

## 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.