Webinar

Convert: $(900)_{10} = (\ ?\ )_2$

#1 Weight Method

0	0	1	1	1	0	0	0	0	1	0	0
2048	1026	512	256	128	64	32	16	8	4	2	1

$900 - 512 = 388 - 256 = 132 - 128 = 4 - 4 = 0$

$(1110000100)_2 = (900)_{10}$

#2 Succession Division

- Divide Conversion Number by 2
-

$900 \div 2 = 450\ r\ 0$
$450 \div 2 = 225\ r\ 0$
$225 \div 2 = 112\ r\ 1$
$112 \div 2 = 56\ r\ 0$
$56 \div 2 = 28\ r\ 0$
$28 \div 2 = 14\ r\ 0$
$14 \div 2 = 7\ r\ 0$
$7 \div 2 = 3\ r\ 1$
$3 \div 2 = 1\ r\ 1$
$1 \div 2 = 0\ r\ 1$

Write Up to Down

(1110000100)
from left to right

Convert $(708)_{10} = (\ ?\ )_{16}$

$708 \div 16 = 44\ r\ 4$
$44 \div 16 = 2\ r\ 12$
$2 \div 16 = 0\ r\ 2$
$(708)_{10} = (2C4)_{16}$

When using decimal number system you can symbolize decimal point numbers by 2^{-k}

Example $(52.5)_{10} = (?)_2$

$52 < 64 = 2$

$$\frac{0}{64}\ \frac{1}{32}\ \frac{1}{16}\ \frac{0}{8}\ \frac{1}{4}\ \frac{0}{2}\ \frac{0}{1} \qquad (52)_{10} = (110100)_2$$

$52 - 32 = 20 - 16 = 4 - 4 = 0$

Now to find $(.5)_{10} \to (?)_2$ do 2^{-k} i.e. $\frac{1}{2}\ \frac{1}{4}\ \frac{1}{8}\ \frac{1}{16} \ldots$

$(.5)_{10} \leq \frac{1}{2} = 2^{-1}$

so $(52)_{10} + (.5)_{10} = (110100.1)_2$

$$\frac{0}{1/4}\ \frac{1}{1/2}$$

- 2's Complement representation is NOT equivalent in a Binary System
- 2's Complement is ITS OWN number system

So $(11001000)_{2\text{s comp}} \neq (11001000)_2$

Propositional Logic

Example : $\neg p \to (q \to r) \equiv q \to (p \vee r)$

$$
\begin{aligned}
&\neg p \to (q \to r) &&\equiv \\
&\neg\neg p \vee (q \to r) &&\equiv \text{ Conditional Identies} \\
&p \vee (q \to r) &&\equiv \text{ Double Negation Law} \\
&p \vee (\neg q \vee r) &&\equiv \text{ Conditional Identies} \\
&(\neg q \vee p) \vee r &&\equiv \text{ associative Law} \\
&q \to (p \vee r) &&\equiv \text{ Conditional Identies}
\end{aligned}
$$

Predicate Logic

U universe : (Mention where in the universe the predicates take value)

$\forall x\, p(x)$ universal quantifier : for all values of (x) p should be true for them

$\exists x\, p(x)$ existential quantifier : There "exsist" an "x" for each p

Example : True or False in Domain = (set of all ints)

a) $\exists x\,(x+2=1)$
True $(x=1)$ exsist in Domain

b) $\exists x\,(x+x=1)$
False (if $x=1$ $\quad 1+1 \neq 1$)

c) $\forall x\,(x^2 - x \neq 0)$
False (for all x this is not true $x=1$ $\quad 1-1=0$)

d) $\forall x\,(x^2>0)$
False (Not all x's satisfy ; $x=0$ $\quad 0^2 \ngtr 0$

e) $\exists x\,(x^2>0)$ True there exist an "x" where $x^2>0$

Example: domain = (set of students at a Uni)

Define the predicates

$E(x) = x$ is enrolled in the class

$T(x) = x$ took the test

Translate from English to logical expressions with same meaning

a) Someone who is enrolled in class took a test

$E(x)$ $T(x)$

$\exists x[E(x) \wedge T(x)]$

* Alot of times when we use exsitential statements, its weak

- we want to make them "Stronger". The way to make them stronger is to use "and" ($\wedge$).

*KEEP MEANING JUST TRANSLATE TO PREDICATE

b) All students enrolled in the class took the test

$\forall x[E(x) \to T(x)]$

* When we use as universal statement, its strong.

- We want to make them "weaker." The way to make them weaker is to use "implication" ($\to$).

c) Everyone who took the test is enrolled in the class.

$\forall x[T(x) \to E(x)]$

d) At least

Example. Domain = (set of real nums)
Determine True or False
A) $\forall x \, \exists y \, (x+y=0)$

$\forall x \, \exists y \, (x+y=0)$
Universal
For All x this needs to be T
$x=1$ $\exists y \, (1+y=0)$ $y=-1$ T
$x=7$ $\exists y \, (7+y=0)$ $y=-7$ T
$x=3.5$ $\exists y \, (3.5+y=0)$ $y=-3.5$ T

All True!

$\exists x \, \forall y \, (x+y=0)$
Exsistential
$x=1$ $\forall y \, (1+y=0)$ F Not All y
$x=7$ $\forall y \, (7+y=0)$ F Not All y

All False!

The Order Matters!