Problem 1:

A	B	C_{in}	$A \dot{\vee} B \vee C$	$A \wedge B$	$C_{in} \wedge (A \dot{\vee} B)$	C_{out}
0	0	0	0	0	0	0
1	0	0	1	0	0	0
0	1	0	1	0	0	0
1	1	0	0	1	0	1
0	0	1	1	0	0	0
1	0	1	0	0	1	1
0	1	1	0	0	1	1
1	1	1	1	1	0	1

a) $S = (A \wedge \neg B \wedge \neg C_{in}) \vee (\neg A \wedge B \wedge \neg C_{in}) \vee (\neg A \wedge \neg B \wedge C_{in}) \vee (A \wedge B \wedge C_{in})$

$C_{out} = (A \wedge B \wedge \neg C_{in}) \vee (A \wedge \neg B \wedge C_{in}) \vee (\neg A \wedge B \wedge C_{in}) \vee (A \wedge B \wedge C_{in})$

b) $S = (A \vee B \vee C_{in}) \wedge (\neg A \vee \neg B \vee C_{in}) \wedge (\neg A \vee B \vee \neg C_{in}) \wedge (\cancel{A \wedge \neg B \wedge \neg C_{in}}\ A \vee \neg B \vee \neg C_{in})$

$C_{out} = (A \vee B \vee C_{in}) \wedge (\neg A \vee B \vee C_{in}) \wedge (A \vee \neg B \vee C_{in}) \wedge (A \vee B \vee \neg C_{in})$

c) $A \vee B = \neg A \uparrow \neg B$

$A \wedge B = \neg(A \uparrow B)$

$A \dot{\vee} B = (A \uparrow (A \uparrow B)) \uparrow (B \uparrow (A \uparrow B))$

$S = \left[(A \dot{\vee} B) \uparrow ((A \dot{\vee} B) \uparrow C_{in})\right] \uparrow \left[C_{in} \uparrow ((A \dot{\vee} B) \uparrow C_{in})\right]$

$C_{out} = \neg(\neg(A \uparrow B)) \uparrow \neg(\neg(C_{in} \uparrow (A \dot{\vee} B)))$

$= (A \uparrow B) \uparrow (C_{in} \uparrow (A \dot{\vee} B))$

Problem2:

a) set $xs = [x, y, z]$

foldl op e xs = $((e\ op\ x)\ op\ y)\ op\ z$

because $e\ op\ x = x$ therefore result = $(x\ op\ y)\ op\ z$

because $x\ op\ e = x$ therefore foldr op e xs = $x\ op\ (y\ op\ z)$

because op is associative

Therefore foldr op e xs = foldl op e xs.

b) if $xs = [x, y, z]$

foldl op2 e xs = $((e\ `op2`\ x)\ `op2`\ y)\ `op2`\ z$

foldr op1 e xs = $x\ `op1`\ (y\ `op1`\ (z\ `op1`\ e))$

$= x\ op1\ (y\ op1\ (e\ op2\ z))$

$= x\ op1\ ((y\ op1\ e)\ op2\ z)$

$= (x\ op1\ (e\ op2\ y))\ op2\ z$

$= ((x\ op1\ e)\ op2\ y)\ op2\ z$

$= ((e\ op2\ x)\ op2\ y)\ op2\ z$

foldr op1 e xs = foldl op2 e xs

c) if $xs = [x, y, z]$ then reverse $xs = [z, y, x]$

foldl op' a (reverse xs) = $((a\ op'\ z)\ op'\ y)\ op'\ x$

foldr op a xs = $x\ op\ (y\ op\ (z\ op\ a))$

$= x\ op\ (y\ op\ (a\ op'\ z))$

$= x\ op\ ((a\ op'\ z)\ op'\ y)$

$= ((a\ op'\ z)\ op'\ y)\ op'\ x$

foldr op a xs = foldl op' a (reverse xs)