



$$\varphi_1(a, b, c) = a + b + c$$

$$\varphi_2(b, d, e) = b + d + e$$

$A, \dots, E$  are boolean.

Belief prop. update equations

$$\mu_{X \rightarrow f}^{(t)}(\hat{x}) = \prod_{f' \in N(X) \setminus \{f\}} \mu_{f' \rightarrow X}^{(t-1)}(\hat{x})$$

$$\mu_{f \rightarrow X}^{(t)}(\hat{x}) = \sum_{\hat{x}'} f(\hat{x}', \hat{x}) \prod_{X' \in N(f) \setminus \{X\}} \mu_{X' \rightarrow f}^{(t-1)}(\hat{x}')$$

$$\mu_{B \rightarrow \varphi_2}^{(2)}(b) = \prod_{f' \in N(B) \setminus \{\varphi_2\}} \mu_{f' \rightarrow B}^{(1)}(b)$$

$$= \mu_{\varphi_1 \rightarrow B}^{(1)}(b)$$

$$\mu_{\varphi_1 \rightarrow B}^{(1)}(b) = \sum_{a, c} \varphi_1(a, b, c) \prod_{X' \in N(\varphi_1) \setminus \{B\}} \mu_{X' \rightarrow \varphi_1}^{(0)}(\hat{x}')$$

$$= \sum_{a, c} \varphi_1(a, b, c) \underbrace{\left( \mu_{A \rightarrow \varphi_1}^{(0)}(a) \right)}_1 \underbrace{\left( \mu_{C \rightarrow \varphi_1}^{(0)}(c) \right)}_1$$

$$= \sum_{a, c} \varphi_1(a, b, c)$$