A

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

Roll # _____ Name _____ Section _____

1. Operating a Raspberry Pi without a connected monitor is known as _____ mode, and common tool for remote access include _____ for text-based login.

   a) detached, RDP
   b) headless, SSH
   c) remote, VNC
   d) server, Bash

2. What is the standard operating voltage for Raspberry Pi GPIO pins?

   a) 1.8V
   b) 3.3V
   c) 5V
   d) 12V

3. Which of the following is NOT a typical requirement for an IoT cloud backend?

   a) Support for IoT protocols (MQTT, CoAP)
   b) Secure remote firmware upgrades
   c) On-device data storage for all sensor readings
   d) Web/mobile apps for data visualization and control

4. What is the difference between a container 'Image' and a 'Container'?

   a) An Image is a running instance, while a Container is the template.
   b) An Image is the set of files defining the package, while a Container is a running instance of that image.
   c) They are synonymous terms in containerization.
   d) An Image includes the OS, while a Container only includes the application.

5. In 2D space, what is the minimum number of non-collinear anchor nodes required for Trilateration to determine a unique node position?

   a) 1
   b) 2
   c) 3
   d) 4

6. In the Ad hoc Positioning System (APS), anchor nodes calculate an average _____ which is then propagated to help other nodes estimate distances.

   a) signal strength
   b) hop length
   c) transmission delay
   d) angle of arrival

7. Which of the following is a global position metric?

   a) X-Y Grid
   b) Euclidean Distance
   c) Latitude and Longitude
   d) Relative Vector

8. Angle of Arrival (AoA) can be measured using: (Multiple Answers)

   a) A rotating element
   b) Magnetometer
   c) Antenna array
   d) Signal strength threshold

Short Answer (2 marks)
Besides being a general-purpose computer, list three reasons why Raspberry Pi is suitable for many IoT applications.

small and (relatively) cheap
allows network connectivity
has on-board processing ability
can directly interface with sensors and actuators

B

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1. Python is the most commonly used programming language on Raspberry Pi due to _____.

   a) usage in web browsers
   b) object oriented nature
   c) good hardware access API
   d) all of the above

2. When connecting a 5V sensor output to a Raspberry Pi GPIO input pin, what circuit technique is recommended to prevent damage?

   a) Using a direct wire connection.
   b) Adding a pull-up resistor.
   c) Implementing a voltage divider.
   d) Using a level shifter chip.

3. In the context of Azure IoT Hub, what is 'attestation'?

   a) The process of sending commands to a device.
   b) The method a device uses to confirm its identity to the hub.
   c) The routing of events from devices to applications.
   d) The provisioning of a new device in the hub.

4. A _____ is a self-contained, isolated environment for running applications, often described as a lightweight virtual machine that doesn't require its own OS kernel or hypervisor.

   a) Process
   b) Thread
   c) Container
   d) Virtual Private Server (VPS)

5. Iterative Multilateration allows nodes to become anchors once localized. What is a primary challenge associated with this approach?

   a) It requires GPS on all nodes.
   b) It only works in 3D space.
   c) Error accumulation with each iteration.
   d) High computational cost for each node.

6. Which ranging technique determines distance based on the propagation time of a signal between sender and receiver, requiring precise clock synchronization?

   a) Received Signal Strength (RSS)
   b) Angle of Arrival (AoA)
   c) Time Difference of Arrival (TDoA)
   d) Time of Arrival (ToA)

7. Why might GPS not be a feasible localization solution for all nodes in a typical Wireless Sensor Network (WSN)? (Multiple Answers)

   a) GPS receivers are often power-hungry.
   b) GPS provides only relative, not global coordinates.
   c) GPS requires at least 10 satellites to be visible.
   d) The cost of adding GPS to every low-cost sensor node can be prohibitive.

8. Which of the following localization methods would fail if all nodes are out of range of known anchors?

   a) APS
   b) Triangulation
   c) GPS
   d) Iterative Multilateration

Short Answer (2 marks)
Explain the difference between the BCM and BOARD numbering modes for Raspberry Pi GPIO pins. Which mode is generally recommended for portability across different Pi models and why?

BOARD pin numbering is 1 to 40, based on the location of a pin within GPIO header
BCM numbering is with respect to Broadcom SoC chip.
The latter varies between boards because different Pi models use different chips. So, BOARD is preferable for portability.