1. Write a complete Arduino Uno program that will continuously blink an LED connected to pin 13, turning it ON for one second and then OFF for one second, in an infinite loop. Explain how the pinMode, digitalWrite, and delay functions are used in this program.

Ans-

```
// Blink LED program
void setup() {
  pinMode(13, OUTPUT); // Set pin 13 as output
}
void loop() {
  digitalWrite(13, HIGH); // Turn LED ON
  delay(1000);            // Wait 1 second
  digitalWrite(13, LOW);  // Turn LED OFF
  delay(1000);            // Wait 1 second
}
```

2. Write a program to control an LED using a push button connected to pin 2. The LED should glow only when the button is pressed.
Explain how digitalRead is used to check the button state.
Ans:-

```
int button = 2; // Button pin
int led = 13;   // LED pin

void setup() {
  pinMode(button, INPUT);  // Button as input
  pinMode(led, OUTPUT);    // LED as output
}
void loop() {
  if(digitalRead(button) == HIGH) { // If button pressed
    digitalWrite(led, HIGH);        // LED ON
  } else {
    digitalWrite(led, LOW);         // LED OFF
  }
}
```

3. Write a program to simulate traffic lights using three LEDs (Red, Yellow, Green). The Red LED should glow for 3 seconds, then Yellow for 1 second, and finally Green for 3 seconds. Explain how delays are used to control timing.

Ans-

```
int red = 8, yellow = 9, green = 10;

void setup() {
  pinMode(red, OUTPUT);
  pinMode(yellow, OUTPUT);
  pinMode(green, OUTPUT);
}
void loop() {
  digitalWrite(red, HIGH); delay(3000);    // Red ON for 3 sec
  digitalWrite(red, LOW);
  digitalWrite(yellow, HIGH); delay(1000);// Yellow ON for 1 sec
  digitalWrite(yellow, LOW);
  digitalWrite(green, HIGH); delay(3000); // Green ON for 3 sec
  digitalWrite(green, LOW);
}
```

4. Write a program to generate sound using a buzzer connected to pin 7. The buzzer should turn ON for 0.5 seconds and OFF for 0.5 seconds repeatedly.
Explain how digital signals control the buzzer.

Ans-

```
int buzzer = 7;
void setup() {
  pinMode(buzzer, OUTPUT);
}
void loop() {
  digitalWrite(buzzer, HIGH); // Buzzer ON
  delay(500);
  digitalWrite(buzzer, LOW);  // Buzzer OFF
  delay(500);
}
```

5. Write a program to read values from a potentiometer connected to analog pin A0 and display them on the Serial Monitor.
Explain how analogRead works.

Ans-

```
int pot = A0; // Potentiometer pin
void setup() {
  Serial.begin(9600); // Start serial monitor
}
void loop() {
  int value = analogRead(pot); // Read analog value
  Serial.println(value);       // Print value
  delay(500);
}
```

6. Write a program to control a servo motor connected to pin 9. The servo should move to 0°, then 90°, then 180°, each for one second.
Explain how the Servo library is used.

Ans-

```
#include <Servo.h>
Servo myservo;

void setup() {
  myservo.attach(9); // Servo connected to pin 9
}
void loop() {
  myservo.write(0);   // Move to 0°
  delay(1000);
  myservo.write(90);  // Move to 90°
  delay(1000);
  myservo.write(180); // Move to 180°
  delay(1000);
}
```

7. Write a program to measure distance using an ultrasonic sensor (HC-SR04). Connect the trigger pin to 9 and echo pin to 10. Display the distance in centimeters on the Serial Monitor. Explain how pulseIn is used.

Ans:

```
int trig = 9, echo = 10;
void setup() {
  Serial.begin(9600);
  pinMode(trig, OUTPUT);
  pinMode(echo, INPUT);
}
void loop() {
  digitalWrite(trig, LOW); delayMicroseconds(2);
  digitalWrite(trig, HIGH); delayMicroseconds(10);
  digitalWrite(trig, LOW);
  long duration = pulseIn(echo, HIGH); // Time taken
  int distance = duration * 0.034 / 2; // Convert to cm
  Serial.println(distance);
  delay(500);
}
```

8. Write a program to read temperature using LM35 sensor connected to analog pin A0. Display the temperature in Celsius on the Serial Monitor.
Explain how analog values are converted to temperature.

Ans:

```
int sensor = A0;
void setup() {
  Serial.begin(9600);
}
void loop() {
  int value = analogRead(sensor); // Read sensor value
  float temp = (value * 5.0 * 100.0) / 1024.0; // Convert to °C
  Serial.println(temp);
  delay(1000);
}
```

9. Q: Write a program to display text and numbers on a 16x2 LCD connected to Arduino Uno.
Display "Hello Arduino!" on the first line and elapsed seconds on the second line.
Explain how lcd.setCursor works.

Ans:

```cpp
#include <LiquidCrystal.h>
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {
  lcd.begin(16, 2);            // Initialize LCD
  lcd.print("Hello Arduino!");// Print text
}
void loop() {
  lcd.setCursor(0, 1);         // Move to 2nd line
  lcd.print(millis()/1000);    // Print seconds
}
```

10. Write a program to control an RGB LED connected to pins 9, 10, and 11. The LED
should glow Red for 1 second, then Green for 1 second, then Blue for 1 second.
Explain how analogWrite controls brightness.

Ans:

```cpp
int red = 9, green = 10, blue = 11;

void setup() {
  pinMode(red, OUTPUT);
  pinMode(green, OUTPUT);
  pinMode(blue, OUTPUT);
}
void loop() {
  analogWrite(red, 255); analogWrite(green, 0); analogWrite(blue, 0); delay(1000); /
  analogWrite(red, 0); analogWrite(green, 255); analogWrite(blue, 0); delay(1000); /
  analogWrite(red, 0); analogWrite(green, 0); analogWrite(blue, 255); delay(1000); /
}
```