$$P(P=t \mid X=t) = \frac{P(P=t, X=t)}{P(X=t)} \propto$$

$P(P=t, X=t)$

$P(P=f, X=t)$

X evidence

P query

S. C. D hidden

$$P(P=t, X=t) = \sum_{S,C,D} P(P=t, X=t, S, C, D)$$

$$= \sum_{f} P(P=t) * P(S) * P(C \mid P=t, S) * P(X=t \mid C) * P(D \mid C)$$

$$f_1(P) \otimes f_2(S) \otimes f_3(C, P, S) \otimes f_4(C) \otimes f_5(C, D)$$

$f_1(P) \to P(P)$

$f_2(S) \to P(S)$

$f_3(C, P, S) \to P(C \mid P, S)$

$f_4(C) \to P(X=t \mid C)$

$f_5(C, D) \to P(D \mid C)$

① join $f_2(S) \otimes f_3(C, P, S) \to f_6(C, P, S)$

② eliminate S : $f_7(C, P)$

③

①

$$P(p.\ X=t) = \sum_{S.C} P(P, X=t.\ S.C)$$

$$= \sum_{S.C} P(p) * P(S) * P(C \mid p, S) * P(X=t \mid C)$$

$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$

$$f_1(p) \quad f_2(S) \quad f_3(C,P,S) \quad f_4(C)$$

$f_2(S)$ and $f_3(C,P,S)$ → $f_6(C,P)$ → $f_8(P)$

$P(p=t, X=t)$

① join $f_2(S)$ and $f_3(C,P,S) = f_5(C,P,S)$

② eliminate S in f_5 → $f_6(C,P)$

③ join $f_6(C,P)$ and $f_4(C)$ → $f_7(C,P)$

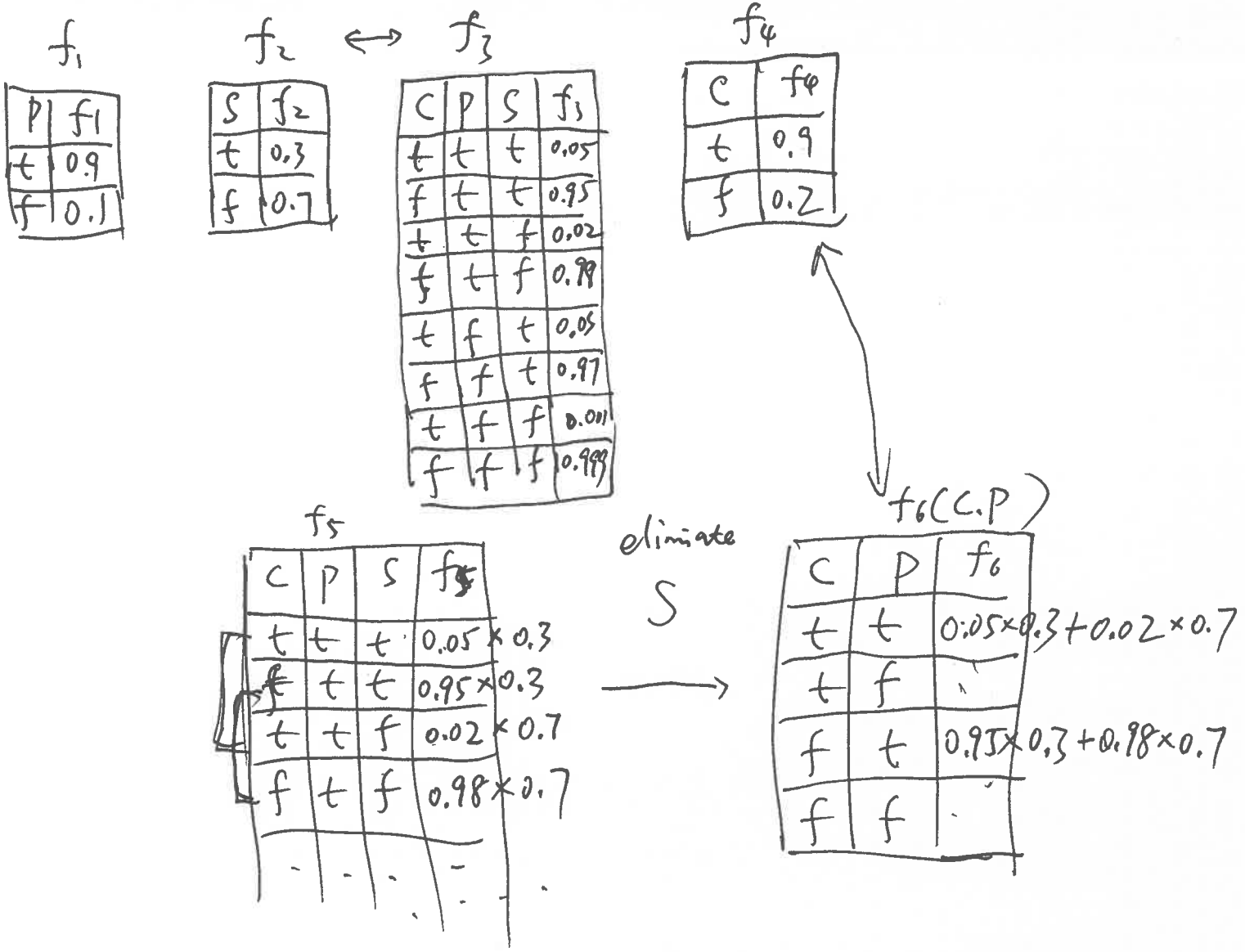
④ eliminate C in f_7 → $f_8(P)$

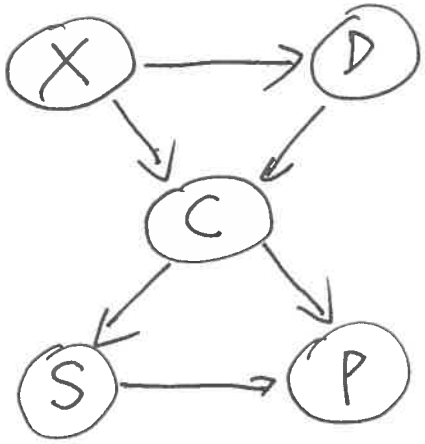
⑤ join $f_1(p)$ and $f_8(P)$ → $f_9(P)$

P	$f_9(P)$
t	A
f	B

$P(p=f.\ X=t)$

$$P(p=t \mid X=t) = \frac{A}{A+B}$$


f_1
P | f_1
t | 0.9
f | 0.1
f_2
S | f_2
t | 0.3
f | 0.7
f_3
C | P | S | f_3
t | t | t | 0.05
f | t | t | 0.95
t | t | f | 0.02
f | t | f | 0.98
t | f | t | 0.05
f | f | t | 0.97
t | f | f | 0.011
f | f | f | 0.989
f_4
C | f_4
t | 0.9
f | 0.2
f_5
C | P | S | f_5
t | t | t | 0.05 × 0.3
f | t | t | 0.95 × 0.3
t | t | f | 0.02 × 0.7
f | t | f | 0.98 × 0.7
eliminate
S
$f_6(C,P)$
C | P | f_6
t | t | 0.05×0.3+0.02×0.7
t | f |
f | t | 0.95×0.3+0.98×0.7
f | f |



$P(p|c) \neq 0.5$

$P(p|c.S) = 0.2$

$P(p) = 0.9$

$P(p|S) = 0.9$

$P(p|x=t) = \frac{P(\cdot\cdot)\cdots}{\cdot\cdot}$

$P(p|x=t.S)$