HW2 Q1 needs solutions.

Q2 is solved in the slides on Ashenhurst decomposition.

Q3 = programming w/ CUDD.

Solution to Q1

$$f = g f_g + \bar{g} f_{\bar{g}}$$

Prove $f \cdot g \subseteq f_g \subseteq f + \bar{g}$

$$f = g f_g + \bar{g} f_{\bar{g}}$$

Multiply LHS, RHS by $g$.

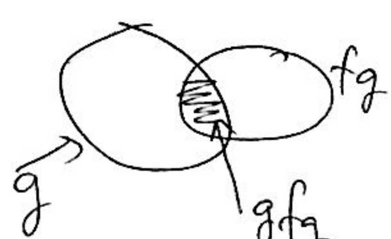
$$\Rightarrow f \cdot g = [g f_g + \bar{g} f_{\bar{g}}] \cdot g$$

$$\Rightarrow f \cdot g = g \cdot g \cdot f_g + 0 = g \cdot f_g$$

$$f \wedge g = g \wedge f_g$$

$$f_g \supseteq g f_g$$

$$\Rightarrow f_g \supseteq f \cdot g$$




$$\boxed{f_g \supseteq f \cdot g}$$

This proves 1 bound.

To prove $f_g \subseteq f + \bar{g}$

$$f = g f_g + \bar{g} f_g.$$

$$f + \bar{g} = g f_g + \underbrace{\bar{g} f_{\bar{g}} + \bar{g}}_{\bar{g}}$$

$$= g \cdot f_g + \bar{g}$$

$$f + \bar{g} = f_g + \bar{g} \quad - (1)$$

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$$f_g \subseteq f_g + \bar{g}$$

$$\subseteq f + \bar{g} \quad \text{from (1)}$$

So. $$\boxed{f \cdot g \subseteq f_g \subseteq f + \bar{g}}$$

Q2

$$f = \bar{w}\bar{x}\bar{z} + w\bar{x}z + \bar{w}yz + wy\bar{z}$$

$$g = w \oplus z = \bar{w}z + w\bar{z} \qquad \bar{g} = \bar{w}\bar{z} + wz$$

Find $f_g$ $\qquad f \cdot g \subseteq f_g \subseteq f + \bar{g}$

$$f \cdot g = [\bar{w}\bar{x}\bar{z} + w\bar{x}z + \bar{w}yz + wy\bar{z}][\bar{w}z + w\bar{z}]$$

$$= \bar{w}yz + wy\bar{z} = \underline{\text{Care-set}}$$

$$f + \bar{g} = \bar{w}\bar{z} + wz + \bar{w}yz + \bar{w}\bar{z} + wy\bar{z} + wz$$

$$= \bar{w}\bar{z} + wz + \bar{w}[yz + \bar{z}] + w[y\bar{z} + z]$$

$$= \bar{w}\bar{z} + wz + \bar{w}[y + \bar{z}] + w[y + z]$$

$$= \bar{w}\bar{z} + w\bar{z} + \bar{w}y + \bar{w}\bar{z} + wy + wz$$

$$= \bar{w}\bar{z} + w\bar{z} + y + wz$$

$$= \bar{w}\bar{z} + w + y$$

$$= \underbrace{w + y + \bar{z}}_{x}$$

Care ∪ don't care set.

| $w \backslash yz$ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 0 | x | x | $\bar{w}yz$ x | X |
| 1 | x | x | x | $wy\bar{z}$ x |

$$f_g = y$$

$f_g$ can be anything in between $f \cdot g$ & $f + \bar{g}$

$\Rightarrow f \cdot g$ = care set

and $f + \bar{g}$ = care-set $\cup$ don't care set.

$f_g$ = Take $f \cdot g$ simplify $f \cdot g$ using don't care.

Similarly. $\boxed{f_{\bar{g}} = \bar{x}}$

$$f = g f_g + \bar{g} f_{\bar{g}}$$

$$f = [w \oplus z] \cdot y + [\overline{w \oplus z}] \cdot \bar{x}$$