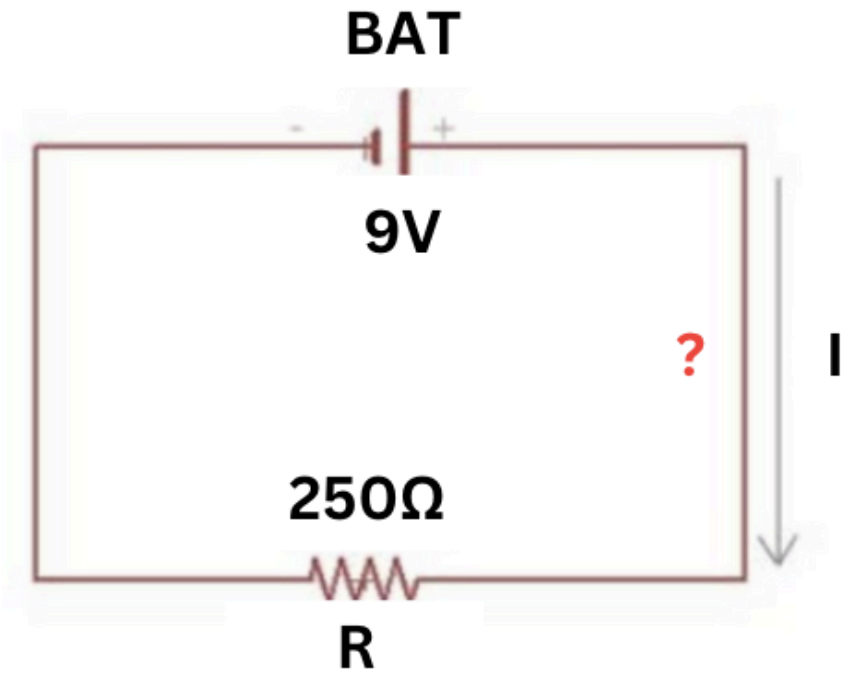
HCI Reverse Final Exam Questions

Multiple Choice

What is the current across "I"?



a) 25 mA
b) 30 mA
c) 32 mA
d) 36 mA

Answer D is correct. BAT is 9V and R is 250 ohms, so we calculate this answer by using Ohm's Law: V = I x R (which in this case switches to I = V/R)

I = 9V/250 Ohms

I = 0.036A

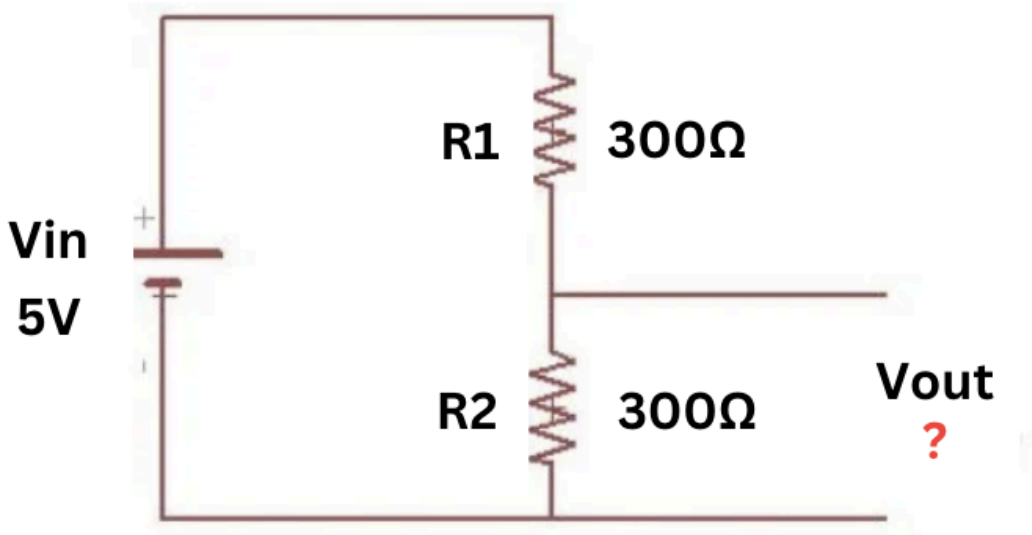
= 36mA (milliAmps)

Which of the following stores electrical energy within them, like a small battery?

a) Transistors
b) Amplifiers
c) Capacitors
d) Resonators

Answer C is correct. Capacitors are used to store electric charge when connected to a voltage source.

If Vin is 5V and R1 and R2 are both 300 ohms, how much is Vout?



a) 2.5 V
b) 3 V
c) 4 V
d) 6.25 V

Answer A is correct. If R1 = R2, Vout = Vin / 2. Therefore, 5/2 is 2.5, so that is the value of Vout.

When thinking about our machine learning unit, what is NOT correct about decision trees?

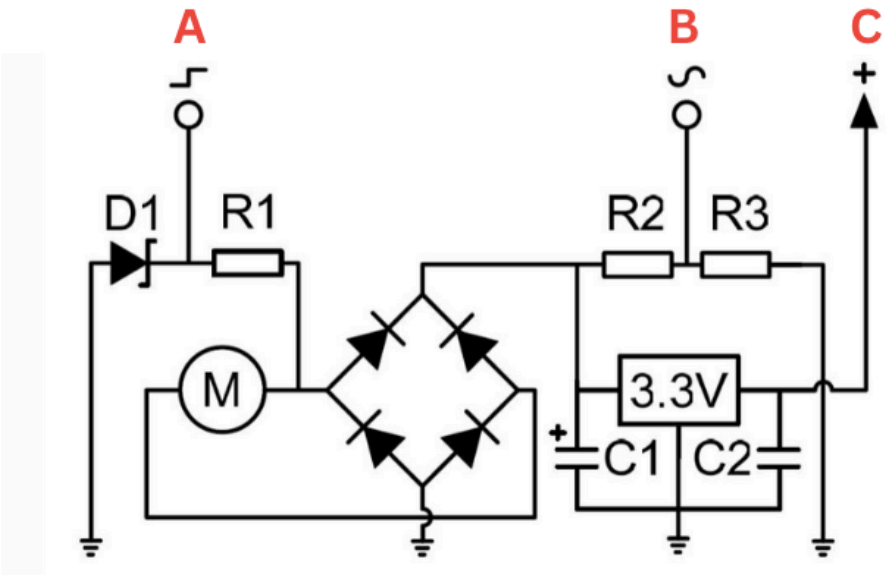
a) They split training data into two parts and recursively train on each part for the remaining tree
b) At each interior node, one feature is analyzed

c) They continue even when information gain is small or none
d) At each leaf, a classification is made

Answer C is correct. If gain is small or none, the decision tree stops in order to avoid overfitting.

Long Answer

This diagram shows a circuit model for a gadget being made in this class. Describe how the circuit works. Make sure to name A, B, and C and describe their functions.



In the diagram, A represents direction, B represents speed, and C represents power. In A, a reverse biased Zener diode (D1) combined with a resistor (R1) are controlling the positive voltage and making sure the current is limited. This produces digital values. In B, resistors (R2 and R3) are tuned in order to create a voltage divider. The resistors must have higher values (are strong) in order to prevent power loss. Their result is produced as an analog voltage. Finally, in C, the voltage regulator provides a clean output from the voltage retained from the full wave bridge, which only produces positive voltage.

To summarize, the power supply makes sure the gadget can be powered with a clean supply, and also that the power is steady and longlasting, also due to the strong current-limiting resistors. The use of parts A and B allow direction and speed to be controlled in the gadget being powered, for a more complex gadget.

Provided below is the Candle0 Code from the first day of class. Provide an overall summary of what the code does. To do this, analyze the lines of code by stating what each means/does (try to cover every part of the code). Also, based on the code, describe what materials from our class kit are needed.

Candle0.ino

```
1  /*------- Hardware configuration -------*/
2  const int  redPin   = 2;
3  const int  greenPin = 3;
4  const int  bluePin  = 4;
5  const byte debugPin = 13;
6
7  /*--------------------------------------------*/
8  void setup() {
9    pinMode(redPin, OUTPUT);
10   pinMode(greenPin, OUTPUT);
11   pinMode(bluePin, OUTPUT);
12   pinMode(debugPin, OUTPUT);
13 }
14
15 void loop() {
16
17     digitalWrite(debugPin,HIGH);
18
19     delay(250);
20
21     digitalWrite(debugPin,LOW);
22
23     digitalWrite(redPin,HIGH); delay(250); digitalWrite(redPin,LOW);
24     delay(500);
25     digitalWrite(greenPin,HIGH); delay(250); digitalWrite(greenPin,LOW); delay(250);
26     digitalWrite(greenPin,HIGH); delay(250); digitalWrite(greenPin,LOW);
27     delay(500);
28     digitalWrite(bluePin,HIGH); delay(250); digitalWrite(bluePin,LOW); delay(250);
29     digitalWrite(bluePin,HIGH); delay(250); digitalWrite(bluePin,LOW); delay(250);
30     digitalWrite(bluePin,HIGH); delay(250); digitalWrite(bluePin,LOW);
31
32     delay(500);
33 }
34
```

Candle Code 0 uses 3 different LEDs (red, green, and blue) and lights them in a specific order and pattern.

Lines 2-5 establish which pins are attached to which digital values of the Arduino Nano through the breadboard (pinout). redPin = 2, greenPin = 3, bluePin = 4, and debugPin = 13. Lines 8-13 set all the pins to Outputs, meaning the LEDs they are connected to will turn on and produce light. Line 15 creates the loop, which will make the code run repeatedly. In lines 17-21, the debugPin is being turned on for a quarter of a second and then off. This pattern is then followed by the red LED doing the same thing, then the green LED repeating the pattern twice, then the blue LED repeating it three times. There is a continuous quarter second pause between the on and off of each LED, to ensure that the light of the LEDs can be seen. The code keeps on running, repeating this sequence over and over until the code is stopped or unplugged from the Nano.

To correctly execute this code physically, we need a breadboard, Arduino Nano, three LEDs, and three resistors.