NO Date 04/02/2026

Understanding Errors

① Syntax error → shell → check formatting

② Indentation error → spacing error → check formatting

③ Import error → spelling errors → no module named as 'xyz'

④ Attribute error → caps / case sensitive

- time does not come under machine //
- attributes that come under machine ?

- Debugging the Circuit

↳ checking polarity
↳ connections

⑤ Logic error → (print) → use command

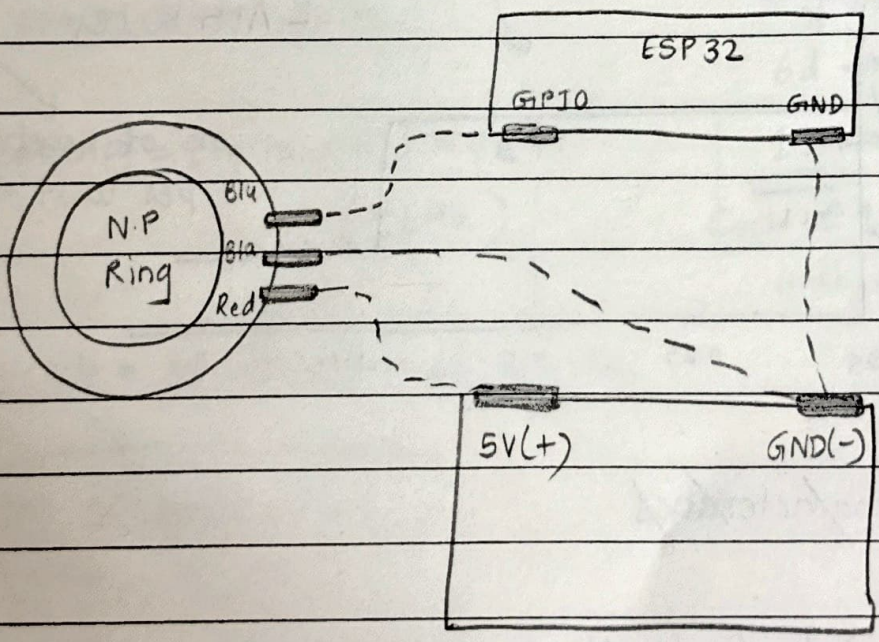
⑥ Name error → name ~~is~~ should be identified

NO Date . .

Random Number Generation

```
import random
r_odt = random.randint(10, 100)
x print("r_odt") → remove the quotations
↳ print(r_odt) ✓
```

Neopixel:



- while = conditional
- for = iterative statement

```
for name in range(0,5)
    print("name")
```

Third variable = increment variable

NO Date . .

to measure the voltage across the LED

↳ voltage w.r.t time

① 0.5 & 0.5 ⟶ equal delay equal light

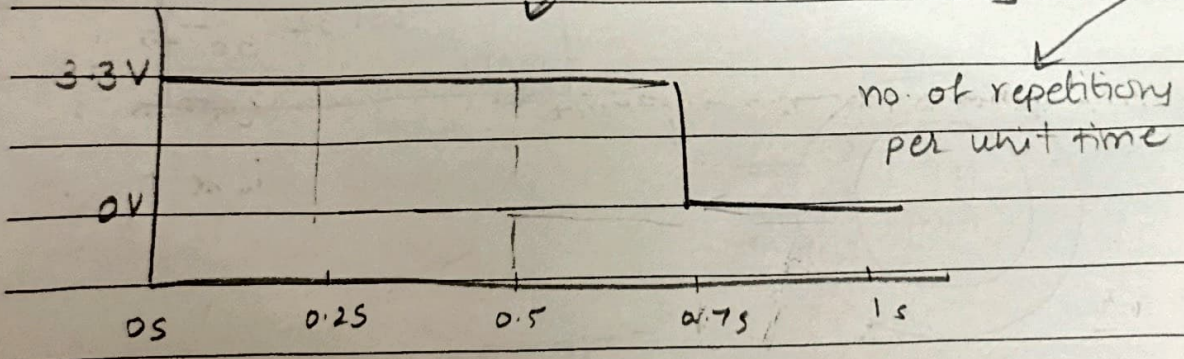
② 0.25 & 0.75 ⟶ more delay less light

③ 0.75 & 0.25 ⟶ less delay more light

⇒ Pulse width modulation

PWM

- Duty Cycle
- Frequency
- Attributes



~~2 characteristics~~

$$\text{Duty Cycle \%} = \frac{\text{On time}}{\text{On time + Off time}} \times 100$$

$$= \frac{0.25}{1} = 0.25 \times 100$$

$$= 25\%$$

NO Date . .

Duty cycle	Value
100%	1023
75%	768
50%	512
25%	256
0%	0

frequency → energy conservation
→ power transmission

~~6d~~

6d → 3

frequency = constant = 1500 Hz
(1 kHz)

1s → ? 1 Hz

Cycle of 1s then unit becomes Hertz

duty cycle = adjust brightness with this

PWM ∝ brightness

V_{out} = Duty Cycle * V_{max}

NO Date . .

IR Obstacle Detection Sensor

ESP32	Sensor
3.3V	Vcc
GND	GND
GPIO 13/14/25	Out

Concept

Push button 1 → (press) → (0-16) → one colour

~~push button 2 → (press) → (16-0) → another colour~~

NeoPixel