1. (a) To design, analyze, and extend a Blink program for the on-board LED on the Arduino Uno with additional features and constraints with a time delay of 1000ms, reflecting a real embedded system scenario.
   (b) Design, implement, and analyze a Blink routine that toggles the onboard LED of the Arduino Uno by directly manipulating the microcontroller's I/O port registers (use port 13) rather than using digitalWrite().

2. Design, implement, and analyze a Blink routine that toggles the onboard LED of the Arduino Uno by directly manipulating the microcontroller's I/O port registers using Port 8, Port 9 with a time delay of 100ms.
   (b) Using Wokwi's simulation environment, your task is to create a project that blinks an LED (onboard or external) with a specified pattern and to analyze its behavior. Your design should include the wiring in Wokwi, the sketch code, timing measurements, and reflection on the simulation.

3. (a) Design, implement, and evaluate an Arduino-based temperature sensing module using the LM35 sensor. Your design must be robust, provide accurate temperature readings to ±1 °C or better in the 0–100 °C range.
   (b) Design a Wokwi simulation with a Raspberry Pi Pico and a push button that controls the onboard (or external) LED. When the user presses the button, the LED toggles (or turns ON while pressed).

4. (a) Design, implement, and evaluate a system using an Arduino, an LM35 temperature sensor, and a buzzer that:
   - Continuously monitors the ambient temperature,
   - Compares against one or more configurable thresholds,
   - Activates a buzzer (and optionally visual indicator) when temperature exceeds (or falls below) the threshold.

   (b) Using the Wokwi Arduino simulator design a blink program that causes two LEDs (say LED1 and LED2) to blink alternately—when LED1 is ON, LED2 is OFF, and vice versa—at a fixed interval (e.g. 500 ms). The design should include both circuit wiring and code. Then extend the design to support changes in blink interval at runtime.

5. (a) Design and implement a motor motion system using Arduino that can accept commands to perform motion (positioning), speed control to handle safety / constraints.
   (b) Design a Wokwi simulation project where an LED (onboard or external) blinks in a specified pattern. Your design should include both the circuit setup and the Arduino code. In addition, you'll analyze timing, simulation behavior.

6. (a) To design, analyze, and extend a Blink program for the on-board LED on the Arduino Uno with additional features and constraints with a time delay of 1000ms, reflecting a real embedded system scenario.
   (b)You are tasked with building a distance measurement system using Python and an HC-SR04 sensor in wokwi platform. The system should reliably measure distances in the range 2 cm to 300 cm.

7. A smart agriculture company wants to remotely monitor environmental conditions—such as temperature, humidity, and soil moisture—in its greenhouse facilities. They aim to collect sensor data in real time, log it locally for backup, and upload it to a cloud platform for data visualization, analytics, and alerts. You have been assigned to design and implement a prototype system using a Raspberry Pi as the edge device to collect and transmit data.

Design and implement a system that:

- Uses Raspberry Pi to collect real-time data from multiple sensors (e.g., DHT11/DHT22 for temperature and humidity, soil moisture sensor).
- Logs the sensor data locally (e.g., in CSV or SQLite database).
- Uploads the data periodically to a cloud platform (such as AWS IoT Core, ThingSpeak, Google Cloud IoT, or Azure IoT Hub).
- Enables remote monitoring and visualization of the data through dashboards or mobile/web interfaces.
- Optionally, triggers alerts or notifications if certain thresholds (e.g., temperature > 35°C) are exceeded.

8. With the increasing demand for telemedicine and remote patient monitoring, healthcare systems are evolving toward IoE-based smart solutions. The goal is to continuously monitor patients' vital parameters, such as heart rate, body temperature, and environmental humidity, and send this data to a cloud platform for real-time analysis and alerts. In this case study, you are required to design, simulate, and test an IoE-enabled healthcare

monitoring system using the ESP32 microcontroller and DHT22 sensor within the Wokwi online simulator environment.

Design and implement a smart healthcare monitoring system that:

- Measures heart rate, body temperature, and ambient humidity in real-time.
- Uses ESP32 as the processing and communication unit.
- Simulates the entire setup on the Wokwi platform.

9. (a) Design, implement, and analyze a Blink routine that toggles the onboard LED of the Arduino Uno by directly manipulating the microcontroller's I/O port registers using Port 8, Port 9 with a time delay of 100ms.
   (b) Design a Wokwi simulation project where an LED (onboard or external) blinks in a specified pattern. Your design should include both the circuit setup and the Arduino code. In addition, you'll analyze timing, simulation behavior.

10. (a) To design, analyze, and extend a Blink program for the on-board LED on the Arduino Uno with additional features and constraints with a time delay of 1000ms, reflecting a real embedded system scenario.
    (b) Design, implement, and analyze a Blink routine that toggles the onboard LED of the Arduino Uno by directly manipulating the microcontroller's I/O port registers (use port 13) rather than using digitalWrite().