"ASSIGNMENT- 1"

NAME: SHAWAIZ SHAHID
ROLL NO.: 23P-0599
SECTION: BS(CS) 2C
DATE: 8th MARCH 2024
COURSE: Digital Logic Design

"Question: 1"

Digital and Analog Quantities:

=> An analog quantity is one having continuous values.

=> A digital quantity is one having a discrete set of values.

Signal Types

=> Analog uses continuous signals

with a range of values e.g. voltage, current, or pressure in analog signals.

=> Digital uses discrete signals with specific levels e.g. voltage levels in digital circuits.

Transmissions

=> Analog is prone to noise interference, it degrades over long distances.

=> Digital is resistant to noise, and is easy to transmit and process accurately

Device that utilizes both Digital and Analog:

=> One example is a modern smartphone.

Digital Components:

1. Processor (CPU): It handles digital computations and executes software.

2. Memory (RAM): It stores and retrieves digital information.

Analog Components:

1. Microphone: It converts analog sound waves into digital signals for recording.

2. Speakers: It converts digital audio signals back into analog sound waves.

"Question : 2"

Significance of Timing Diagrams:

1. Visualization of Signals:

=> Timing diagrams provide a visual representation of how signals change over time in a digital system. This includes clock signals, data inputs, and outputs.

2. Temporal Relationships:

=> They help illustrate the temporal relationships between different signals, indicating when events occur in relation to each.

3. Clock Synchronization:

=> Timing diagrams are crucial for understanding and ensuring proper clock synchronization within a digital system, ensuring that components operate in harmony.

4. Debugging and Analysis:

=> Engineers use timing diagrams for debugging and analyzing digital circuits. Anomalies or errors in signal timing can be identified and addressed.

5. Verification of Specifications:

=> They help in verifying that a digital system works according to specified timing requirement, ensuring reliable and predictable.

Difference between Serial and Parallel Data Transfer:

Serial Data Transfer:

- In serial data transfer, one bit of data is transmitted at a time over a signal channel or wire.

- It can be synchronous (Clock-driven) or asynchronous (no fixed timing relationship).
- It generally takes longer to transmit a given amount of data compared to parallel transfer.
- It is used in communication interfaces like USB, UART, and serial communication links.

Parallel Data Transfer:

- In parallel data transfer, multiple bits are transmitted simultaneously using multiple channels or wires.
- It usually synchronous with a clock signal, ensuring synchronized transmission of all bits.
- It can transmit a larger amount of data in a

shorter time compared to serial transfer.

- It is used in internal buses within computers and in memory interfaces.

"QUESTION : 3"

=> 1010 - 1101 => (10-13)

$$\begin{array}{r} 1010 \\ -\ 1101 \\ \hline 101 \end{array}$$

Not applicable without using the 2's compliment.

2's compliment method :

	128	64	32	16	8	4	2	1	
+13 =	0	0	0	0	1	1	0	1	
1's =	1	1	1	1	0	0	1	0	= -14
2's =								+1	
	1	1	1	1	0	0	1	1	= -13

So, $(10-3)_{10} = (-3)_2 =$ 11110011
+ 1010

$(10-3)_{10} = (-3)_{10} =>$ 11111101 = -3

"Question : 4"

76.123 :

$\Rightarrow (70 \times 10^{1}) + (6 \times 10^{0}) + (1 \times 10^{-1})$
$+ (2 \times 10^{-2}) + (3 \times 10^{-3})$

$\Rightarrow 70 + 6 + 0.1 + 0.02 + 0.003$

"Question : 5"

We can find the largest number by 2-methods :

=> Method : 1

6 bits => 32 16 8 4 2 1
1 1 1 1 1 1

$32 + 16 + 8 + 4 + 2 + 1$
$\boxed{63}$

Method : 2

by formula => $2^{n} - 1$

$\Rightarrow \quad 2^6 - 1$

$64 - 1$

$\boxed{63}$

"Question: 6"

a) $(24, 40)$ by repeated division:

2	24 — 0	2	40 — 0
2	12 — 0	2	20 — 0
2	6 — 0	2	10 — 0
2	3 — 1	2	5 — 1
2	1	2	2 — 0
			1

$(24)_{10} = (11000)_2$

$(40)_{10} = (101000)_2$

Addition:

$$\begin{array}{r} 11000 \\ +101000 \\ \hline 1000000 \end{array}$$

$\Rightarrow 11000 + 101000$

$\Rightarrow 1000000$

Multiplication:

```
        101000
      × 11000
      --------
        000000
       000000×
      000000××
     101000×××
  + 101000××××
  ------------
    1111000000
```

=> (11000) × (101000)

=> 1111000000

Using sum of weights

$(53)_{10}$ =

weight ⇒	2^5	2^4	2^3	2^2	2^1	2^0
	32	16	8	4	2	1
	1	1	0	1	0	1

⇒ Sum = 32 + 16 + 4 + 1 = 53

So, $(53)_{10} = (110101)_2$

$(147)_{10}$:

Weight

weight =	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
	128	64	32	16	8	4	2	1
	1	0	0	1	0	0	1	1

Sum = 128 + 16 + 2 + 1
= 147

So, $(147)_{10} = (10010011)_2$

Addition :

$$
\begin{array}{r}
10010011 \\
+\ 110101 \\
\hline
11001000
\end{array}
$$

$\Rightarrow (110101) + (10010011)$
$\Rightarrow 11001000$

Multiplications

$$
\begin{array}{r}
10010011 \\
\times\ 110101 \\
\hline
10010011 \\
00000000\times \\
10010011\times\times \\
00000000\times\times\times \\
10010011\times\times\times\times \\
+\ 10010011\times\times\times\times\times \\
\hline
1111001101111
\end{array}
$$

$\Rightarrow (10010011) \times (110101)$
$= 1111001101111$

"Questions 7"

Using repeated division for the whole part.

$(39.875)_{10}$ =

2	39	— 1	= LSB
2	19	— 1	
2	9	— 1	
2	4	— 0	
2	2	— 0	
	1		= MSB

$(39)_{10} = (100111)_2$

Now for fractional part we repeated multiplication

=> $0.875 \times 2 = 1.75$ = MSB
$0.75 \times 2 = 1.5$
$0.5 \times 2 = 1.0$ = LSB
$0.0 \times 2 = 0$

$(0.875)_{10} = (111)_2$

So, $(39.875)_{10} = (10011.111)$

MSB LSB MSB LSB

"Questions 8"

i) $+27 = \frac{128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1}{0 \quad 0 \quad 0 \quad 1 \quad 1 \quad 0 \quad 1 \quad 1}$

$(27)_{10} = (00011011)_2$

ii) -127 = for this, first make positive 127

$+127 = \frac{128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1}{0 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1}$

$(127)_{10} = (01111111)_2$

Now using 1's compliments

$\Rightarrow$ 01111111 = 127
10000000 = -128 = 1's

Now taking 2's compliments

$$\begin{array}{r} 10000000 \\ +1 \\ \hline 10000001 \end{array} = -127$$

$(-127)_{10} = (10000001)_2$

"Question 8"

$(-57)_{10}$ = to convert this into binary we first need to make its positive numbers in 8-bit form.

128	64	32	16	8	4	2	1
0	0	1	1	1	0	0	1

$(00111001)_2 = (57)_{10}$

Now taking 1's compliments

$\Rightarrow$ 11000110 = 1's

Now taking 2's compliments

$$
\begin{array}{rl}
\Rightarrow 11000110 & = -58 \\
+1 & = 1 \\
\hline
11000111 & = -57
\end{array}
$$

So, $(-57)_{10} = (11000111)_2$