Practice Questions for Midterm 1

Question 1

Consider the following truth table:

p	q	r	output
T	T	T	T
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	F
F	T	F	T
F	F	T	T
F	F	F	F

Write a proposition in CNF and DNF forms

Question 2

Please negate the following propositions, and simplify them with De-Morgan's Law

$$p \to q$$

$$(p \to q) \vee (q \wedge (r \to p))$$

Question 3

Please convert the following bit string under different representations into base 10

1101 1010 0010 0111

As if the string is unsigned: _____

As if the string is in signed magnitude: _____

As if the string is in two's complement: _____

11010111010000

As if the string is unsigned: _____

As if the string is in signed magnitude: _____

As if the string is in two's complement: _____

Can you also explain pros and cons of the above representations?

Question 4

Assume we have two unsigned binary numbers in fixed width 4 such that:

$x = (x_3, x_2, x_1, x_0)_{2,4}$ and $y = (y_3, y_2, y_1, y_0)_{2,4}$

Please give a formula to compute unsigned binary number, $z = (z_3, z_2, z_1, z_0)_{2,4}$, with fixed width 4 where $z = x + y$:

z_3=_____

z_2=_____

z_1=_____

z_0=_____

Question 5

Please convert the following numbers into fixed width representations:

$(27)_{10}$

unsigned binary fixed width 6 ($)_{2,6}$

signed magnitude binary width 6 ($)_{2,6}$

two's complement width 6 ($)_{2,6}$

$(1F6C)_{16}$
unsigned binary fixed width 16 ($)_{2,16}$
signed magnitude binary width 16 ($)_{2,16}$
two's complement width 16 ($)_{2,16}$

$(712)_8$
unsigned binary fixed width 10 ($)_{2,10}$
signed magnitude binary width 10 ($)_{2,10}$
two's complement width 10 ($)_{2,10}$

Question 6

Let the domain D = $\mathbb{Z}$, translate the following sentence to a proposition

" Every odd number can be divided by some positive number "

(1) Define 2 predicates and write the proposition
(2) Write the negation
(3) Translate the negation back into English sentence

Question 7

(1) Negate the following proposition

$$\forall x_1 \in \mathbb{R}, \exists x_2 \in \mathbb{R}, (p \to q) \vee (P(x_1) \wedge P(x_2))$$

(2) Define a predicate P(x) such that the following statement is true

$$\exists x \in \mathbb{Z}, P(x) \wedge (x = 5)$$