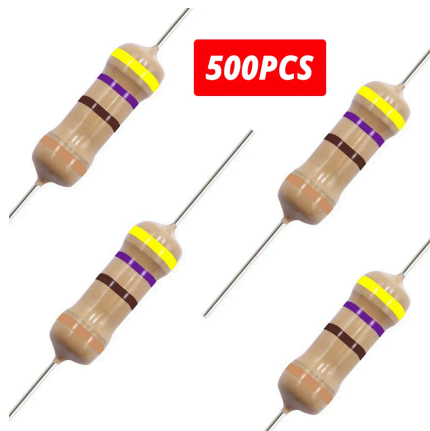


Multiple Choice

1. What is the power in Ohms for the following resistor (see image below):

- a. 340
- b. 470
- c. 120
- d. 10k



Answer: B (470 Ohm Resistor) based on the following diagram below

www.resistorguide.com

	Color	Significant figures	Multiply	Tolerance (%)	Temp. Coeff. (ppm/K)	Fail Rate (%)
Bad	black	0 0 0	x 1		250 (U)	
Beer	brown	1 1 1	x 10	1 (F)	100 (S)	1
Rots	red	2 2 2	x 100	2 (G)	50 (R)	0.1
Our	orange	3 3 3	x 1K		15 (P)	0.01
Young	yellow	4 4 4	x 10K		25 (Q)	0.001
Guts	green	5 5 5	x 100K	0.5 (D)	20 (Z)	
But	blue	6 6 6	x 1M	0.25 (C)	10 (Z)	
Vodka	violet	7 7 7	x 10M	0.1 (B)	5 (M)	
Goes	grey	8 8 8	x 100M	0.05 (A)	1(K)	
Well	white	9 9 9	x 1G			
Get	gold		x 0.1	5 (J)		
Some	silver		x 0.01	10 (K)		
Now!	none			20 (M)		

6 band		3.21kΩ 1% 50ppm/K
5 band		521Ω 1%
4 band		82kΩ 5%
3 band		330Ω 20%

gap between band 3 and 4 indicates reading direction

2. Based on the study of home sensor deployment and acceptance, what was a key obstacle that was an unintentional finding of the study? (Note: All of the following statistics are correct)

- e. 13% of participants were unable to install any sensor
- f. 75% of sensors were installed correctly

- g. Image and sound sensors were the most refused to install by participants
- h. The most successful sensor type for installation and placement was a current sensor

Answer: C because the study was intended to find the difference between sensors, accessibility, and the statistics around installation for each part. It was unintentionally found that participants refused to install image and sound sensors for reasons outside of hardware difficulty and ease of use (they refused out of fear of being seen/heard even though they knew the sensors were fake).

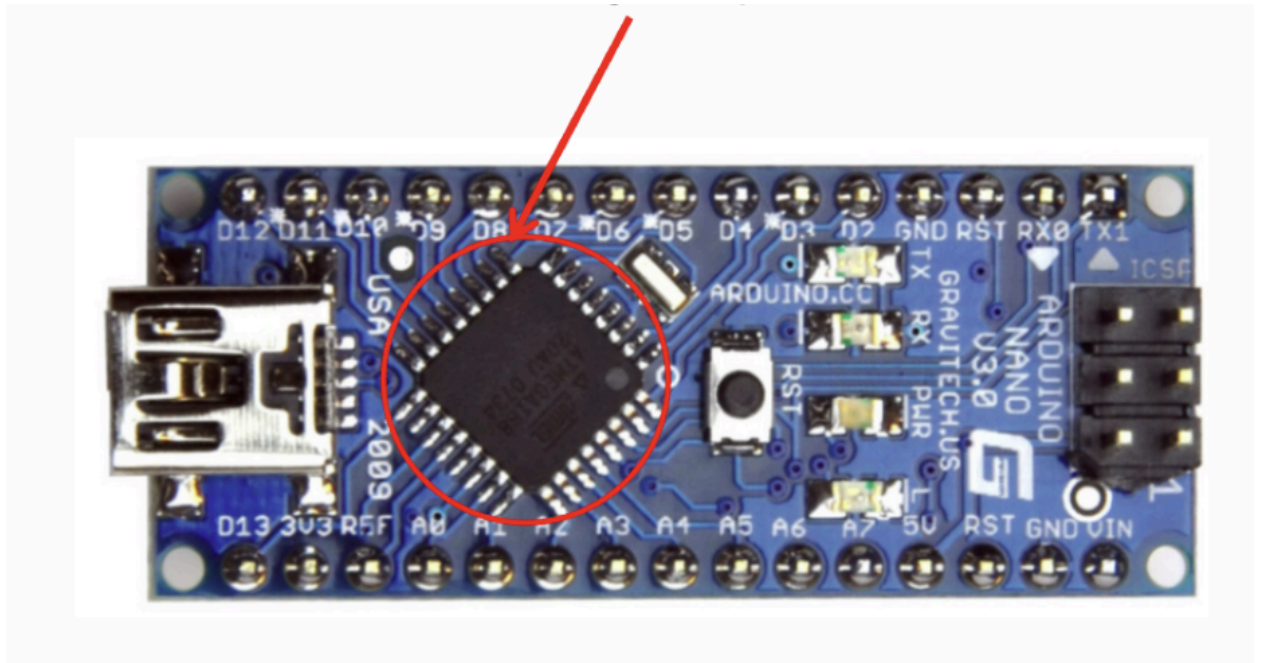
3. Do the two legs on an LED pin differ in use? If so, why?
- a. No, they do not differ in use, only in length of the legs for aesthetic purposes
 - b. No, they do not differ in use, only in length of the legs for ease of use in hardware applications
 - c. Yes, the short leg is the anode (positive) end, and the long leg is the cathode (negative) end
 - d. Yes, the short leg is the cathode (negative) end, and the long leg is the anode (positive) end

Answer: D, short leg- cathode (-), long leg- anode (+)

4. Which of the following will turn on a pin in row index 5, column index 1?
- a. `digitalWrite(columns[1], HIGH); digitalWrite(rows[5], LOW);`
 - b. `digitalWrite(columns[1], LOW); digitalWrite(rows[5], HIGH);`
 - c. `digitalWrite(columns[1], HIGH); digitalWrite(rows[5], HIGH);`
 - d. `digitalWrite(columns[1], LOW); digitalWrite(rows[5], LOW);`

Answer: A- `digitalWrite(columns[1], HIGH); digitalWrite(rows[5], LOW);` column must be on high and row on low for an LED to turn "on"

5. In the following diagram, what is the black chip in the center of the Arduino Nano? Hint: Often gets fried



- a. 16 MHz Resonator
- b. ATmega328 MicroController
- c. 12V Voltage Regulator
- d. 0.1uF Capacitor

Answer: B- ATmega328 MicroController

Long Question 1:

Explain how to use a multimeter and where you should test for power of continuity on a breadboard. In what steps should you test this? Assume we are using an Arduino Nano connected to a computer source for power

Answer: First, since we are using a computer-connected Arduino Nano, we will turn on the multimeter and select a voltage higher than the 5 volts from the nano on the "V" for voltage setting. Then, turn the multimeter dial to the Continuity mode. Connect the black probe (COM) to the red (positive) probe. Ensure that it beeps to show continuity before placing it on the breadboard. Place the black probe to ground and the red probe to the 5v output or power rail. Confirm that there is a continuous beep ongoing as you have both probes on their respective points. At this point, you can connect the red probe to the 5v power supply and jump between wires to test continuity across your board. Here, you should confirm whether there is continuity and power supply by listening for a beep from the multimeter. From here, you can switch it to Resistance/Ohm mode to test the power supply (and amount) at points on the board. With this setting, place both black and red probes on either end of a wire or interaction zone on the breadboard to measure the resistance.

Long Question 2:

Explain the steps in which you would set up a four-pin LED pin on a breadboard using an arduino nano. What is one area which would cause a short circuit and why?

Answer: First, you would set up your arduino nano in the middle of your breadboard, ensuring that both sets of pins on either side are sitting entirely in the breadboard. Collect your parts, including the four-pin LED, resistor, and jumper wires. Next, place the end of one jumper wire into a pin slot right next to the bottom left ground pin in the arduino. Connect this arduino ground pin to the left across the empty pin slots, to the negative power rail. Next, follow the same process with another jumper wire, connecting this to the 5v power supply from the Arduino nano (taking power from your connected computer) between an empty slot next to the 5v pin and across to the left to the red, positive power rail. Take three 470 Ohm resistors, colored by (in order) yellow, violet, and brown. Following the same procedure, connect one end of each of these three resistors to empty digital pins along the arduino nano perimeter; for example, I might connect my resistors to D3, D4, and D5. next, place the other end of the resistor into an empty row, ensuring that the wires between resistors are not touching and that each row only has one item in it (the one end of the resistor). These three digital pin outputs will be for the R, G, and B levels in the four-pin LED. The long leg on the LED is the cathode (negative). Find this on the four-pin LED and separate this from the other three legs. Connect each of these three shorter legs into the rows on your breadboard, aligning each leg with a row that has the end of a resistor. Now, each of these three rows should have one end of a resistor and one leg of the LED. Once your three legs are connected,

place the fourth, long, cathode pin into the ground (negative) power rail. Now, you can run a code with a four-pin LED. One space that could short circuit is placing the 5v and ground pins from the arduino accidentally into the same power rail. Another is having the wires of the resistors touch.