データベースシステム 中間レポート

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中間確認 1-1 $NOT\,(A\,IMP\,B)\,OR\,(B\,IMP\,C)\,OR\,(A\,IMP\,C)\,OR\,(A\,IMP\,B\,IMP\,C)$

$$(与式) = NOT\,(A\,IMP\,B)\,OR\,(B\,IMP\,C)\,OR\,(A\,IMP\,C)\,OR\,(A\,IMP\,(B\,IMP\,C)) \quad (\because IMP\,の結合則)$$

$$= NOT\,(A\,IMP\,B)\,OR\,(B\,IMP\,C)\,OR\,(A\,IMP\,C)\,OR\,(A\,IMP\,(NOT\,B\,OR\,C))$$

$$= NOT\,(A\,IMP\,B)\,OR\,(B\,IMP\,C)\,OR\,(A\,IMP\,C)\,OR\,(NOT\,A\,OR\,(NOT\,B\,OR\,C))$$

$$= NOT\,(NOT\,A\,OR\,B)\,OR\,(B\,IMP\,C)\,OR\,(A\,IMP\,C)\,OR\,(NOT\,A\,OR\,NOT\,B\,OR\,C)$$

$$= NOT\,(NOT\,A\,OR\,B)\,OR\,(NOT\,B\,OR\,C)\,OR\,(A\,IMP\,C)\,OR\,(NOT\,A\,OR\,NOT\,B\,OR\,C)$$

$$= NOT\,(NOT\,A\,OR\,B)\,OR\,(NOT\,B\,OR\,C)\,OR\,(NOT\,A\,OR\,C)\,OR\,(NOT\,A\,OR\,NOT\,B\,OR\,C)$$

ド・モルガン則より

$$= NOT(NOT\,A)\,AND\,NOT\,B\,OR\,(NOT\,B\,OR\,C)\,OR\,(NOT\,A\,OR\,C)\,OR\,(NOT\,A\,OR\,NOT\,B\,OR\,C)$$

二重否定より

$$= A\,AND\,(NOT\,B)\,OR\,(NOT\,B)\,OR\,C\,OR\,NOT\,A\,OR\,C\,OR\,NOT\,A\,OR\,(NOT\,B)\,OR\,C$$

$$= A\,AND\,NOT\,B\,(OR\,C)\,OR\,NOT\,A\,(OR\,C)\,OR\,NOT\,A\,(OR\,C) \quad (\because 同一律)$$

$$= A\,AND\,NOT\,B\,OR\,C\,OR\,(NOT\,A)\,OR\,(NOT\,A) \quad (\because 同一律)$$

$$= A\,AND\,NOT\,B\,OR\,C\,OR\,NOT\,A \quad (\because 同一律)$$

$$= A\,AND\,NOT\,B\,OR\,NOT\,A\,OR\,C \quad (\because 交換則)$$

中間確認 1-2

A	B	C	D	X,Y
T	T	T	T	F
F	T	T	T	T
T	F	T	T	F
T	T	F	T	F
T	T	T	F	T
F	F	T	T	F
F	T	F	T	F
F	T	T	F	T
T	F	F	T	T
T	F	T	F	F
T	T	F	F	F
F	F	F	T	T
F	F	T	F	T
F	T	F	F	F
T	F	F	F	T
F	F	F	F	T

i) 積和標準形

X = T は 2, 5, 8, 9, 12, 13, 15, 16 行目であるからそれぞれについて, 命題変数 P が T なら P, F なら NOT P とし, それらを AND でつなぎ, 各論理式を OR でつなぐ

$$
\begin{aligned}
X = \ & \textit{NOT A AND B AND C AND D OR} \\
& \textit{A AND B AND C AND NOT D OR} \\
& \textit{NOT A AND B AND C AND NOT D OR} \\
& \textit{A AND NOT B AND NOT C AND D OR} \\
& \textit{NOT A AND NOT B AND NOT C AND D OR} \\
& \textit{NOT A AND NOT B AND C AND NOT D OR} \\
& \textit{A AND NOT B AND NOT C AND NOT D OR} \\
& \textit{NOT A AND NOT B AND NOT C AND NOT D}
\end{aligned}
$$

ii) 和積標準形

Y = F は 1, 3, 4, 6, 7, 10, 11, 14 行目であるからそれぞれについて, 命題変数 P が T なら NOT P, F なら P とし, それらを OR でつなぎ, 各論理式を AND でつなぐ

$$Y = (NOT\ A\ OR\ NOT\ B\ OR\ NOT\ C\ OR\ NOT\ D)\ AND$$
$$(NOT\ A\ OR\ B\ OR\ NOT\ C\ OR\ NOT\ D)\ AND$$
$$(NOT\ A\ OR\ NOT\ B\ OR\ C\ OR\ NOT\ D)\ AND$$
$$(A\ OR\ B\ OR\ NOT\ C\ OR\ NOT\ D)\ AND$$
$$(A\ OR\ NOT\ B\ OR\ C\ OR\ NOT\ D)\ AND$$
$$(NOT\ A\ OR\ B\ OR\ NOT\ C\ OR\ D)\ AND$$
$$(NOT\ A\ OR\ NOT\ B\ OR\ C\ OR\ D)\ AND$$
$$(A\ OR\ NOT\ B\ OR\ C\ OR\ D)$$

iii) X = Y を示す

1) 1 行目：A=T, B=T, C=T, D=T を代入

$$X = F\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ T\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ F$$
$$= F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F$$
$$= F$$

$$Y = (F\ OR\ F\ OR\ F\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ F)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ F)\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ F)\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ T)$$
$$= F\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T$$
$$= F$$

2) 2 行目 : A=F, B=T, C=T, D=T を代入

$$X = T\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ F$$
$$= T\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F$$
$$= T$$

$$Y = (T\ OR\ F\ OR\ F\ OR\ F\ )\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ F\ )\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ F\ )\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ F\ )\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ F\ )\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ T)$$
$$= T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T$$
$$= T$$

3) 3 行目：A=T, B=F, C=T, D=T を代入

$$
\begin{aligned}
X =& F \ AND \ F \ AND \ T \ AND \ T \ OR \\
& T \ AND \ F \ AND \ T \ AND \ F \ OR \\
& F \ AND \ F \ AND \ T \ AND \ F \ OR \\
& T \ AND \ T \ AND \ F \ AND \ T \ OR \\
& F \ AND \ T \ AND \ F \ AND \ T \ OR \\
& F \ AND \ T \ AND \ T \ AND \ F \ OR \\
& T \ AND \ T \ AND \ F \ AND \ F \ OR \\
& F \ AND \ T \ AND \ F \ AND \ F \\
=& F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \\
=& F
\end{aligned}
$$

$$
\begin{aligned}
Y =& (F \ OR \ T \ OR \ F \ OR \ F) \ AND \\
& (F \ OR \ F \ OR \ F \ OR \ F) \ AND \\
& (F \ OR \ T \ OR \ T \ OR \ F) \ AND \\
& (T \ OR \ F \ OR \ F \ OR \ F) \ AND \\
& (T \ OR \ T \ OR \ T \ OR \ F) \ AND \\
& (F \ OR \ F \ OR \ F \ OR \ T) \ AND \\
& (F \ OR \ T \ OR \ T \ OR \ T) \ AND \\
& (T \ OR \ T \ OR \ T \ OR \ T) \\
=& T \ AND \ F \ AND \ T \ AND \ T \ AND \ T \ AND \ T \ AND \ T \ AND \ T \\
=& F
\end{aligned}
$$

4) 4 行目：A=T, B=T, C=F, D=T を代入

$$X = F\ AND\ T\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ T\ AND\ F$$
$$= F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F$$
$$= F$$

$$Y = (F\ OR\ F\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ F\ OR\ F\ OR\ F)\ AND$$
$$(T\ OR\ T\ OR\ T\ OR\ F)\ AND$$
$$(T\ OR\ F\ OR\ F\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ F\ OR\ T)$$
$$= T\ AND\ T\ AND\ F\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T$$
$$= F$$

5) 5 行目：A=T, B=T, C=T, D=F を代入

$$
\begin{aligned}
X =& F \; AND \; T \; AND \; T \; AND \; F \; OR \\
& T \; AND \; T \; AND \; T \; AND \; T \; OR \\
& F \; AND \; T \; AND \; T \; AND \; T \; OR \\
& T \; AND \; F \; AND \; F \; AND \; F \; OR \\
& F \; AND \; F \; AND \; F \; AND \; F \; OR \\
& F \; AND \; F \; AND \; T \; AND \; T \; OR \\
& T \; AND \; F \; AND \; F \; AND \; T \; OR \\
& F \; AND \; F \; AND \; F \; AND \; T \\
=& F \; OR \; T \; OR \; F \; OR \; F \; OR \; F \; OR \; F \; OR \; F \\
=& T
\end{aligned}
$$

$$
\begin{aligned}
Y =& (F \; OR \; F \; OR \; F \; OR \; T) \; AND \\
& (F \; OR \; T \; OR \; F \; OR \; T) \; AND \\
& (F \; OR \; F \; OR \; T \; OR \; T) \; AND \\
& (T \; OR \; T \; OR \; F \; OR \; T) \; AND \\
& (T \; OR \; F \; OR \; T \; OR \; T) \; AND \\
& (F \; OR \; T \; OR \; F \; OR \; F) \; AND \\
& (F \; OR \; F \; OR \; T \; OR \; F) \; AND \\
& (T \; OR \; F \; OR \; T \; OR \; F) \\
=& T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \\
=& T
\end{aligned}
$$

6) 6 行目：A=F, B=F, C=T, D=T を代入

$$\begin{aligned}
X =& T\ AND\ F\ AND\ T\ AND\ T\ OR \\
& F\ AND\ F\ AND\ T\ AND\ F\ OR \\
& T\ AND\ F\ AND\ T\ AND\ F\ OR \\
& F\ AND\ T\ AND\ F\ AND\ T\ OR \\
& T\ AND\ T\ AND\ F\ AND\ T\ OR \\
& T\ AND\ T\ AND\ T\ AND\ F\ OR \\
& F\ AND\ T\ AND\ F\ AND\ F\ OR \\
& T\ AND\ T\ AND\ F\ AND\ F \\
=& F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F \\
=& F
\end{aligned}$$

$$\begin{aligned}
Y =& (T\ OR\ T\ OR\ F\ OR\ F)\ AND \\
& (T\ OR\ F\ OR\ F\ OR\ F)\ AND \\
& (T\ OR\ T\ OR\ T\ OR\ F)\ AND \\
& (F\ OR\ F\ OR\ F\ OR\ F)\ AND \\
& (F\ OR\ T\ OR\ T\ OR\ F)\ AND \\
& (T\ OR\ F\ OR\ F\ OR\ T)\ AND \\
& (T\ OR\ T\ OR\ T\ OR\ T)\ AND \\
& (F\ OR\ T\ OR\ T\ OR\ T) \\
=& T\ AND\ T\ AND\ T\ AND\ F\ AND\ T\ AND\ T\ AND\ T\ AND\ T \\
=& F
\end{aligned}$$

7) 7 行目：A=F, B=T, C=F, D=T を代入

$$X = T \ AND \ T \ AND \ F \ AND \ T \ OR$$
$$F \ AND \ T \ AND \ F \ AND \ F \ OR$$
$$T \ AND \ T \ AND \ F \ AND \ F \ OR$$
$$F \ AND \ F \ AND \ T \ AND \ T \ OR$$
$$T \ AND \ F \ AND \ T \ AND \ T \ OR$$
$$T \ AND \ F \ AND \ F \ AND \ F \ OR$$
$$F \ AND \ F \ AND \ T \ AND \ F \ OR$$
$$T \ AND \ F \ AND \ T \ AND \ F$$
$$= F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F$$
$$= F$$

$$Y = (T \ OR \ F \ OR \ T \ OR \ F) \ AND$$
$$(T \ OR \ T \ OR \ T \ OR \ F) \ AND$$
$$(T \ OR \ F \ OR \ F \ OR \ F) \ AND$$
$$(F \ OR \ T \ OR \ T \ OR \ F) \ AND$$
$$(F \ OR \ F \ OR \ F \ OR \ F) \ AND$$
$$(T \ OR \ T \ OR \ T \ OR \ T) \ AND$$
$$(T \ OR \ F \ OR \ F \ OR \ T) \ AND$$
$$(F \ OR \ F \ OR \ F \ OR \ T)$$
$$= T \ AND \ T \ AND \ T \ AND \ T \ AND \ F \ AND \ T \ AND \ T \ AND \ T$$
$$= F$$

8) 8 行目：A=F, B=T, C=T, D=F を代入

$$X = T\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ T$$
$$= F\ OR\ F\ OR\ T\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F$$
$$= T$$

$$Y = (T\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ F)\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ F)$$
$$= T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T$$
$$= T$$

9) 9 行目：A=T, B=F, C=F, D=T を代入

$$X = F\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ F$$
$$= F\ OR\ F\ OR\ F\ OR\ T\ OR\ F\ OR\ F\ OR\ F\ OR\ F$$
$$= T$$

$$Y = (F\ OR\ T\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ F)\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ F)\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ F)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ T)$$
$$= T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T$$
$$= T$$

10) 10 行目：A=T, B=F, C=T, D=F を代入

11

$$X = F\ AND\ F\ AND\ T\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ F\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ T$$
$$= F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F$$
$$= F$$

$$Y = (F\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ F\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ F)\ AND$$
$$(T\ OR\ T\ OR\ T\ OR\ F)$$
$$= T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ F\ AND\ T\ AND\ T$$
$$= F$$

11) 11 行目：A=T, B=T, C=F, D=F を代入

$$X = F\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ T\ AND\ F\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ T\ AND\ T$$
$$= F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F$$
$$= F$$

$$Y = (F\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ F\ OR\ F\ OR\ F)\ AND$$
$$(T\ OR\ F\ OR\ F\ OR\ F)$$
$$= T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ F\ AND\ T$$
$$= F$$

12) 12 行目 : A=F, B=F, C=F, D=T を代入

$$X = T \; AND \; F \; AND \; F \; AND \; T \; OR$$
$$F \; AND \; F \; AND \; F \; AND \; F \; OR$$
$$T \; AND \; F \; AND \; F \; AND \; F \; OR$$
$$F \; AND \; T \; AND \; T \; AND \; T \; OR$$
$$T \; AND \; T \; AND \; T \; AND \; T \; OR$$
$$T \; AND \; T \; AND \; F \; AND \; F \; OR$$
$$F \; AND \; T \; AND \; T \; AND \; F \; OR$$
$$T \; AND \; T \; AND \; T \; AND \; F$$
$$= F \; OR \; F \; OR \; F \; OR \; F \; OR \; T \; OR \; F \; OR \; F \; OR \; F$$
$$= T$$

$$Y = (T \; OR \; T \; OR \; T \; OR \; F) \; AND$$
$$(T \; OR \; F \; OR \; T \; OR \; F) \; AND$$
$$(T \; OR \; T \; OR \; F \; OR \; F) \; AND$$
$$(F \; OR \; F \; OR \; T \; OR \; F) \; AND$$
$$(F \; OR \; T \; OR \; F \; OR \; F) \; AND$$
$$(T \; OR \; F \; OR \; T \; OR \; T) \; AND$$
$$(T \; OR \; T \; OR \; F \; OR \; T) \; AND$$
$$(F \; OR \; T \; OR \; F \; OR \; T)$$
$$= T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T$$
$$= T$$

13) 13 行目：A=F, B=F, C=T, D=F を代入

$$X = T\ AND\ F\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$T\ AND\ F\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ T\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ F\ AND\ T$$
$$= F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ T\ OR\ F\ OR\ F$$
$$= T$$

$$Y = (T\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ F\ OR\ T)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ F\ OR\ F)\ AND$$
$$(T\ OR\ T\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ T\ OR\ F)$$
$$= T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T$$
$$= T$$

14) 14 行目：A=F, B=T, C=F, D=F を代入

$$X = T \ AND \ T \ AND \ F \ AND \ F \ OR$$
$$F \ AND \ T \ AND \ F \ AND \ T \ OR$$
$$T \ AND \ T \ AND \ F \ AND \ T \ OR$$
$$F \ AND \ F \ AND \ T \ AND \ F \ OR$$
$$T \ AND \ F \ AND \ T \ AND \ F \ OR$$
$$T \ AND \ F \ AND \ F \ AND \ T \ OR$$
$$F \ AND \ F \ AND \ T \ AND \ T \ OR$$
$$T \ AND \ F \ AND \ T \ AND \ T$$
$$= F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F \ OR \ F$$
$$= F$$

$$Y = (T \ OR \ F \ OR \ T \ OR \ T) \ AND$$
$$(T \ OR \ T \ OR \ T \ OR \ T) \ AND$$
$$(T \ OR \ F \ OR \ F \ OR \ T) \ AND$$
$$(F \ OR \ T \ OR \ T \ OR \ T) \ AND$$
$$(F \ OR \ F \ OR \ F \ OR \ T) \ AND$$
$$(T \ OR \ T \ OR \ T \ OR \ F) \ AND$$
$$(T \ OR \ F \ OR \ F \ OR \ F) \ AND$$
$$(F \ OR \ F \ OR \ F \ OR \ F)$$
$$= T \ AND \ T \ AND \ T \ AND \ T \ AND \ T \ AND \ T \ AND \ T \ AND \ F$$
$$= F$$

15) 15 行目：A=T, B=F, C=F, D=F を代入

$$X = F\ AND\ F\ AND\ F\ AND\ F\ OR$$
$$T\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$F\ AND\ F\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ F\ OR$$
$$F\ AND\ T\ AND\ F\ AND\ T\ OR$$
$$T\ AND\ T\ AND\ T\ AND\ T\ OR$$
$$F\ AND\ T\ AND\ T\ AND\ T$$
$$= F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ F\ OR\ T\ OR\ F$$
$$= T$$

$$Y = (F\ OR\ T\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(T\ OR\ F\ OR\ T\ OR\ T)\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ T)\ AND$$
$$(F\ OR\ F\ OR\ T\ OR\ F)\ AND$$
$$(F\ OR\ T\ OR\ F\ OR\ F)\ AND$$
$$(T\ OR\ T\ OR\ F\ OR\ F)$$
$$= T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T\ AND\ T$$
$$= T$$

16) 16 行目：A=F, B=F, C=F, D=F を代入

$$X = T \; AND \; F \; AND \; F \; AND \; F \; OR$$
$$F \; AND \; F \; AND \; F \; AND \; T \; OR$$
$$T \; AND \; F \; AND \; F \; AND \; T \; OR$$
$$F \; AND \; T \; AND \; T \; AND \; F \; OR$$
$$T \; AND \; T \; AND \; T \; AND \; F \; OR$$
$$T \; AND \; T \; AND \; F \; AND \; T \; OR$$
$$F \; AND \; T \; AND \; T \; AND \; T \; OR$$
$$T \; AND \; T \; AND \; T \; AND \; T$$
$$= F \; OR \; F \; OR \; F \; OR \; F \; OR \; F \; OR \; F \; OR \; T$$
$$= T$$

$$Y = (T \; OR \; T \; OR \; T \; OR \; T) \; AND$$
$$(T \; OR \; F \; OR \; T \; OR \; T) \; AND$$
$$(T \; OR \; T \; OR \; F \; OR \; T) \; AND$$
$$(F \; OR \; F \; OR \; T \; OR \; T) \; AND$$
$$(F \; OR \; T \; OR \; F \; OR \; T) \; AND$$
$$(T \; OR \; F \; OR \; T \; OR \; F) \; AND$$
$$(T \; OR \; T \; OR \; F \; OR \; F) \; AND$$
$$(F \; OR \; T \; OR \; F \; OR \; F)$$
$$= T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T \; AND \; T$$
$$= T$$

以上 (1) → (16) の結果より, X=Y が示された

中間確認 1-3 $(\forall_x)((f(x)\ OR\ (\exists_x)(f(x)\ IMP\ g(x))\ IMP\ f(x)\ OR\ (\exists_x)(g(x)\ IMP\ NOT\ g(y))))$

$(\forall_x)(f(x)\ OR\ (\exists_x)((f(x)\ IMP\ g(x))\ IMP\ f(x)\ OR\ (\exists_x)(g(x)\ IMP\ NOT\ f(x))))$

$= (\forall_x)(f(x)\ OR\ (\exists_x)((f(x)\ IMP\ g(x))\ IMP\ f(x)\ OR\ (\exists_x)(NOT\ g(x)\ OR\ NOT\ g(y))))$

$= (\forall_x)(f(x)\ OR\ (\exists_x)((f(x)\ IMP\ g(x))\ IMP\ f(x)\ OR\ (\exists_x)(NOT\ g(x)\ OR\ NOT\ g(y))))$

$= (\forall_x)(f(x)\ OR\ (\exists_x)((f(x)\ IMP\ g(x))\ IMP\ f(x)\ OR\ (NOT\ (\exists_x)\ (g(x))\ OR\ NOT\ (\exists_x)\ (g(y)))))$

$\qquad$ ($\because$ 述語論理式の基本公式)

$= (\forall_x)(f(x)\ OR\ (\exists_x)((NOT\ f(x)\ OR\ g(x))\ IMP\ f(x)\ OR\ (NOT\ (\exists_x)\ (g(x))\ OR\ NOT\ (\exists_x)\ (g(y)))))$

$= (\forall_x)(f(x)\ OR\ (\exists_x)(NOT(NOT\ f(x)\ OR\ g(x))\ OR\ f(x)\ OR\ (NOT\ (\exists_x)\ (g(x))\ OR\ NOT\ (\exists_x)\ (g(y)))))$

$= (\forall_x)(f(x)\ OR\ (\exists_x)(NOT(NOT\ f(x))\ AND\ NOT\ g(x)\ OR\ f(x)\ OR\ (NOT\ (\exists_x)\ (g(x))\ OR\ NOT\ (\exists_x)\ (g(y)))))$

$\qquad$ ($\because$ ド・モルガンの公式)

$= (\forall_x)(f(x)\ OR\ (\exists_x)(f(x)\ AND\ NOT\ g(x)\ OR\ f(x)\ OR\ NOT\ (\exists_x)\ (g(x))\ OR\ NOT\ (\exists_x)\ (g(y))))$

$\qquad$ ($\because$ 二重否定)

$= (\forall_x)(f(x)\ OR\ (\exists_x)(f(x)\ AND\ NOT\ g(x)\ OR\ f(x)\ OR\ NOT\ (\exists_x)\ (g(x))\ OR\ NOT\ (\exists_x)\ (g(x))))$

$\qquad$ ($\because$ 述語論理式の基本公式)

$= (\forall_x)(f(x)\ OR\ (\exists_x)(f(x)\ AND\ NOT\ g(x)\ OR\ f(x)\ OR\ NOT\ (\exists_x)\ (g(x))))$

$\qquad$ ($\because$ 同一律)

$= (\forall_x)(f(x)\ OR\ (\exists_x)(f(x)\ AND\ NOT\ g(x)\ OR\ NOT\ (\exists_x)\ (g(x))))$

$\qquad$ ($\because$ 同一律)

$= (\forall_x)(f(x)\ OR\ (\exists_x)(f(x)\ AND\ NOT\ g(x)))$

$\qquad$ ($\because$ 同一律)

$= (\forall_x)(f(x)\ OR\ (\forall_x)(f(x))\ AND\ NOT\ (\forall_x)(g(x))$ $\qquad$ ($\because$ 述語論理式の基本公式)

$= (\forall_x)(f(x)\ AND\ NOT\ (\forall_x)(g(x))$ $\qquad$ ($\because$ 同一律)

$= (\forall_x)(f(x)\ AND\ NOT\ g(x))$

中間確認 1-4 $A \cap (A \cup B) \cap B \cap (B \cup C) \cap C \cap (C \cup A)$

$A \cap (A \cup B) \cap B \cap (B \cup C) \cap C \cap (C \cup A)$

$= A \cup (A \cap B) \cap B \cap (B \cup C) \cap C \cap (C \cup A) \quad (\because 分配則)$

$= A \cup (A \cap B) \cap B \cup (B \cap C) \cap C \cap (C \cup A) \quad (\because 分配則)$

$= A \cup (A \cap B) \cap B \cup (B \cap C) \cap C \cup (C \cap A) \quad (\because 分配則)$

$= A \cap B \cup (B \cap C) \cap C \cup (C \cap A) \quad (\because 吸収律)$

$= A \cap B \cap C \cup (C \cap A) \quad (\because 吸収律)$

$= A \cap B \cap C \quad (\because 吸収律)$