Long answer:

1) Describe the basic function of capacitors, and explain how they differ from resistors. Give one example of a use-case where you might want a capacitor.
Answer: Capacitors are components that have the ability to store a charge by use of an electric field. They consist of two conductive plates separated by an insulating material called a dielectric. When a voltage is applied across a capacitor, the two plates are charged and attracted together, but have difficulty flowing freely across the insulator.
The resistance of a capacitor changes based on how fast the current flowing through it changes direction: with a low-frequency current (DC, for example), the capacitor has high resistance. With a higher-frequency current, the capacitor has low resistance. See the water balloon analogy. Because of this variable resistance, they may be used to filter out low-frequency current in various applications. Due to their ability to hold charge, they can also be used to supply a short burst of power when needed.
Resistors, on the other hand, do not store charge, and solely limit the flow of current in a circuit.
You might use a capacitor in a situation where you need to filter noise in power sources going to devices that need to operate smoothly and without spikes or dips in performance.

2)

a) List and explain the two steps of machine learning.
Answer: The two steps in machine learning are Training and Prediction (AKA Classification/Recognition).
In Training, a model is fed with data to learn patterns and relationships. This data should include both observed features and a corresponding class (or label), and there should be a substantial amount of it for best results. The trainer must select the right algorithm to use and adjust the model's parameters iteratively to work best with the kind of data being fed to it.
In Prediction, also called Classification or Recognition, the model is actually deployed onto data it hasn't been fed yet to see how well it performs in making predictions based on patterns learned during training.

b) What is one example of a common issue you can run into during these steps, and how might you avoid it?
Answer: One common issue that can arise is overfitting, which is when a model learns the training data too well and cannot find patterns that can be generalized to new data. One way you might avoid this is by using the simplest model that fits your data, as more complex models with more parameters are more likely to

catch data noise and little details. This makes them more likely to cause overfitting when those details don't correspond to actual generalizable patterns.

Multiple-choice:

1) What does the symbol I represent in the equation V = I * R?
    a) Induction
    b) Current
    c) Flow
    d) Insulation

    Answer: b) Current.
    As mentioned in class, "(I) don't know why I is used for Current." While Flow is used as a metaphor for Current, it is not the actual term used for I. Inductor and Insulation are both unrelated to this.

2) What values might you get back from an analogRead() call on a regular analog Arduino pin?
    a) Only 0 or 1
    b) LOW or HIGH
    c) Values within a maximum range of 0-1023
    d) Decimal values between 0 and 5.5, depending on how much voltage is currently being supplied to the pin

    Answer: c) Values within a maximum range of 0-1023
    Both the boolean values of 0 and 1 and the Arduino values of LOW and HIGH (essentially 0 and 1) are used for digital ports, not analog. A call of analogRead() on Arduino will map the input voltage to that pin to a 10-bit number between 0 and roughly 1023.
    Note: An answer of d for this question may receive partial credit because the input voltage is used here, but it is incorrect. This was mentioned on the slides and in class, and anyone who used an analog port for input may have skimmed this on the official documentation.

3) Which option describes a typical servo motor?
    a) A motor with a fixed range of rotation that can be set to keep itself at a specific angle
    b) A motor with a 360-degree range of rotation that can be set to keep itself at a specific angle
    c) A motor with a 360-degree range of motion that is moved in steps which can be counted to measure the angle of rotation
    d) A motor with a fixed range of rotation which "bounces back" to the opposite end of that range when it hits its limit

Answer: a) A motor with a fixed range of rotation that can be set to keep itself at a specific angle

A defining feature of a servo motor is the ability to have very precise control over what angle they are at, at all times. There is no likelihood that you will "lose track" of how it is positioned if you miscount steps or tell it to exceed its maximum movement range. For that reason, c and d are both out.

Note: b may receive partial credit because there are servos that have the full 360-degree range of motion, but they are not the default, so it is incorrect.

4) Which of these is NOT a good guideline for designing AI-infused systems?
    a) Discard user-specific behavior data
    b) Convey the consequences of user actions
    c) Make clear why the system did what it did
    d) Support efficient correction

Answer: a) Discard user-specific behavior data

This may directly contradict the guideline to "learn from user behavior," and is likely depriving the system of chances to improve with use. While identifying information may need to be handled according to specific policies or discarded, an AI-infused system should be learning from user behavior.

5) What is one function of the 328P microcontroller in an Arduino Nano?
    a) To provide power to the board
    b) To control the flow of current
    c) To process input and output signals
    d) To heat up and burn you when installed incorrectly

Answer: c) To process input and output signals

Other components on the arduino handle providing and controlling power and current, and arguably heating up and burning the user is not an intended feature (or function) of the 328P.