

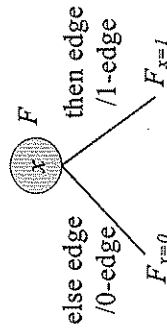
## Shannon Decomposition & *ite* Format

- Let  $f$  be a Boolean expression and  $x$  be a Boolean variable:

$$f = x \cdot f_{x=1} + \bar{x} \cdot f_{x=0}$$

- $f_{x=1}$  represents the function  $f$  evaluated at  $x=1$
- $f_{x=0}$  represents the function  $f$  evaluated at  $x=0$

- The if-then-else (*ite*) format of the Shannon decomposition



$$f = \text{ite}(x, F_1, F_2) \equiv x \cdot F_1 + \bar{x} \cdot F_2;$$

$$F_1 \equiv f_{x=1}, \quad F_2 \equiv f_{x=0}.$$

Dr. Xing

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An example:

$$f = ab + cd$$

$$= a \cdot f_{a=1} + \bar{a} \cdot f_{a=0}$$

Verification:

$$f_{a=1} = b + cd$$

$$f_{a=0} = cd$$

$$a \cdot f_{a=1} + \bar{a} \cdot f_{a=0}$$

$$= a(b + cd) + \bar{a}cd$$

$$= ab + acd + \bar{a}cd$$

$$= ab + cd.$$