Introduction To Embedded System Design

Assignment Solutions- Week 1

1. Which of the following is not an example of embedded systems?
    a. Smart Watch
    b. Drone
    c. Microwave oven
    d. **Smart phone**

Explanation: The smartphones that we use today are portable general purpose computers which the user can customize according to their own requirements. An important consideration for being an embedded computer is that it performs dedicated tasks.

2. What feature does the MSP430 NOT add to Gillette Fusion ProGlide Razor?

   a. It maintains the vibration level throughout the lifetime of the battery
   b. It helps in using a single switch for the ON/OFF feature
   c. **It automatically orders a new razor when the lifetime of the product has expired**
   d. It implements a timeout feature in the product

Explanation: The MSP430 in the Razor adds all the mentioned features but not the automatic ordering feature, because the microcontroller in the Razor is neither connected to the internet nor any other device.

3. How does active noise cancellation work?

   a. It changes the size of the ear cup according to the noise level.
   b. **It actively monitors the noise and produces the antiphase version of the noise**.
   c. It actively actuates the pressure of the ear cup according to the noise level.
   d. It increases the audio input level according to the noise level.

Explanation: In active noise cancellation headphones, the ambient noise is detected by a secondary microphone on the outer side and an anti phase version of the noise is added to the original signal using various signal processing techniques.

4. Which sensor is used in a smart watch to calculate the steps?

a. **Accelerometer**
b. Shock Sensor
c. Magnetometer
d. Vibration Sensor

Explanation: A wearable tracker continuously senses the movements of the body on a 3 axis accelerometer.

Shock sensor is a piezoelectric sensor that is used to detect vibrations and impact. Magnetometer is a device that measures magnetism—the direction, strength, or relative change of a magnetic field at a particular location.

5. Which of the following are the features of Microcontroller?

a. CPU, Image Processor, I/O Ports, WIFI
b. CPU, Memory, Wifi, Timer
c. **CPU, Memory, I/O Ports, Timer**
d. CPU, Memory, I/O Ports, Bluetooth

Explanation:A microcontroller has the CPU, Memory, I/O Ports and Timer. WiFI/Bluetooth is not a common feature of microcontrollers.

6. What does the ROM used in desktop computers store?
a. NTFS
b. **BIOS**
c. ExFAT
d. Ext4

Explanation: BIOS is firmware used to perform hardware initialization during the booting process, and to provide runtime services for operating systems and programs.This has to be stored in ROM so that it remains stored in the memory even after power off.

7. How does the colour mixer project produce such vibrant colours?

a. It varies the current through the the LEDs using the three potentiometers
b. It uses rotary encoders to measure the angles of the three knobs and controls the LEDs according to the value noted by the microcontroller
c. **It samples the value from the three potentiometers and controls the LED current by using Pulse Width Modulation**
d. None of the above

Explanation: The variable intensity combination of Red, Green and Blue can produce millions of colors and the same principle is used in the Color Mixer project where the intensity of Red, Green and Blue is varied by varying the duty cycle or ON time of the Leds by PWM, according to the sampled value of three potentiometers.

8. Which of the following statements is false?

a. SRAM is faster as compared to DRAM

b. SRAM is less memory dense as compared to DRAM
c. **DRAM is faster as compared to SRAM**
d. DRAM requires less power than SRAM

DRAM is at least ten times slower than SRAM. SRAM is faster and typically used for cache. While a DRAM module only requires one transistor and one capacitor to store every bit of data, SRAM needs 6 transistors. So SRAM is less memory dense
SRAM needs a constant power supply, which means it consumes more power. DRAM requires reduced power consumption as the information is stored in the capacitor.

9. How can the number of bits stored in a SRAM chip be calculated?

a. No. of address lines *No. of data lines
b. **2^(No. of address lines) *No. of data lines**
c. No. of address lines *2^(No. of data lines)
d. 2^(No. of address lines*No. of data lines)

Explanation:

If there are:

n= number of address lines

m= number of data lines

Number of address locations in the RAM = 2^(no of address lines)

And since each location has m bits data,

So total number of bits = (2^n) * m

10. What is DMA used for?

a. It is used as a non volatile storage
b. It is a hardware implemented function used to copy contents directly from the program memory to the RAM
c. **It is a hardware implemented function used to copy contents directly from/to the memory to/from the I/O ports**
d. None of the above

Explanation: Direct memory access (DMA) is a method that allows an input/output (I/O) device to send or receive data directly to or from the main memory, bypassing the CPU to speed up memory operations.In this method on the request of DMA controller the CPU relinquishes the data buses for the DMA.