

Explain the operating principle of a common anode and common cathode 7-segment display and provide its truth table.

In Common cathode seven-segment displays, all the cathode connections of led segments are connected together to logic 0 or ground. whereas all the anode connections together of the led segments are connected together to logic 1 in a common anode seven-segment display.

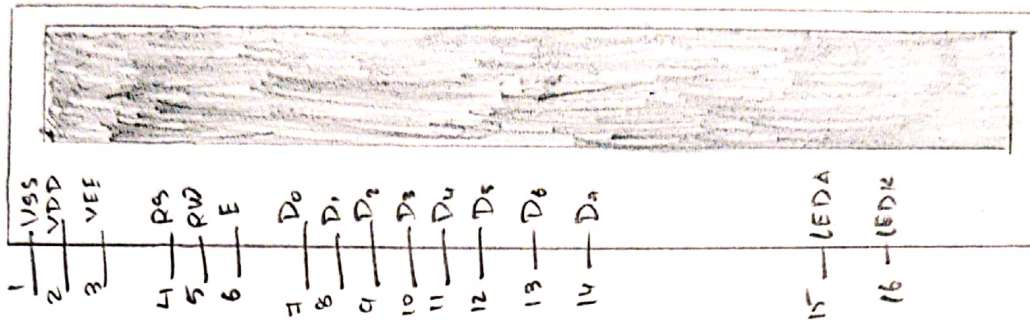
Decimal Digit	Individual Segments illuminated						
	a	b	c	d	e	f	g
0	1	1	1	1	1	1	0
1	0	1	1	0	0	0	0
2	1	1	0	1	1	0	1
3	1	1	1	1	0	0	1
4	0	1	1	0	0	1	1
5	1	0	1	1	0	1	1
6	1	0	1	1	1	1	1
7	1	1	1	0	0	0	0
8	1	1	1	1	1	1	1
9	1	1	1	1	0	1	1

2) Compare the key hardware capabilities of the ESP32 and Arduino highlighting their main features.

feature	ESP32	Arduino
Microcontroller	ESP32 (developed by espressif system)	various microcontrollers from different manufacturers used in Arduino board.
wireless capabilities	Built in wifi (802.11 b/g/n) and bluetooth	Typically, no built in wireless capabilities
Programming environment	Arduino IDE, platform IO, Espressif IDE	Arduino IDE
Connectivity	Ideal for IoT app. and projects requiring wireless communication	Basic connectivity, many required additional shield modules for advanced features.
use cases	IoT projects, home automation, industrial automation	Educational purposes, prototyping, hobbyist, projects.
Microcontroller variants	Storage family of microcontroller (ESP32)	Various microcontrollers are used in different arduino boards.



③ Draw the pin structure of a 16x2 LCD and describe each pin using a table.



Pin 1  $\rightarrow$  Ground pin of LCD

Pin 2  $\rightarrow$  Power supply voltage of LCD

Pin 3  $\rightarrow$  Adjust the contrast of LCD.

Pin 4  $\rightarrow$  Toggles b/w command / Data register.

Pin 5  $\rightarrow$  Toggle the LCD b/w Read / Write operation.

Pin 6  $\rightarrow$  must be hold high to perform Read / write operation.

Pin 7-14  $\rightarrow$  Pin used to send command (or) data to LCD.

Pin 15  $\rightarrow$  Normal LED like operation to illuminate the LCD.

Pin 16  $\rightarrow$  Normal LED like operation to illuminate the LCD connected with GND.