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	$\neg\Big(\big(\neg x \rightarrow (y \wedge z)\big) \wedge \big(\neg y \rightarrow (x \wedge z)\big)\Big)$
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.

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

$$\text{LEQV} \quad \neg(\neg x \wedge \neg y \wedge \neg z) \wedge \neg(\neg x \wedge \neg y \wedge z) \wedge \neg(\neg x \wedge y \wedge \neg z) \wedge \neg(x \wedge \neg y \wedge \neg z)$$

$$\text{LEQV} \quad (\neg\neg x \vee \neg\neg y \vee \neg\neg z) \wedge (\neg\neg x \vee \neg\neg y \vee \neg z) \wedge (\neg\neg x \vee \neg y \vee \neg\neg z) \wedge (\neg \vee \neg\neg y \vee \neg\neg z)$$

$$\text{LEQV} \quad (x \vee y \vee z) \wedge (x \vee y \vee \neg z) \wedge (x \vee \neg y \vee z) \wedge (\neg \vee y \vee z)$$

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

So we end up with:

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

(d)

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

LEQV	$\big(\neg\neg x \lor (y \land z)\big) \land \big(\neg\neg y \lor (x \land z)\big)$	[$\rightarrow$ law]
LEQV	$\big(x \lor (y \land z)\big) \land \big(y \lor (x \land z)\big)$	[double negation]
LEQV	$\big((x \lor y) \land (x \lor z)\big) \land \big((y \lor x) \land (y \lor z)\big)$	[distributive laws]
LEQV	$(x \lor y) \land (x \lor z) \land (y \lor x) \land (y \lor z)$	[associative laws]
LEQV	$\big((x \lor y) \land (y \lor x)\big) \land (x \lor z) \land (y \lor z)$	[by reordering]
LEQV	$(x \lor y) \land (x \lor z) \land (y \lor z)$	[idempotency laws]