Problem 4.

(a)

x	y	z	$(\neg x$	$\rightarrow$	$(y \wedge z))$	$\wedge$	$(\neg y$	$\rightarrow$	$(x \wedge z))$
0	0	0	1	0	0	0	1	0	0
0	0	1	1	0	0	0	1	0	0
0	1	0	1	0	0	0	0	1	0
0	1	1	1	1	1	1	0	1	0
1	0	0	0	1	0	0	1	0	0
1	0	1	0	1	0	1	1	1	1
1	1	0	0	1	0	1	0	1	0
1	1	1	0	1	1	1	0	1	1

(b)

To get the DNF form, we highlight all rows that evaluate to true.

x	y	z	$\big(\neg x$	$\rightarrow$	$(y \wedge z)\big)$	$\wedge$	$\big(\neg y$	$\rightarrow$	$(x \wedge z)\big)$
0	0	0	1	0	0	0	1	0	0
0	0	1	1	0	0	0	1	0	0
0	1	0	1	0	0	0	0	1	0
0	1	1	1	1	1	1	0	1	0
1	0	0	0	1	0	0	1	0	0
1	0	1	0	1	0	1	1	1	1
1	1	0	0	1	0	1	0	1	0
1	1	1	0	1	1	1	0	1	1

So we end up with:

$$(\neg x \wedge y \wedge z) \vee (x \wedge \neg y \wedge z) \vee (x \wedge y \wedge \neg z) \vee (x \wedge y \wedge z)$$

(c)

To get the CNF form, we negate our original expression.

x	y	z	$\neg\Big(\big(\neg x \to (y \land z)\big) \land \big(\neg y \to (x \land z)\big)\Big)$
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Now negate the DNF for this truth table.

$$\neg\big((\neg x \land \neg y \land \neg z) \lor (\neg x \land \neg y \land z) \lor (\neg x \land y \land \neg z) \lor (x \land \neg y \land \neg z)\big)$$

LEQV $\neg(\neg x \land \neg y \land \neg z) \land \neg(\neg x \land \neg y \land z) \land \neg(\neg x \land y \land \neg z) \land \neg(x \land \neg y \land \neg z)$

LEQV $(\neg\neg x \lor \neg\neg y \lor \neg\neg z) \land (\neg\neg x \lor \neg\neg y \lor \neg z) \land (\neg\neg x \lor \neg y \lor \neg\neg z) \land (\neg \lor \neg\neg y \lor \neg\neg z)$

LEQV $(x \lor y \lor z) \land (x \lor y \lor \neg z) \land (x \lor \neg y \lor z) \land (\neg \lor y \lor z)$

Eaiser way: (I watched this part of the lecture after I did this already D:)
Highlight all rows that evaluate to false. Then negate all of the variables.

x	y	z	$(\neg x$	$\to$	$(y \land z))$	$\land$	$(\neg y$	$\to$	$(x \land z))$
0	0	0	1	0	0	0	1	0	0
0	0	1	1	0	0	0	1	0	0
0	1	0	1	0	0	0	0	1	0
0	1	1	1	1	1	1	0	1	0
1	0	0	0	1	0	0	1	0	0
1	0	1	0	1	0	1	1	1	1
1	1	0	0	1	0	1	0	1	0
1	1	1	0	1	1	1	0	1	1

So we end up with:

$$(x \lor y \lor z) \land (x \lor y \lor \neg z) \land (x \lor \neg y \lor z) \land (\neg \lor y \lor z)$$

(d)

$\big(\neg x \to (y \wedge z)\big) \wedge \big(\neg y \to (x \wedge z)\big)$

LEQV	$\big(\neg\neg x \vee (y \wedge z)\big) \wedge \big(\neg\neg y \vee (x \wedge z)\big)$	[$\to$ law]
LEQV	$\big(x \vee (y \wedge z)\big) \wedge \big(y \vee (x \wedge z)\big)$	[double negation]
LEQV	$\big((x \vee y) \wedge (x \vee z)\big) \wedge \big((y \vee x) \wedge (y \vee z)\big)$	[distributive laws]
LEQV	$(x \vee y) \wedge (x \vee z) \wedge (y \vee x) \wedge (y \vee z)$	[associative laws]
LEQV	$\big((x \vee y) \wedge (y \vee x)\big) \wedge (x \vee z) \wedge (y \vee z)$	[by reordering]
LEQV	$(x \vee y) \wedge (x \vee z) \wedge (y \vee z)$	[idempotency laws]