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IO4041 Introduction to Internet of Things – BSE Spring 2025 – Quiz 5

Roll # _____ Name _____ Section _____

1. What are the two primary modes for referring to GPIO pins on a Raspberry Pi?
 - a) Physical and Logical
 - b) BCM and BOARD
 - c) Input and Output
 - d) Digital and Analog

2. Which of the following are key features or characteristics of Raspberry Pi boards? (Multiple Answers)
 - a) Low cost
 - b) Runs a full operating system
 - c) High power consumption, typically > 50W
 - d) ARM-based processors

3. In the Azure IoT Solution Architecture, the path for processing and displaying data in real-time is known as the:
 - a) Cold Path
 - b) Warm Path
 - c) Hot Path
 - d) Edge Path

4. Edge computing primarily involves processing data _____, which helps reduce _____ and bandwidth usage compared to sending all data to the cloud.
 - a) far from the source, latency
 - b) close to the source, latency
 - c) in the cloud, processing power
 - d) on the device, storage

5. Range-free localization methods, like APS, primarily rely on _____ instead of direct distance or angle measurements.
 - a) GPS signals
 - b) Signal strength variation
 - c) Network connectivity information
 - d) Time difference of arrival

6. Received Signal Strength (RSS) based ranging estimates distance based on the principle that radio signal power _____ as distance increases.
- a) increases linearly
 - b) stays constant
 - c) decays
 - d) fluctuates randomly
7. In GPS, accuracy refers to:
- a) How close readings are to each other
 - b) The number of satellites in range
 - c) How close readings are to ground truth
 - d) The signal strength
8. GPS is often not included in every WSN node because: (Multiple Answers)
- a) It's not accurate enough
 - b) It consumes too much power
 - c) It interferes with other signals
 - d) It cannot be used indoors

Short Answer (2 marks)

Why is it often necessary to use a voltage divider or level shifter when connecting sensors with a 5V output signal to a Raspberry Pi's GPIO input pins?

GPIO pins should never be connected to a voltage source higher than 3.3V, otherwise there is risk of pin damage. But several sensors (and other external modules) operate at 5V. Voltage divider does the voltage reduction.

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1. Why must Python scripts accessing Raspberry Pi GPIO pins typically be run with sudo (as root)?
 - a) Python requires root privileges for all scripts.
 - b) The RPi.GPIO library has a bug requiring root access.
 - c) To ensure the script has maximum CPU priority.
 - d) OS considers direct hardware I/O access a sensitive action.**
2. Using the CSI (Camera Serial Interface) port on a Raspberry Pi for camera modules is better than connecting a camera over USB because _____.
 - a) it requires no software configuration.
 - b) it allows for longer cable lengths compared to USB.
 - c) it offers direct and faster data transfer.**
 - d) it consumes less power than a USB connection.
3. Azure IoT Hub provides two main mechanisms for cloud-to-device communication. What are they?
 - a) MQTT and CoAP
 - b) REST APIs and WebSockets
 - c) Cloud-to-device messages and Direct Methods**
 - d) Device Twins and Event Hubs
4. Which of the following are considered benefits of Edge Computing? (Multiple Answers)
 - a) Works well in locations with intermittent internet connectivity.**
 - b) Enhanced data privacy by keeping sensitive data local.**
 - c) Infinite scalability and flexibility comparable to the cloud.
 - d) Simplified maintenance compared to cloud solutions.
5. What is the fundamental difference between Triangulation and Trilateration localization techniques?
 - a) Triangulation uses distance measurements; Trilateration uses angle (bearing) measurements.
 - b) Triangulation uses angle (bearing) measurements; Trilateration uses distance measurements.**
 - c) Both use distance, but Trilateration requires more anchor nodes.
 - d) Both use angles, but Triangulation is less accurate.

6. The Time Difference of Arrival (TDoA) technique often uses two different types of signals (e.g., radio and acoustic) primarily to:
 - a) Increase the communication range.
 - b) Eliminate the need for precise clock synchronization.
 - c) Reduce the hardware cost.
 - d) Improve signal strength measurement.
7. Which of the following is considered range-free localization techniques?
 - a) Trilateration
 - b) Approximate Point in Triangulation (APIT)
 - c) Triangulation
 - d) Localization based on Received Signal Strength (RSS)
8. Iterative multilateration may accumulate error over time because:
 - a) Nodes drop messages
 - b) Distance measures are exact
 - c) Each new anchor uses previous approximations
 - d) Signal strength decreases

Short Answer (2 marks)

Briefly contrast the primary intended use cases and typical capabilities (e.g., processing power, OS) of a Raspberry Pi versus an Arduino Uno.

In contrast with Arduino Uno, Pi has a faster & powerful CPU, larger memory and runs an OS. Arduino Uno is suitable for simple sensing and control applications that require minimal on-board processing. Pi has much diverse applications including and beyond IoT use cases.