

WELCOME TO Adda247

*"If you can think, you can
Achieve"
So start thinking..*

*Renu Raj Garg
M.Tech (VLSI Design)
13 Year of Teaching
Experience
Worked 10 Year in NTRO*

GATE 2024



प्रवास Batch

COMMUNICATION

QUANTIZER IN PCM

TIME- 9:00PM

RENU SIR



Chapter-2

Digital Communications

In today's lecture we will cover the following Topics :

1. **QUANTIZER in PCM**



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AIR 64 CE UTKARSH MISHRA	AIR 71 EE SONESH SANJAY PAKAR	AIR 76 CE BIPANKAR DAS	AIR 87 EC SURAJIT RABI DAS	AIR 91 EE RISHABH GUPTA	AIR 111 ES ANIL GUPTA
AIR 130 EE SAURAV PATEL	AIR 136 CE RUPESH SACHDEVA	AIR 200 ECE WASIUZZAMA	AIR 212 IN WASIUZZAMA	AIR 217 ME VISHAL KUMAR	AIR 219 ME NITISH KUMAR
AIR 258 EE MANAV	AIR 348 EE AMAN NAMDEV	AIR 392 EE GAURAV MAHAJAN	AIR 403 EC MOHAN KUMAR SINGH	AIR 567 EE SHANKAR JHA	AIR 571 ME VLENDER MEENA



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BILINGUAL

PRACHAND BATCH FREE FOR ALL

ELECTRICAL,
ELECTRONICS COMMUNICATION ENGINEERING

GATE 2024 & ALL PSU's



Start Apr 11, 2023

7:30 AM to 11:30 PM

Code
free

You Tube Classes Schedule



EE & EC ENGINEERING

EXAM TARGET	SUBJECT	TIME	FACULTY
ALL PSUs	ENGINEERING MATHS	11:00 AM	ANANT SIR
GATE 2024-25	NETWORK THEORY	6:00 PM	RAVI SIR
GATE 2024-25	ELECTRICAL MACHINE	7:30 PM	SANTAN SIR
GATE 2024-25	COMMUNICATION	9:00 PM	RENU SIR

FREE APP CLASS SCHEDULE

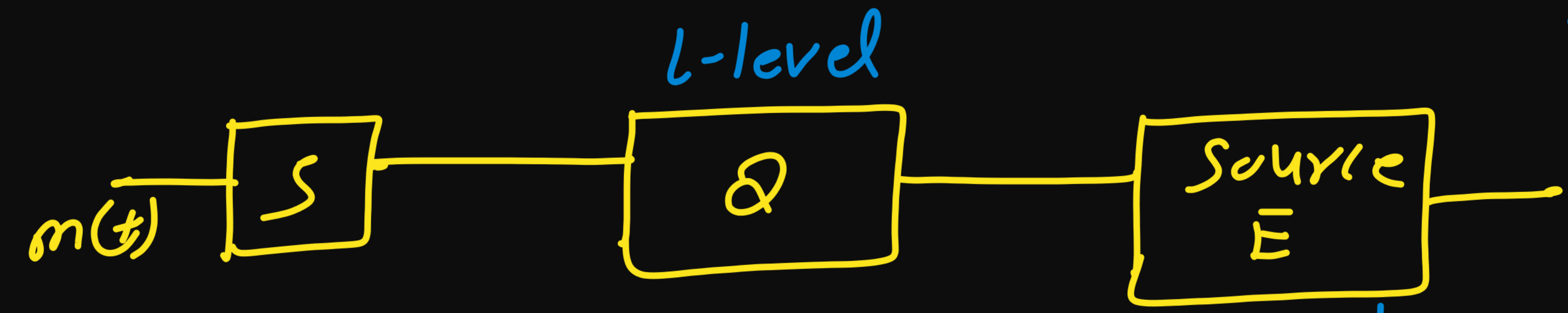


EE & ECE ENGINEERING



NETWORK THEORY	SATURDAY Live @11AM	RAVI SIR
COMMUNICATION	WEDNESDAY Live @8PM	RENU SIR
ANALOG ELECTRONICS	THURSDAY Live @8PM	LAWRENCE SIR
ENGINEERING MATHEMATICS	FRIDAY Live @11AM	ANANT SIR
ELECTRICAL MACHINE	MONDAY Live @8PM	SANTAN SIR

* Quantizer in PCM

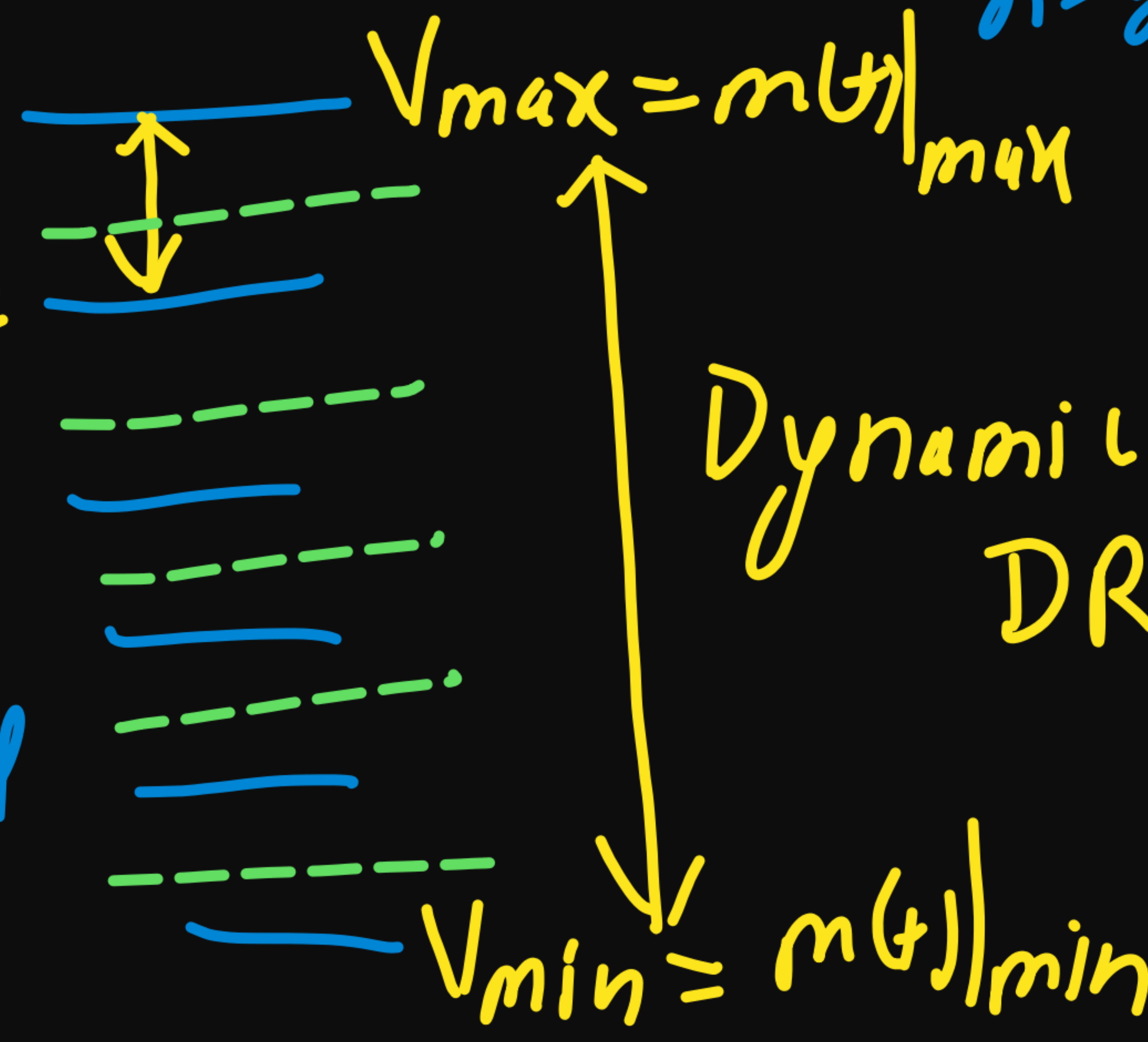


$$\frac{2^n}{2} < L \leq 2^n$$

$$\boxed{2 < L \leq 2^n}$$

$$\boxed{L \leq 2^n}$$

$\delta = \Delta = \text{step size}$



h-bit \rightarrow 9-level, 10-level
 16-level

- 1-bit \rightarrow 2 level, 2 level
- 2-bit \rightarrow 3 level, 4 level
- 3-bit \rightarrow 5 level, 6 level, 7 level, 8-level

$$V_{min} = m(t)|_{min}$$

$$\Delta = \frac{DR}{L} = \frac{V_{max} - V_{min}}{L} \leftarrow \text{Uniform quantizer}$$

$$Q_{c/max} = \pm \Delta/2$$

$Q_c = \text{Actual value} - \text{quantised value}$

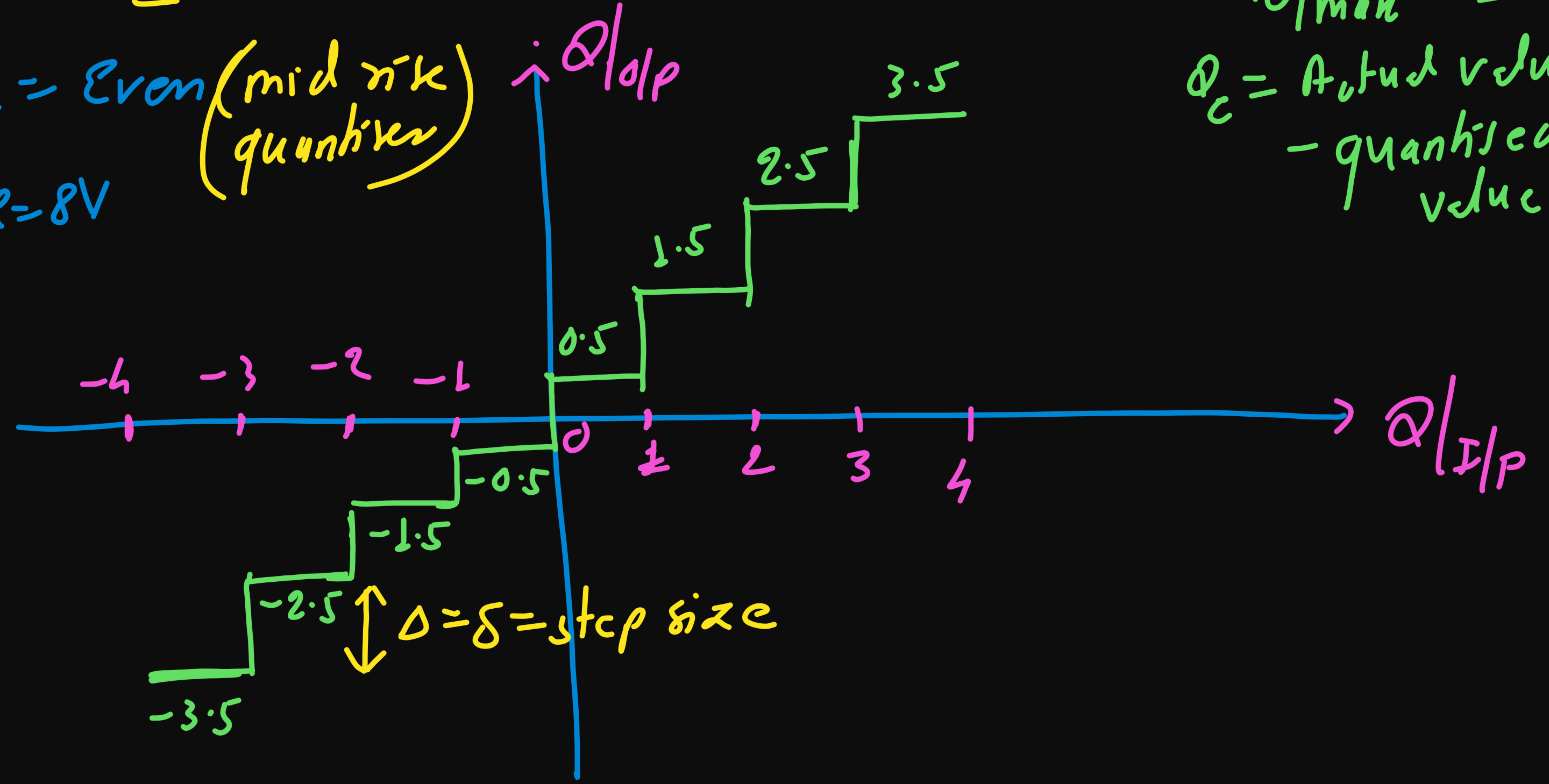
Case (i)

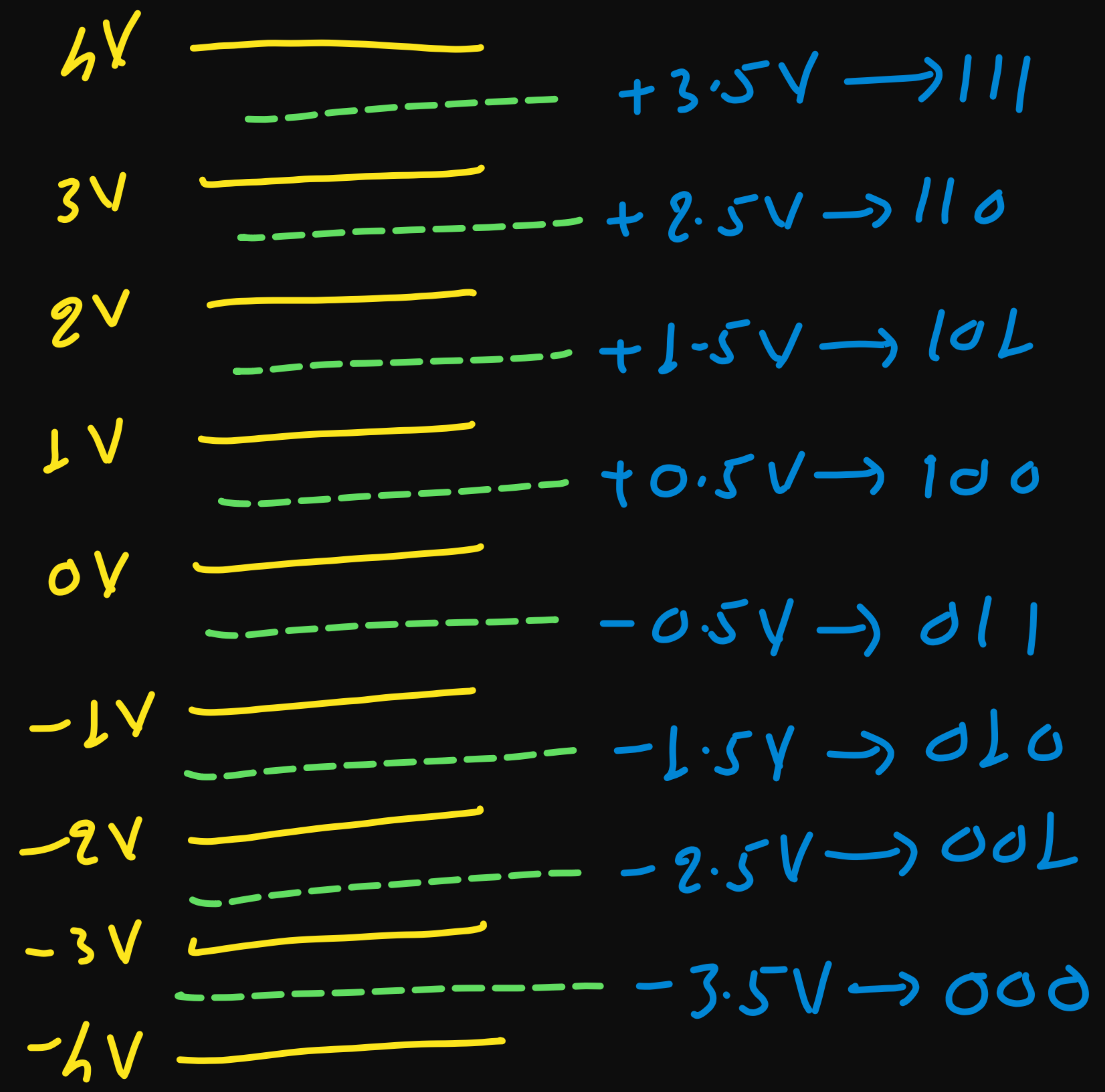
$L = \text{Even}$ (mid rise quantizer)

$V_{max} = +4V$
 $V_{min} = -4V$
 $DR = 8V$

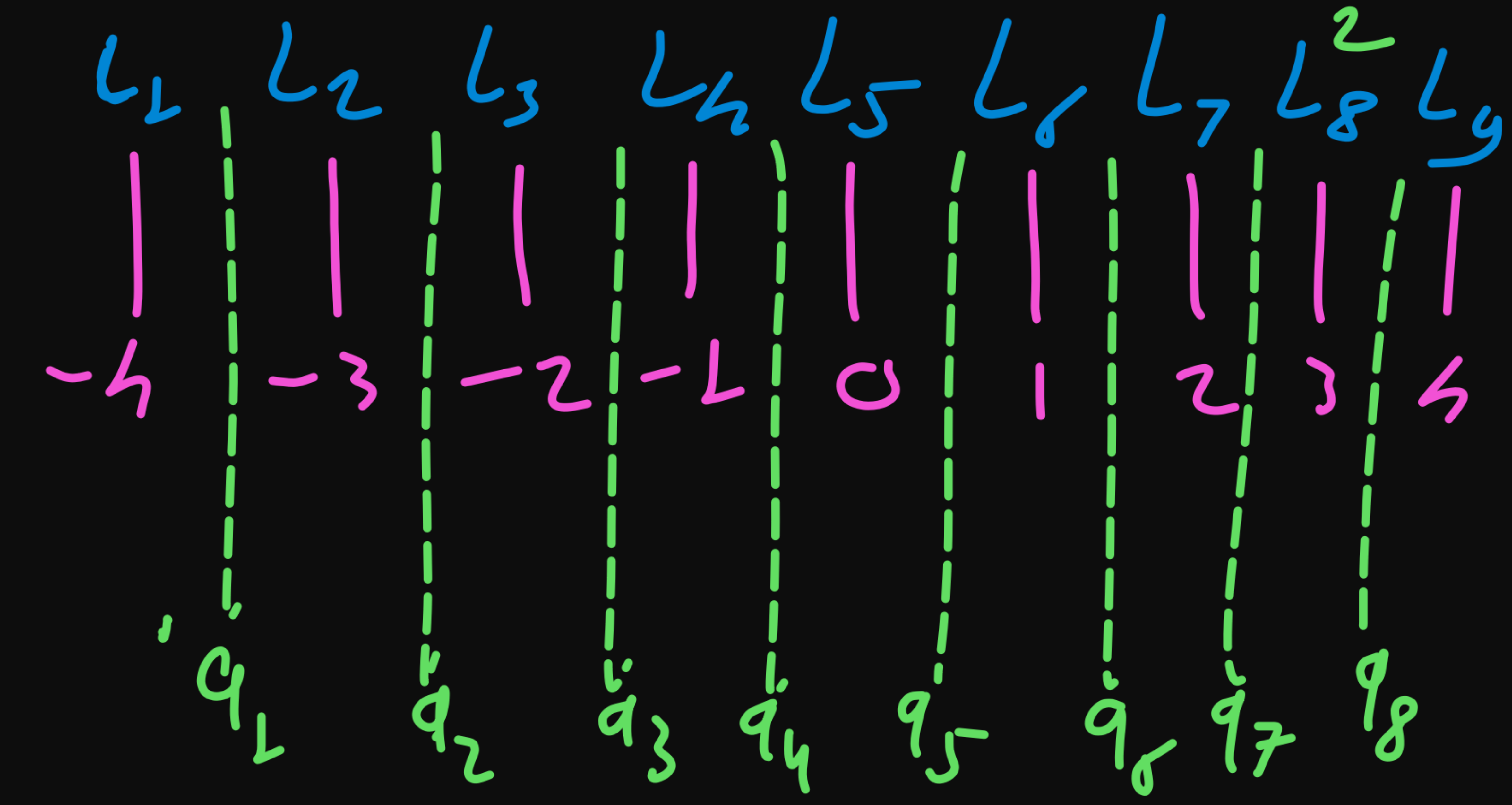
$L = 8 \text{ level}$

$\Delta = \frac{DR}{L} = 1 \text{ Volt}$





$$q_1 = \frac{L_1 + L_2}{2}, \quad L_1 = q_1 - \frac{\Delta}{2}, \quad L_2 = \frac{q_1 + \Delta}{2} = \frac{q_1 + q_2}{2}$$



Case (ii) when $L = \text{odd}$ (mid tread quantiser)

$$V_{\max} = +3.5 \text{ V}$$

$$V_{\min} = -3.5 \text{ V}$$

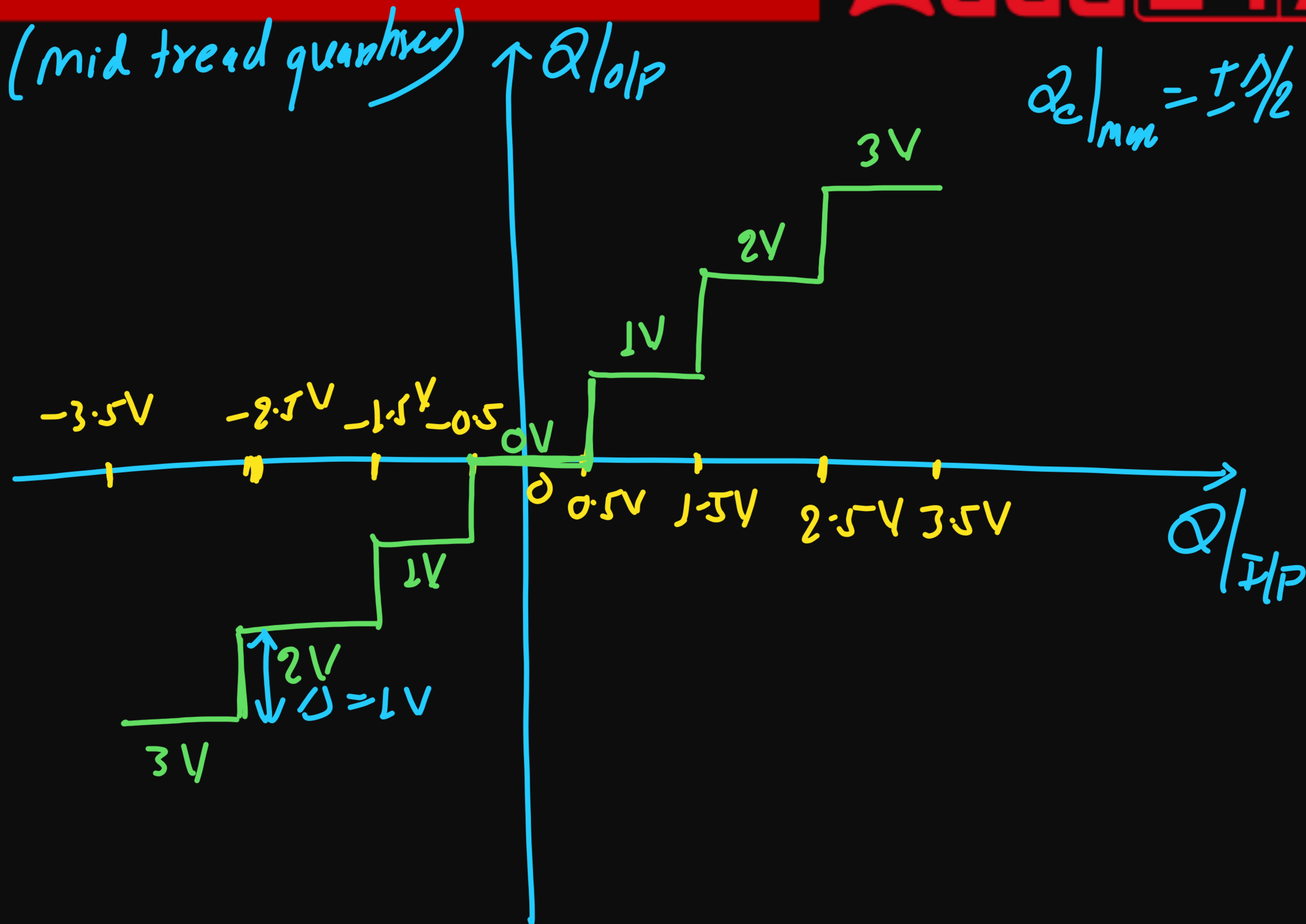
$$L = 7\text{-level}$$

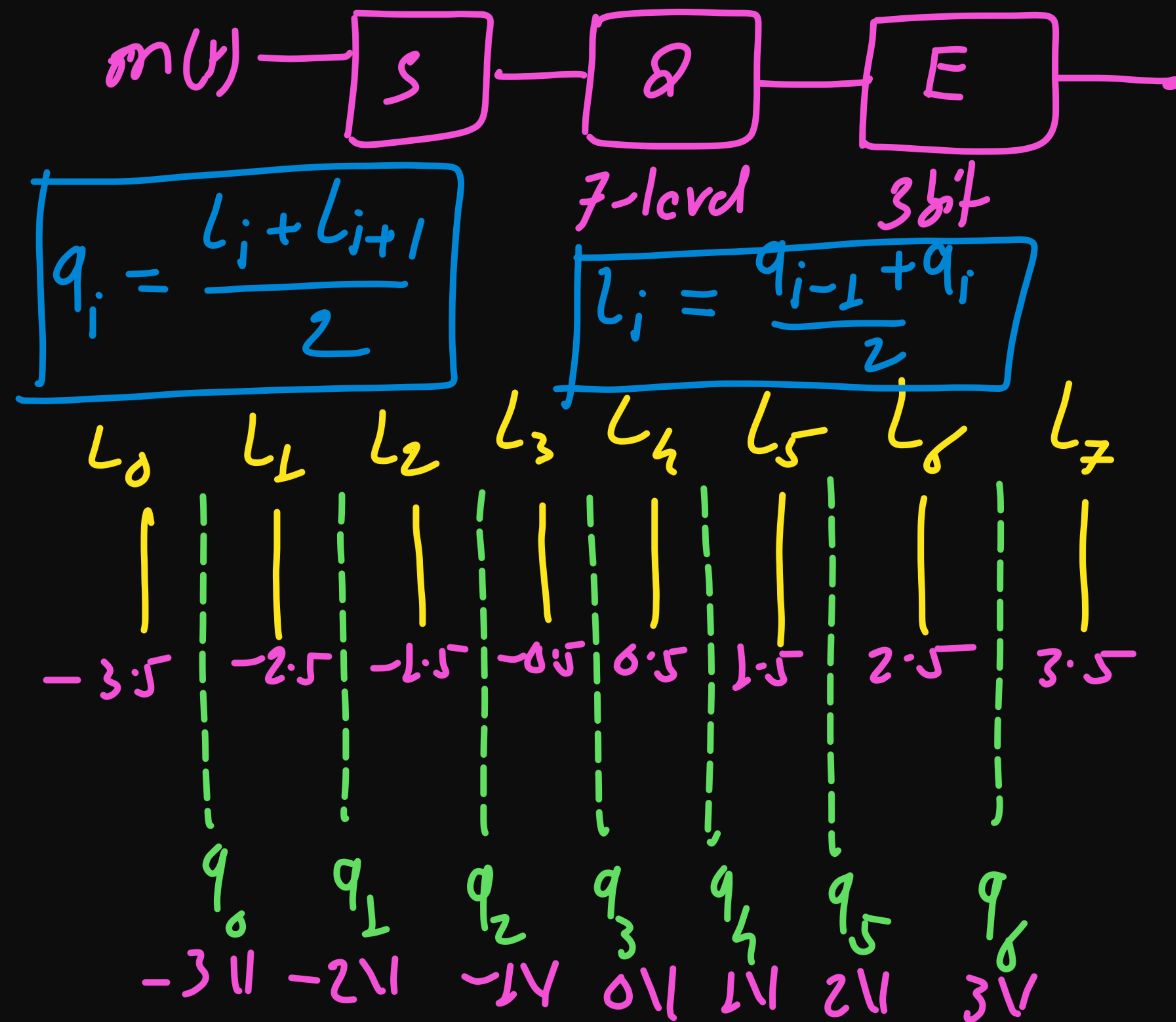
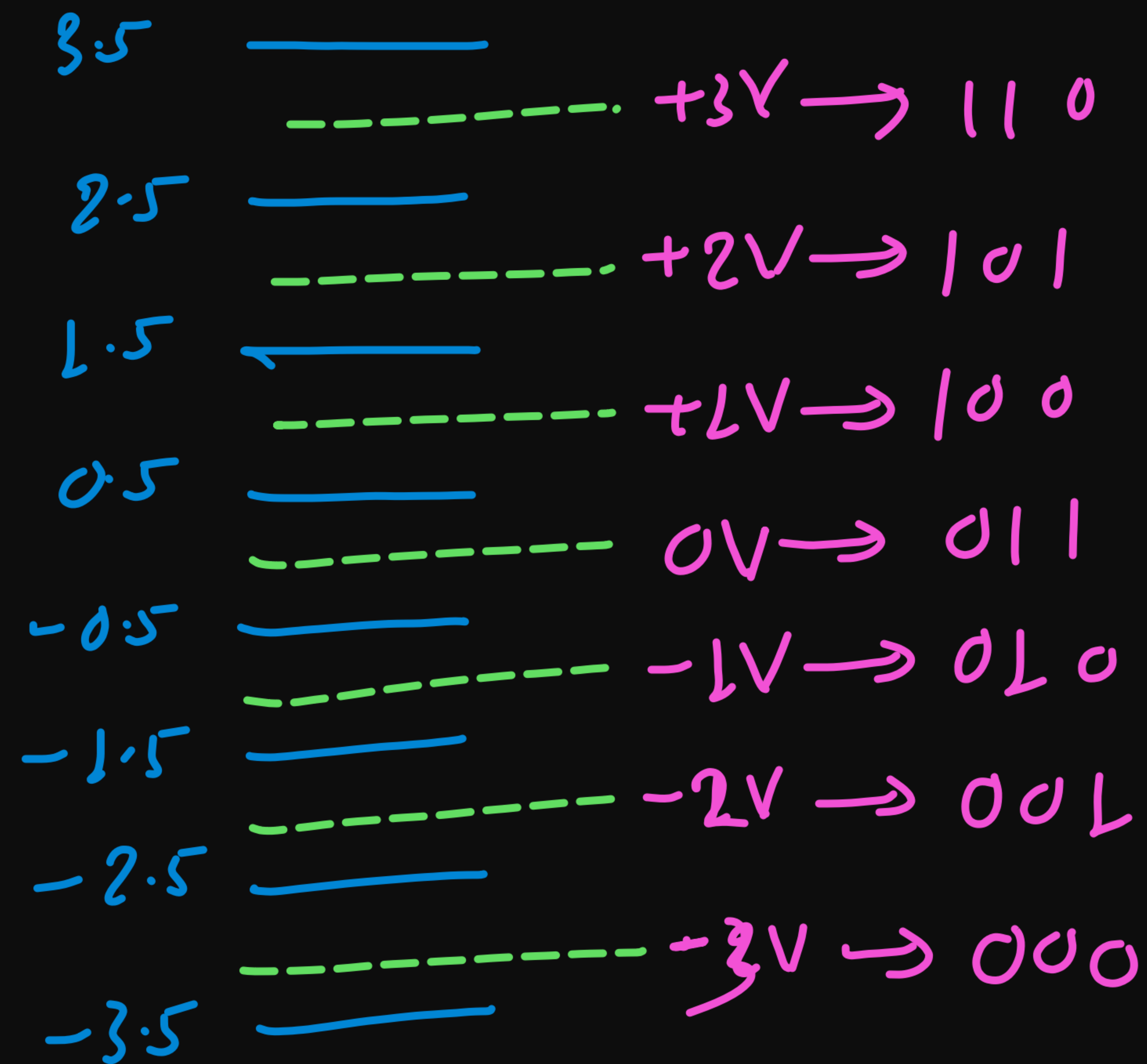
$$n = 3 \text{ bit}$$

$$DR = 7 \text{ Volt}$$

$$\Delta = \frac{DR}{L} = 1 \text{ Volt}$$

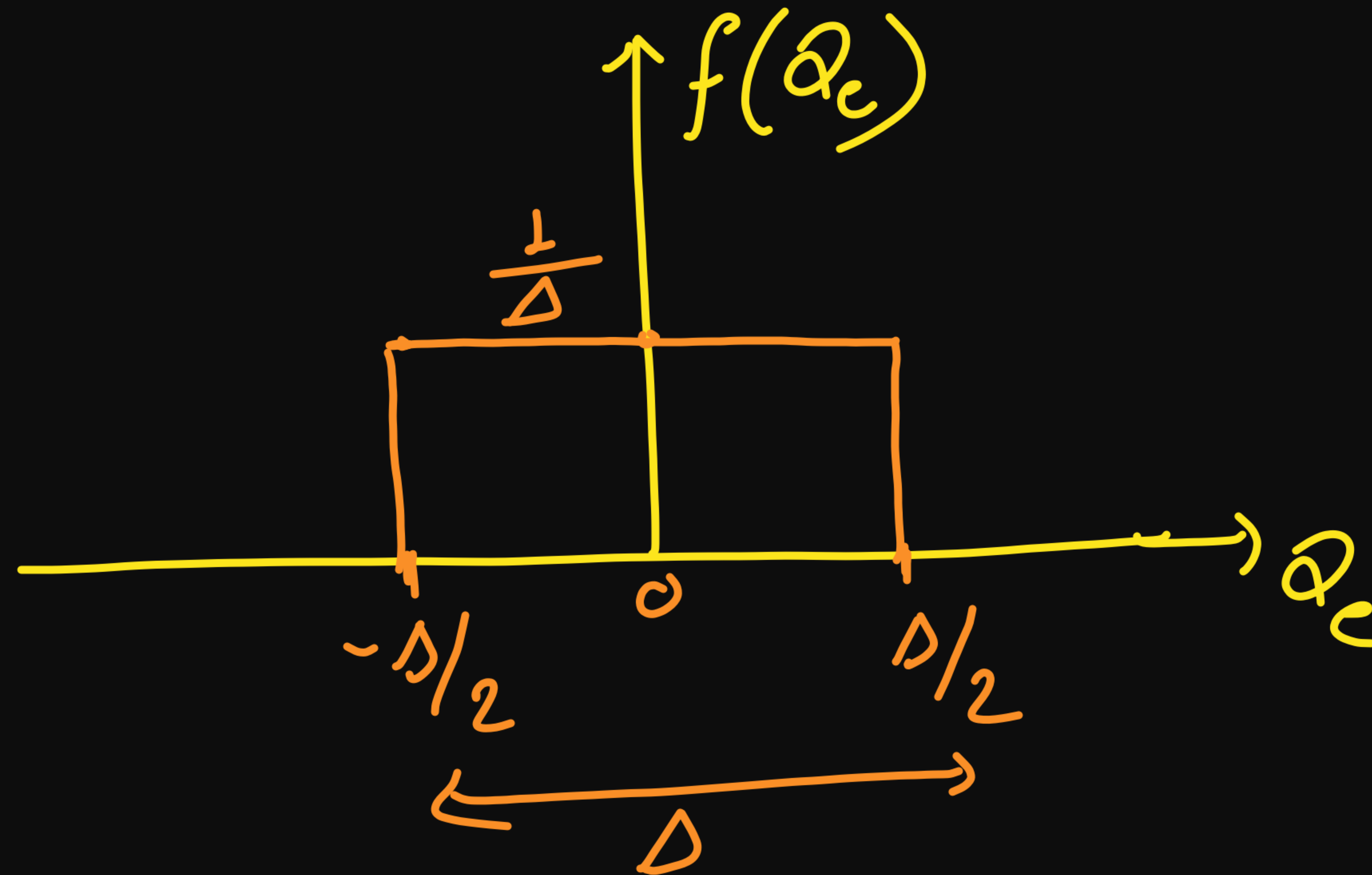
$$Q_c|_{\max} = \pm \Delta/2$$





Probability density fn. of Quantisation Error (Q_e) \rightarrow Uniform quantizer

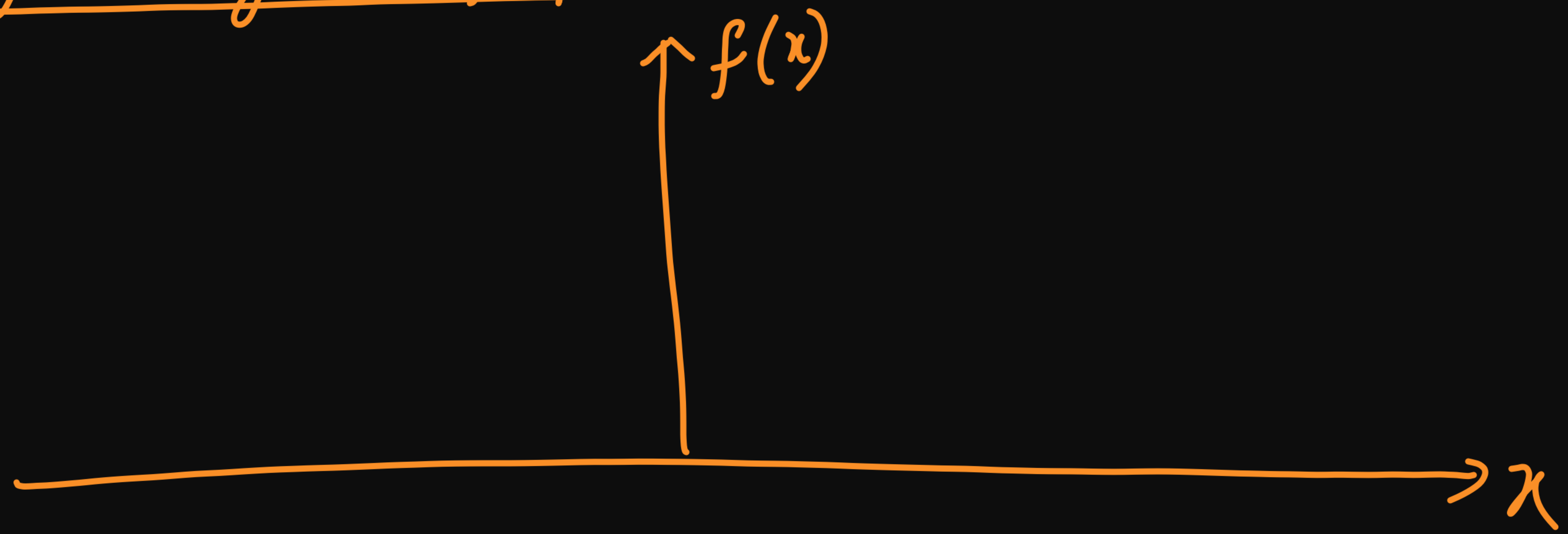
$$Q_{e|max} = \pm \Delta/2$$



$$f(x) = \text{PDF}$$
$$F(x) = \text{CDF}$$

$$\int_{-\infty}^{\infty} f(x) dx = 1$$

Probability density fn. of quanta:





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