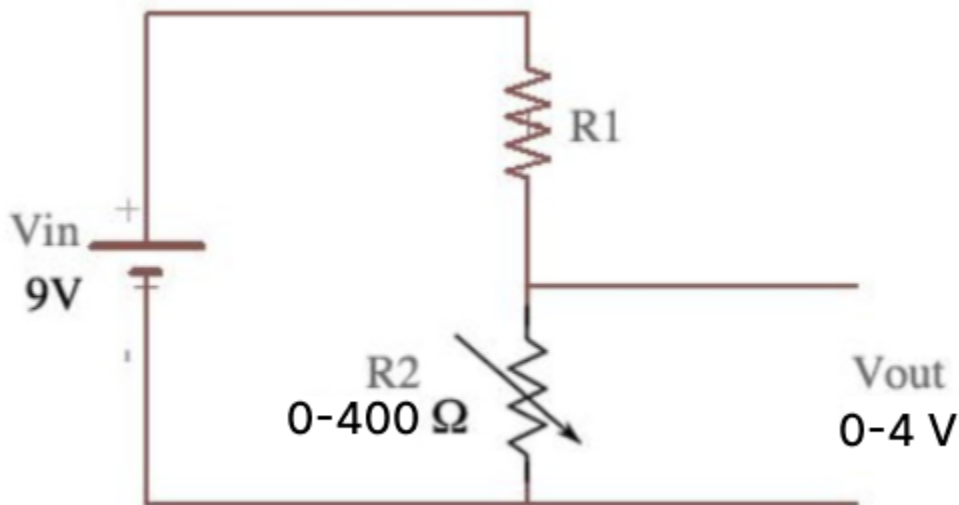


Gadgets Final Exam

Multiple Choice

- 1) You have a circuit like the diagram depicted below with a resistance sensor at R2 that ranges from 0-400 Ohms. You would like your Vout to be between 0 and 4 Volts. What value should you choose for R1?



- A) 1300 Ohms
- B) 1300 Ohms
- C) 850 Ohms
- D) 800 Ohms
- E) 500 Ohms

Solution: E) 500 Ohms.

$$4 = 9 * (400/(x+400))$$

$$(x + 400)(4/9) = 400$$

$$(4/9)x + (4/9)400 = 400$$

$$x = 500$$

- 2) Which of these statements is false?
- a) A THT component goes through the holes of a PCB
 - b) A SMT component stays on the surface of a PCB
 - c) Different traces can cross each other as long as they are on the same side of the PCB

d) Via helps avoid traces from contacting each other

- A) a, b, and c
- B) b and c
- C) Only c
- D) Only d
- E) None of the above

Solution: C) Only c.

THT means through hole component, which goes through the holes of a PCB, making a) true. SMT stands for surface mount component which is a component that stays on the surface of a PCB, making b) true. Different traces (that are meant for different purposes) should not touch each other no matter what side they are on since they will interfere with each other due to a lack of protection.

- 3) Which are true statements about analog and digital pins?
- a) An analog pin only outputs 0 or 1
 - b) A digital pin only outputs 0 or 1
 - c) An analog pin outputs 1 using a logic high minimum value that creates a range of values that are considered 1
 - d) The region between logical high minimum and logic low maximum is undefined

- A) a, c, and d
- B) a and c
- C) b and d
- D) Only b
- E) None of the above

Solution: C) b and d

A digital pin only outputs 0 or 1 while an analog pin outputs a range of values. A digital pin outputs 1 using a logic high minimum value that creates a range of values that are considered 1, and the region between logic high minimum and logic low maximum is undefined.

- 4) What are the steps of machine learning?

- A) Training and prediction

- B) Instructing, filtering, and estimation
- C) Coaching and recognition
- D) Teaching, refining, and classification
- E) None of the above

Solution: A) training and prediction

There are two steps of machine learning as defined in the class lecture slides: training and prediction. The first step, training, involves teaching the model various things and the second step, prediction, is using the model to predict output learned from training.

- 5) Jess is trying to use resistors in either a series or parallel configuration, but he is unsure of which to do. He has four resistors: 220Ω, 470Ω, 750Ω, and 10KΩ. He wants to use **only three** of these to create a total resistance of 281Ω (with rounding). Which resistors and what configuration should he use?

- A) Series, 220Ω, 470Ω, 750Ω
- B) Parallel, 220Ω, 470Ω, 750Ω
- C) Series, 220Ω, 750Ω, 10KΩ
- D) Parallel, 470Ω, 750Ω, 10KΩ
- E) None of the above

Solution: D) Parallel, 470Ω, 750Ω, 10KΩ

Using the parallel resistance equation $(1/R_{\text{total}}) = (1/R_1) + (1/R_2) + (1/R_3)$ and the resistance values, we get 280.82 for R_{total} , which rounds to 281. No other combination results in this resistance.

Long Answer

- 1) Explain 2 of Weiser's thoughts on the future of computing and relate it to what you have learned about computing through this class.

Sample Answer:

In this class, we've learned a lot about various sensors and gadgets which can help us do various tasks that integrate into our daily lives. From creating gadgets that automate mundane tasks to developing sensors capable of detecting emergency situations, there has been an emphasis on harnessing the power of Arduinos and computing to enhance

various aspects of our life. At the beginning of the semester, we learned how the capabilities of the Arduino Micro's computing power is similar to that of the computer that once propelled humans into space. The class focuses on utilizing low cost processors and how to utilize them during a time when computation is everywhere. This accessibility of computing power resonates strongly with Weiser's vision of the future, where computing becomes ubiquitous and ingrained in our daily routines. There is an abundance of machines and it is not inaccessible. Since now it is so cheap to have computers, this vision is more achievable and realistic.

Weiser's perspective on the future of computing aligns closely with the objective of this class, which is to focus on using technology to augment our physical daily lives rather than isolating it into the digital realm. One key concept from Weiser's paper emphasizes the importance of computers augmenting the physical world rather than replacing it, which contrasts with the concept of virtual reality. Similarly, our class emphasizes the transformation of the physical environment through the use of sensors and displays to enhance real-world interactions. Through another paper "Tangible bits: towards seamless interfaces between people, bits and atoms," we learned about how utilizing peripheral cues within the physical world is important since it allows us to stay know about digital statuses without requiring full attention. This showcases how principles of human computer interaction align with utilizing these sensors and gadgets to create a seamless bridge between people and the digital world.

- 2) Explain 2-3 methods using computing that have been employed to help the elderly and the benefits and drawbacks to each.

Sample Answer:

Two methods that utilize computing we discussed in class to aid the elderly in maintaining their well-being are digital family portraits and unobtrusive home activity recognition systems. Each approach has unique benefits and drawbacks.

The digital family portrait augments people's lives with an sensor data display, which serves as a subtle yet effective means of facilitating communication between elders and their caregivers. By integrating an informative display into a normal picture frame, it blends into the home environment, avoiding being intrusive. However, there is the concern regarding privacy of elders as elders may feel their privacy is compromised by constant monitoring. However, I think that this subtle method of reminding someone of their loved ones is a great method of ensuring that there is more communication and

connection which might lead to further action by the caregiver to check up on an elder's wellbeing.

The second concept, unobtrusive home activity recognition systems through water usage monitoring, offers a different approach to understanding elderly individuals' daily routines. By analyzing patterns in water consumption, caregivers can gain insights into the elder's activities and potentially detect changes from their normal behavior. This technology operates within the pipes of someone's home, minimizing the impact on daily life. However, its effectiveness in addressing emergency health issues is uncertain. While changes in water usage may indicate disruptions in routine, they may not reliably signal sudden health crises such as falls or strokes. Relying solely on activity monitoring may result in delayed responses to emergencies, putting the elder's well-being at risk.

Both methods demonstrate the potential of computing technologies to assist the elderly in maintaining their autonomy and well-being. However, they have some potential pitfalls regarding the balance of collecting data, which causes data privacy concerns, and providing useful information for caregivers.