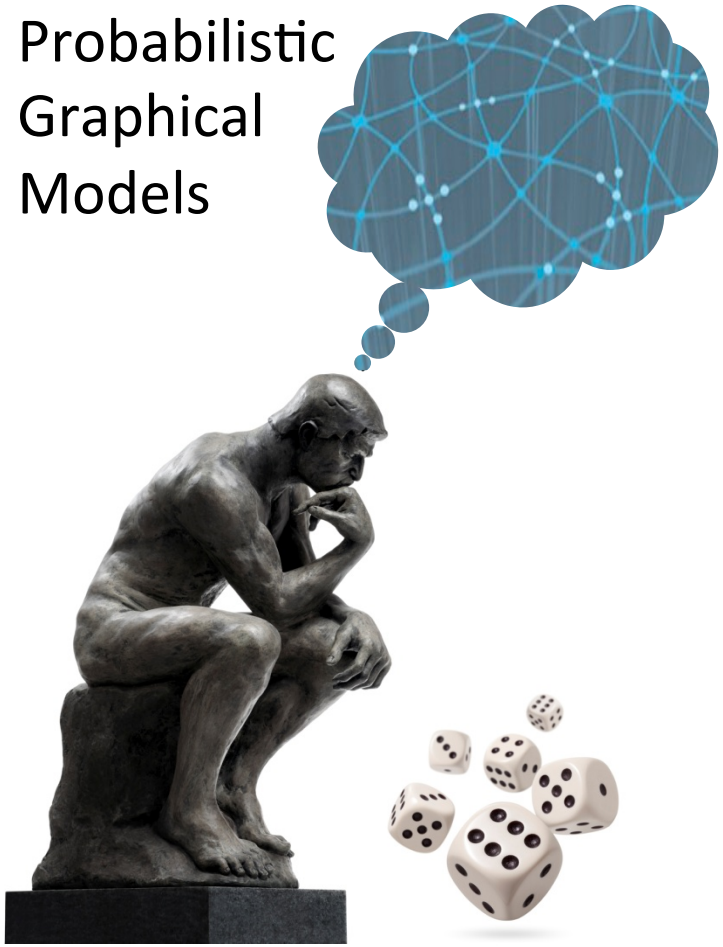
Probabilistic Graphical Models

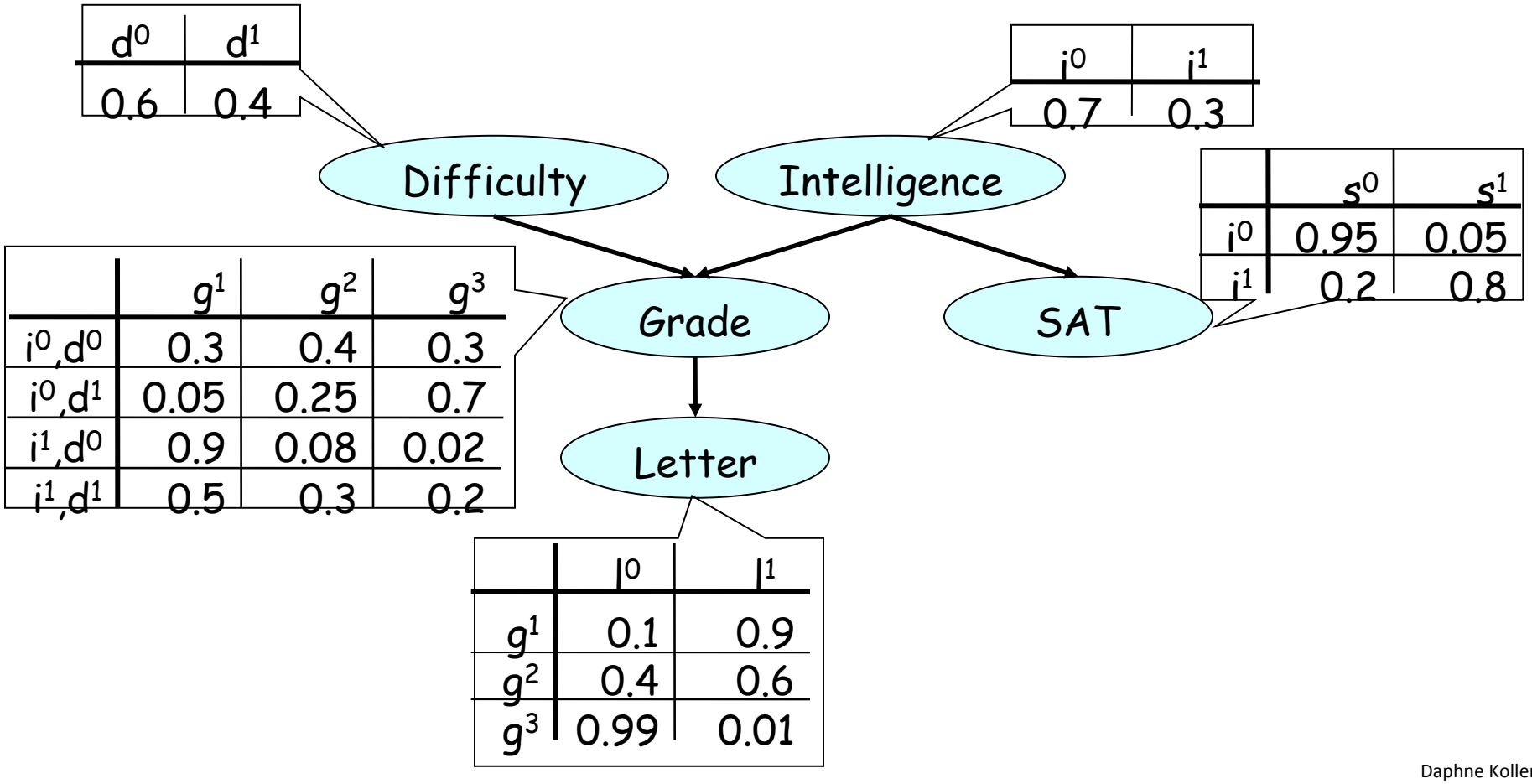


Representation

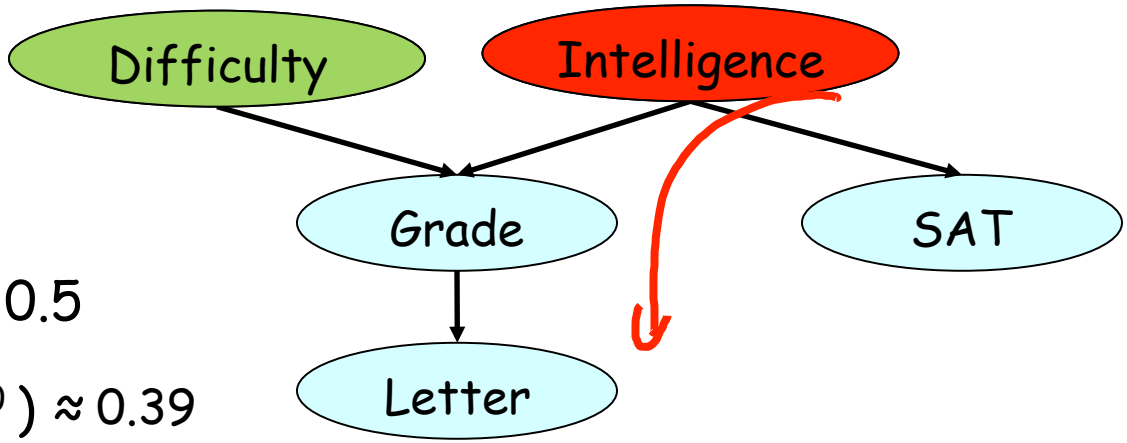
Bayesian Networks

Reasoning Patterns

The Student Network



Causal Reasoning



$P(l^1) \approx 0.5$

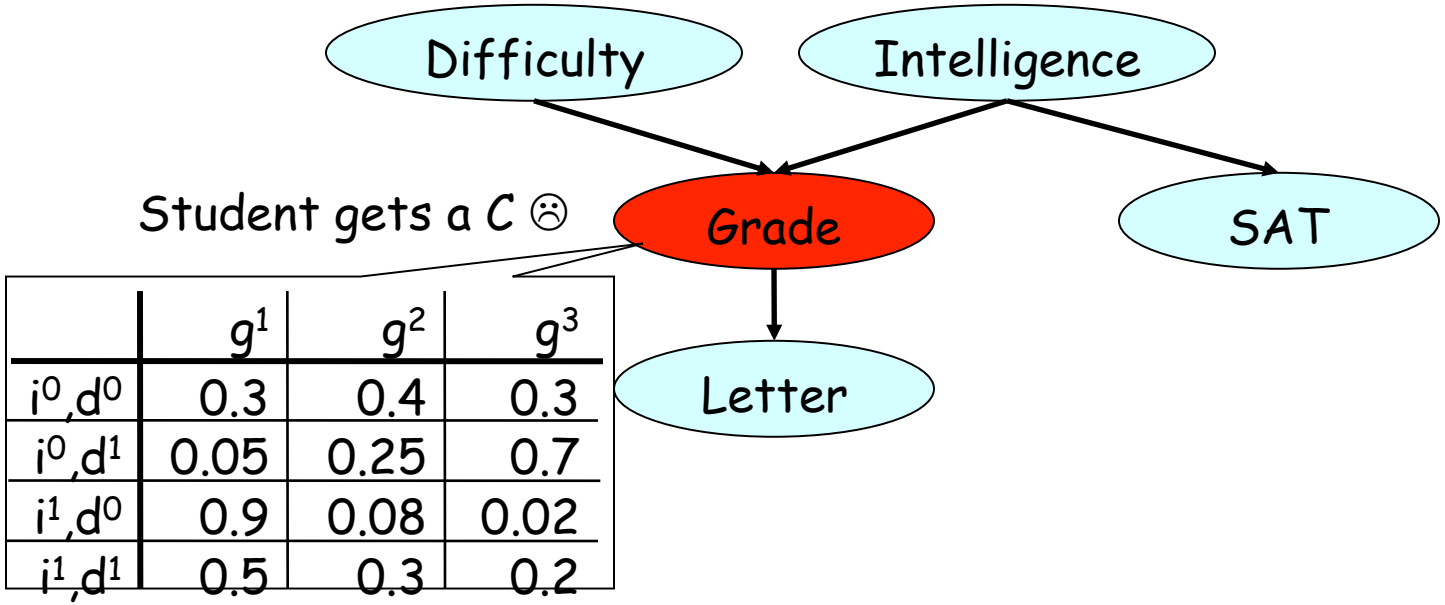
$P(l^1 \mid i^0) \approx 0.39$

$P(l^1 \mid i^0, d^0) \approx 0.51$

Evidential Reasoning

$P(d^1) = 0.4$ $\quad$ $P(i^1) = 0.3$

$P(d^1 \mid g^3) \approx 0.63$ $\quad$ $P(i^1 \mid g^3) \approx 0.08$

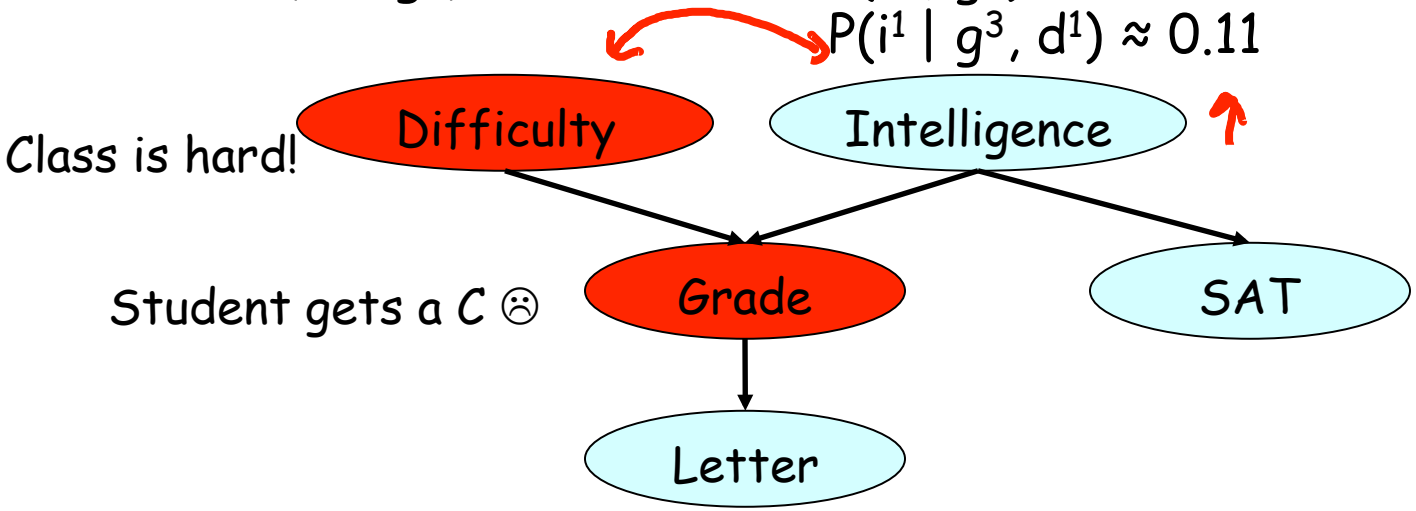


	g^1	g^2	g^3
i^0,d^0	0.3	0.4	0.3
i^0,d^1	0.05	0.25	0.7
i^1,d^0	0.9	0.08	0.02
i^1,d^1	0.5	0.3	0.2

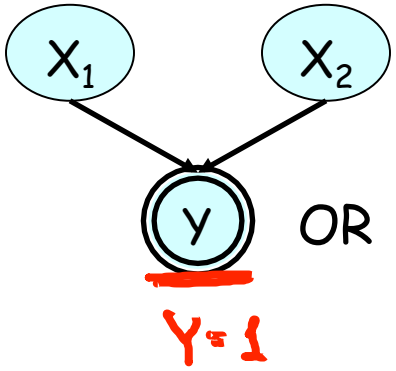
Intercausal Reasoning

$P(d^1) = 0.4$
$P(d^1 \mid g^3) \approx 0.63$

$P(i^1) = 0.3$
$P(i^1 \mid g^3) \approx 0.08$
$P(i^1 \mid g^3, d^1) \approx 0.11$



Intercausal Reasoning Explained



explaining away

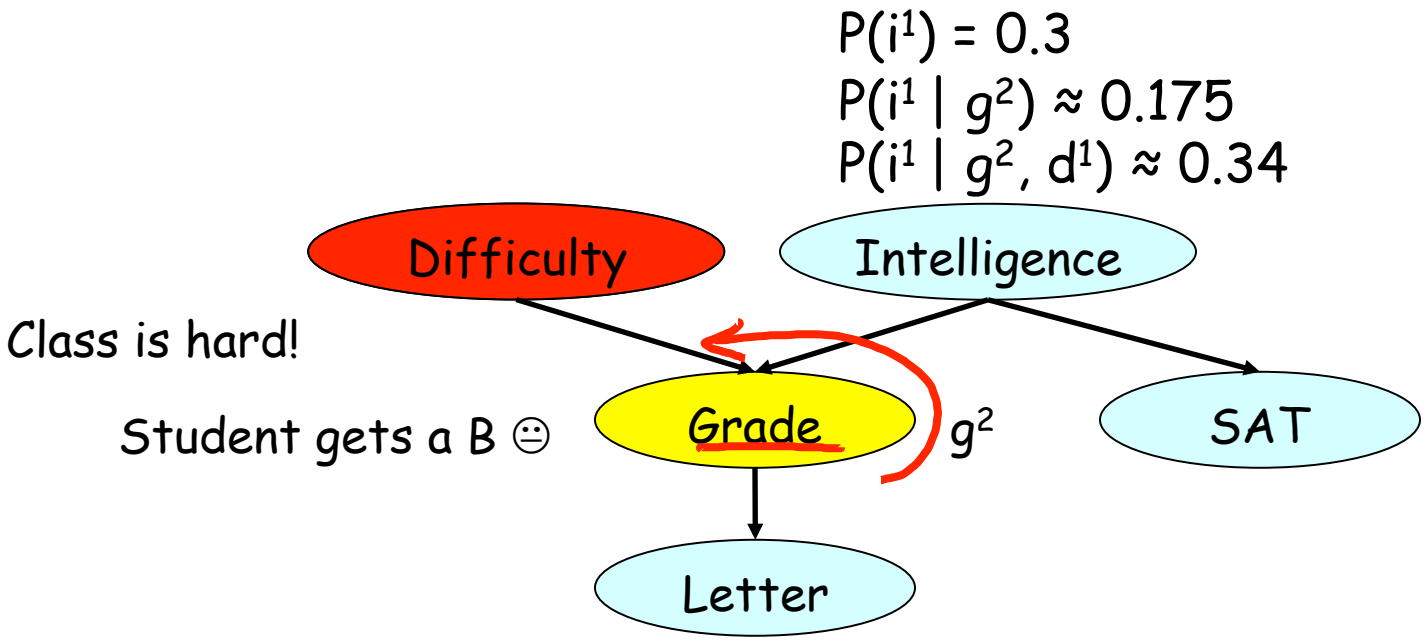
X_1	X_2	Y	Prob
0	0	0	0.25
0	1	1	0.25
1	0	1	0.25
1	1	1	0.25

0.33
0.33
0.33

$P(X_1=1) = \frac{2}{3}$ $P(X_2=1) = \frac{2}{3}$

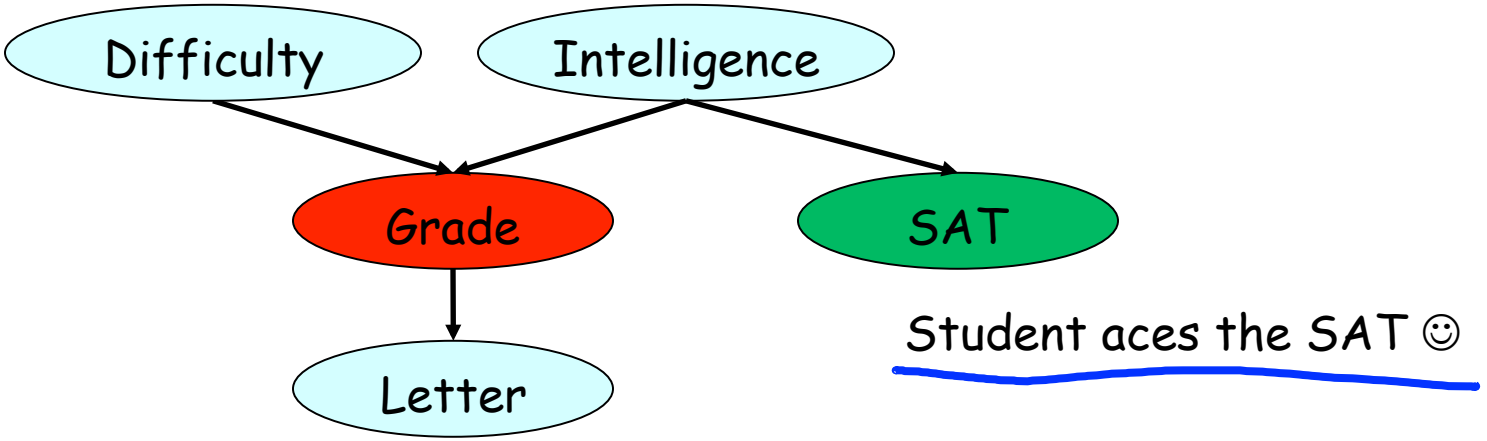
conditional $P(X_2=1 \mid X_1=1) = 0.5$

Intercausal Reasoning II



Student Aces the SAT

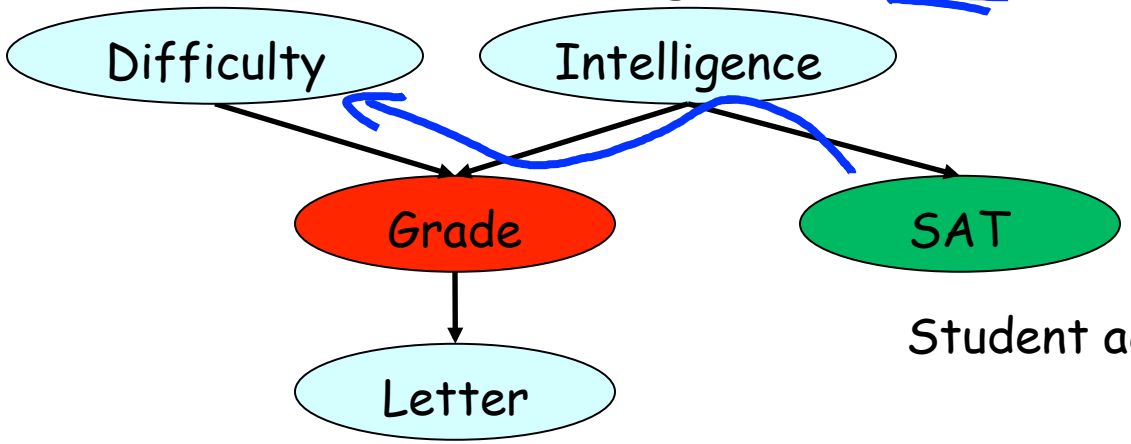
- What happens to the posterior probability that the class is hard?



Student Aces the SAT

$P(d^1) = 0.4$
$P(d^1 \mid g^3) \approx 0.63$
$P(d^1 \mid g^3, s^1) \approx 0.76$

$P(i^1) = 0.3$
$P(i^1 \mid g^3) \approx 0.08$
$P(i^1 \mid g^3, s^1) \approx 0.58$



Student aces the SAT ☺

Student gets a C ☹