AKTU

GATEWAY CLASSES

Digital System Design

B.Tech. 3rd Sem

EC & Allied



Exam/Result Oriented Content

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- ✓ Pdf Notes
- ✓ PYQs

DIGITAL SYSTEM DESIGN

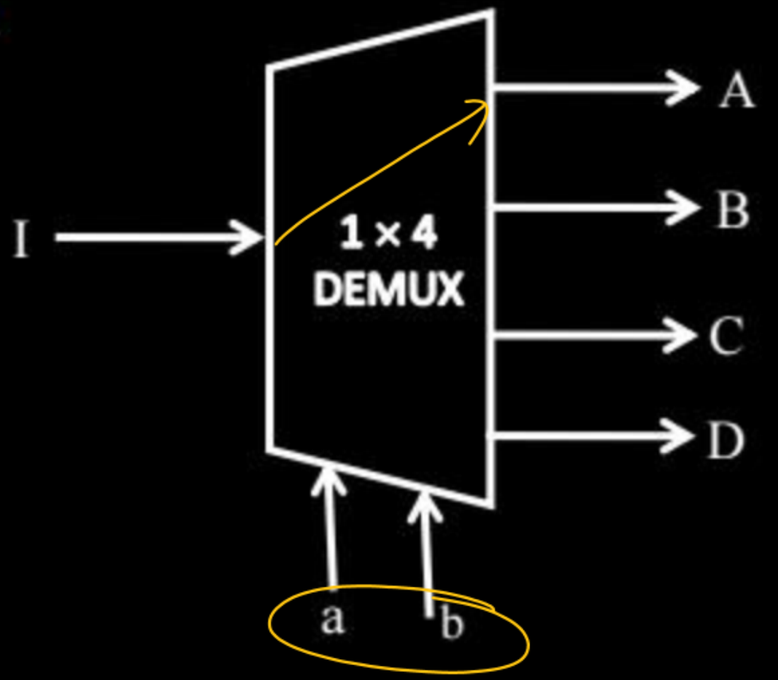
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UNIT 2 : Combinational circuits

Today's Target

- DEMUX
- Implementation of Higher-order DeMultiplexers
- Multiplexed Display
- Pixel Oriented & Character Oriented
- Display Driver

DEMULTIPLEXER



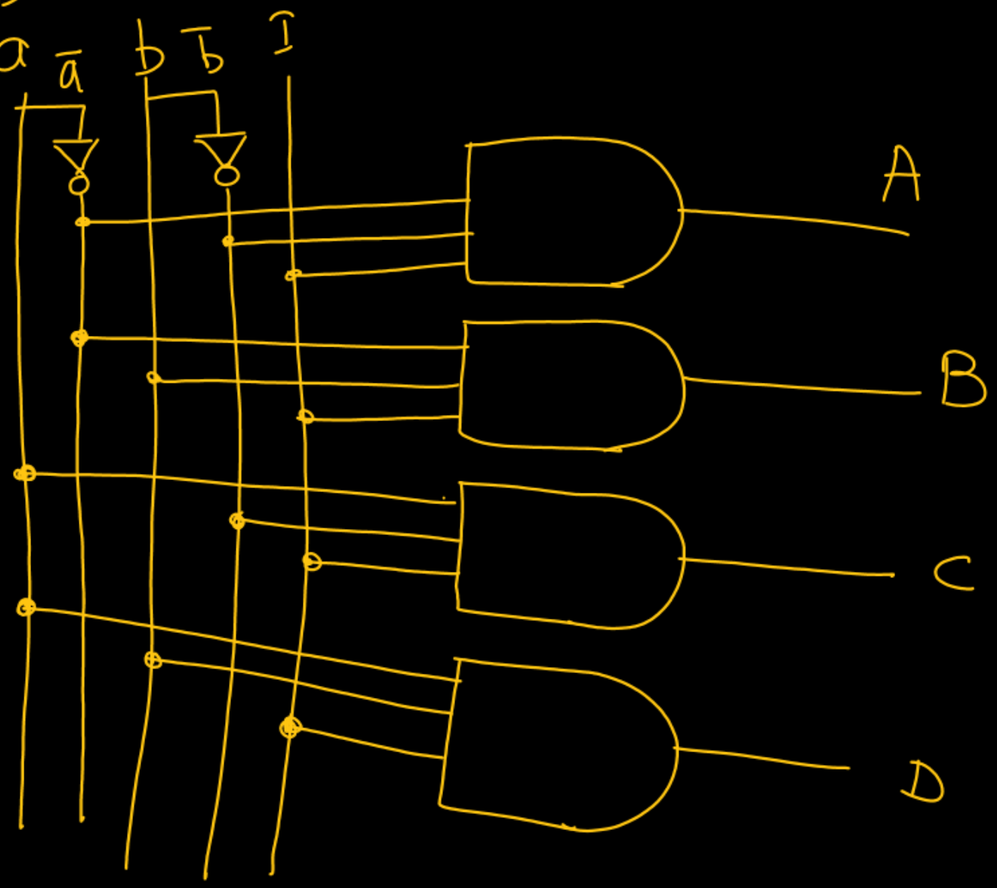
- inverse of the multiplexer
- single data input
- n address inputs
- 2^n outputs
- The address input determine which data output is going to have the same value as the data input.
- other data outputs will have the value 0.
- abbreviation used is DEMUX.

TRUTH TABLE AND CIRCUIT DIAGRAM

Data Input	Select Inputs		Outputs			
I	a	b	A	B	C	D
I	0	0	I	0	0	0
I	0	1	0	I	0	0
I	1	0	0	0	I	0
I	1	1	0	0	0	I

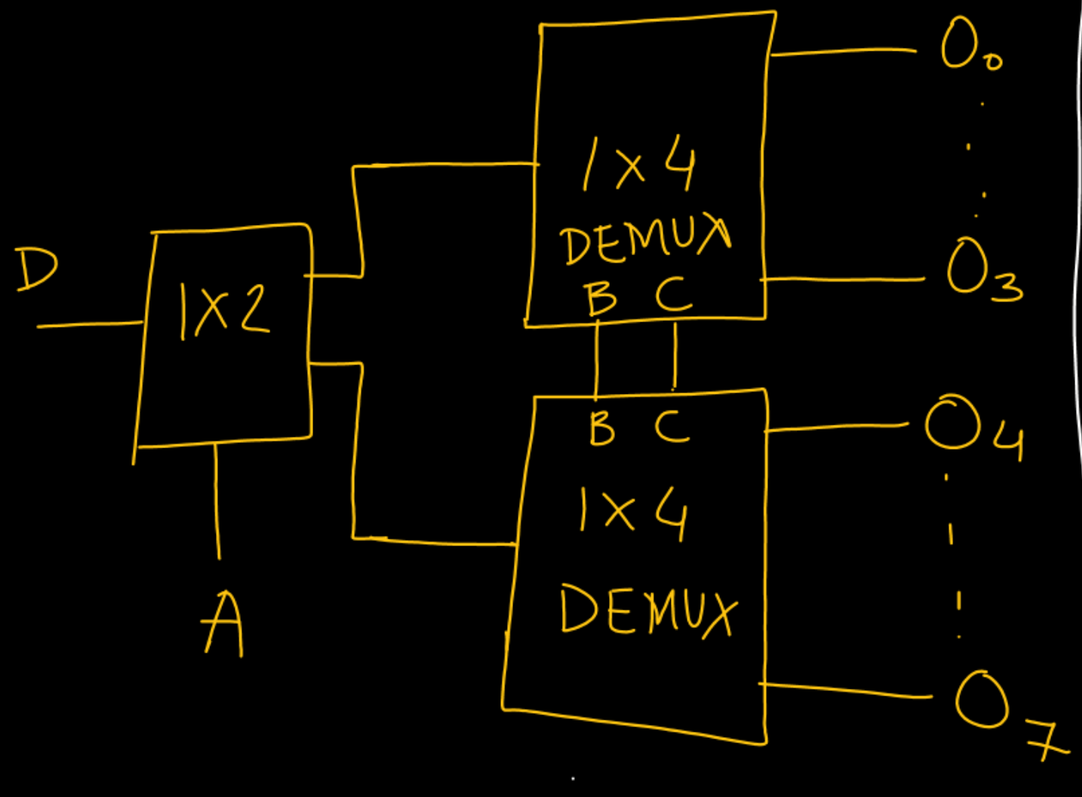
$A = \bar{a}\,\bar{b}\,I \quad B = \bar{a}\,b\,I \quad C = a\,\bar{b}\,I$

$D = a\,b\,I$

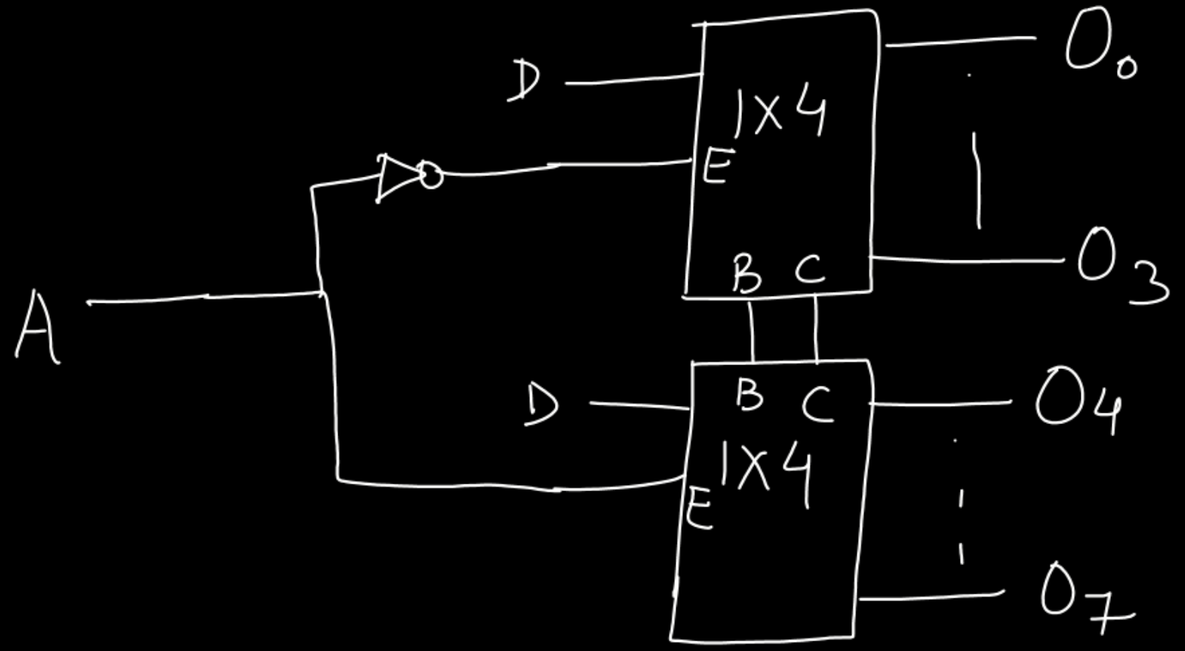


HIGHER ORDER DEMUX USING LOWER ORDER DEMUX

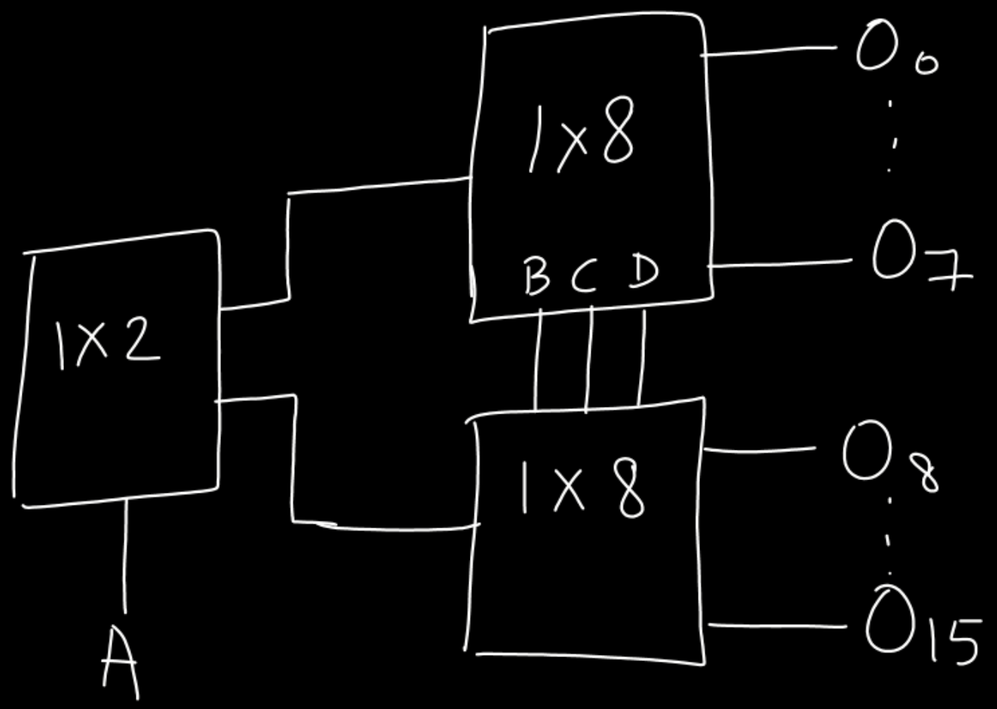
1 × 8 USING 1 × 4 DEMUX



A B C



1 × 16 USING 1 × 8 DEMUX



Multiplexed display

- Multiplexed displays are electronic display devices where the entire display is not driven at one time.
- Instead, sub-units of the display are multiplexed
- typically, rows or columns for a dot matrix display or
- individual characters for a character oriented display, occasionally individual display elements



- These are driven one at a time, but the electronics and the persistence of vision combine to make the viewer believe the entire display is continuously active.
- Advantages compared to a non-multiplexed display:

➢ Fewer wires (often, far fewer wires) are needed

➢ simpler driving electronics can be used

➢ both lead to reduced cost

➢ reduced power consumption

Two Broad Categories

- character-oriented displays
- pixel-oriented displays

Character-oriented displays

- display an entire character at one time.
- various segments of each character are connected in a two-dimensional diode matrix and will only illuminate if both the "row" and "column" lines of the matrix are at the correct electrical potential.
- If the display had been built with every segment being individually connected, the display would have required 49 wires just for the digits, with more wires being needed for all of the other indicators that can be illuminated.
- By multiplexing the display, only seven "digit selector" lines and seven "segment selector" lines are needed.
- The extra indicators are arranged as if they were segments of an additional digit or two or extra segments of existing digits and are scanned using the same multiplexed strategy as the real digits.
- A keyboard matrix circuit has a very similar arrangement as a multiplexed display

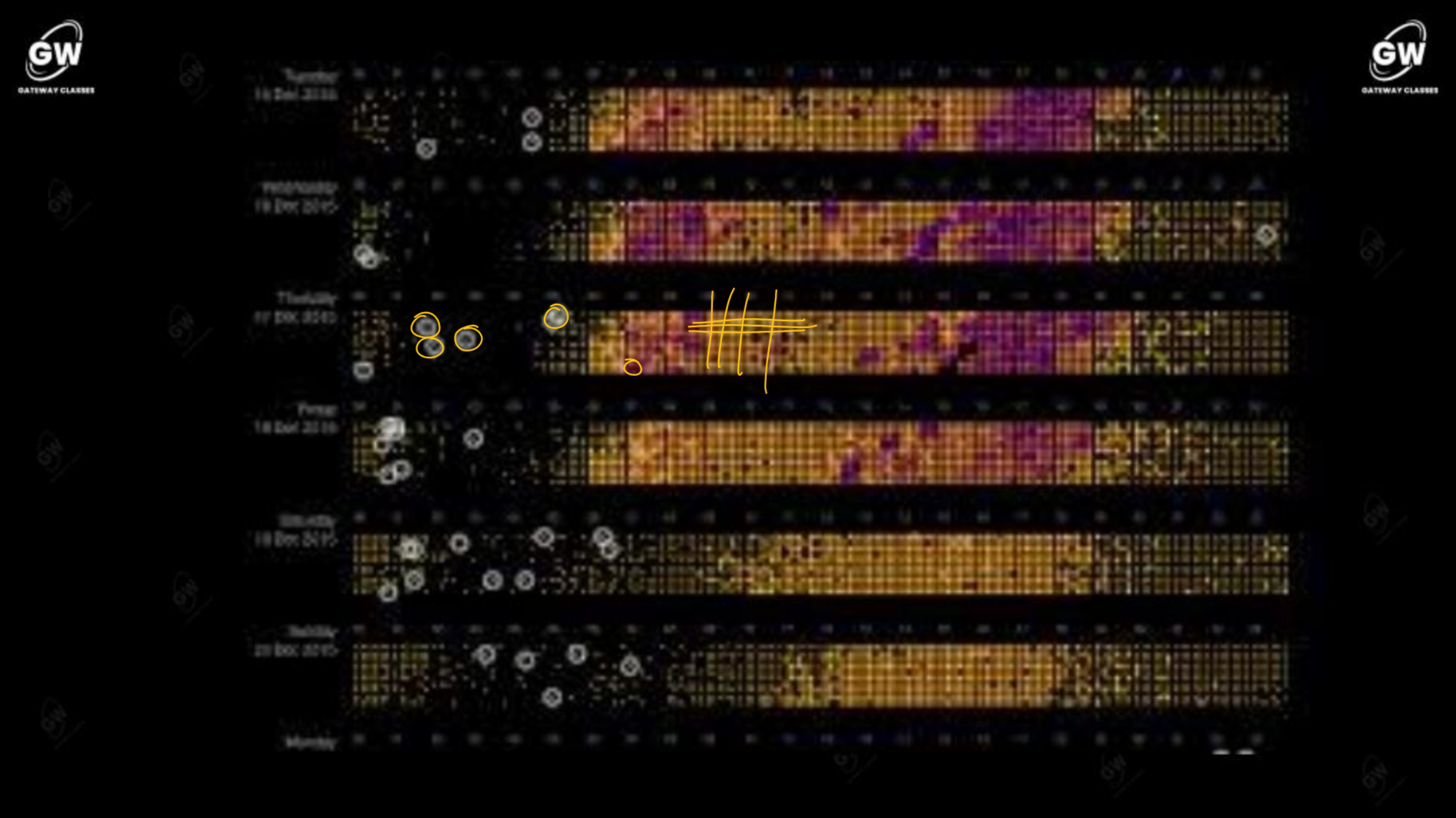


Pixel-oriented displays

- In dot matrix displays, individual pixels are located at the intersections of the matrix's "row" and "column" lines and each pixel can be individually controlled.
- For a typical 1024×768 (XGA) computer screen, 2,359,296 wires would be needed for non-multiplexed control. That many wires would be completely impractical.



- By arranging the pixels into a multiplexed matrix, only 1792 wires are needed.
- Pixel-oriented displays may drive a single pixel at a time or an entire row or column of pixels simultaneously.
- Active-matrix LCD provide a storage element at each pixel so that the pixel continues to display the correct state even when not being actively driven.



Break up

- Because most multiplexed displays do not present the entire display simultaneously, they are subject to "break up" if :

➢ the observer's point of regard is in motion.

➢ People with nystagmus (involuntary eye movement) are much more likely to experience the effect.

➢ provoked by chewing hard candy which causes vibration of the user's eyes.

➢ The multiplexed nature of a display can also be revealed by observing it through a mechanical stroboscope.



Display driver

- A **display driver** is usually a semiconductor integrated circuit
- provides an interface function between a microprocessor or a microcontroller or general-purpose peripheral interface and a particular type of display device, e.g. LCD, LED, CRT, ETC.
- accept commands and data using serial or parallel interface and generate signals with suitable voltage, current, timing and demultiplexing to make the display show the desired text or image.
- The display driver may itself be an application-specific microcontroller and may incorporate RAM, Flash memeory, EEPROM, ROM
- Example of a display driver IC is the Hitachi HD44780 LCD controller, KS0108, SSD1815 and ST7920 .

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