



**RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES**

**B.Sc. (General) Degree in Information and Communication Technology
Third Year - Semester II Examination – February/ March 2019**

ICT 3304 – EMBEDDED SYSTEMS

Time: Three (3) hours

Instructions

1. Answer all questions.
 2. If you are unclear about any question, make assumptions and clearly mention the assumptions.
 3. There are four (04) questions in this question paper.
 4. All subsections of questions carry same amount of marks.
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1. Answer all sub sections

- a) Smart systems are defined as systems which incorporate the functions of **sensing**, **actuation** and **control**. Further they are capable of describing and analyzing a situation while taking decisions based on the available data. Take an example of a **smart home** and describe extensively what a smart system is covering above aspects of a general smart system. **(18 Marks)**
- b) The code that runs in an Arduino is called a sketch. There are two main parts in a sketch.
- Setup() function
 - Loop() function.

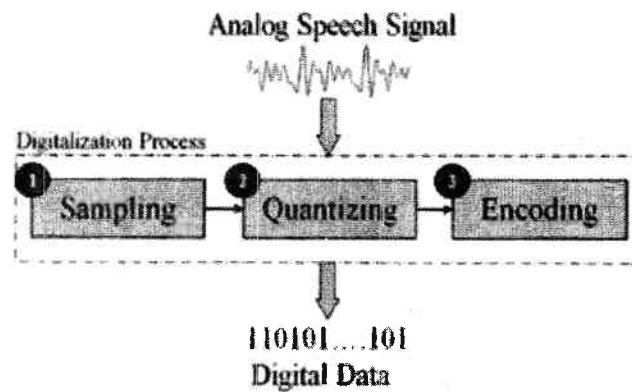
What is the significance of these two functions? Identify the major difference between these two portions of the sketch. You must explain giving two (02) examples. **(7 Marks)**

2. Answer all sub sections

- a) Resistors have a color code to identify the value of the resistance.
- State the resistor color code and show how to find the color code of 330 Ohms resistor. **(5 Marks)**
 - Elaborate on why you need to connect a resistor to a LED when you want to connect the LED to a 5V supply. (Hint: You may use the ohm's law for calculations) **(5 Marks)**
 - State 5 **best practices** that you learnt at the class labs when working with electronic development boards and prototype kits such as Arduino. **(5 Marks)**
- b) If you have a 3x3 LED matrix, explain how you would draw a cross sign (X mark). Use illustrations if necessary. **(10 Marks)**

3. Answer all sections.

- a) Transistors are the basic building blocks of any digital design. Draw and explain how a NAND gate can be designed using transistors. **(10 Marks)**
- b) Analog to digital conversion consists of 3 main steps as illustrated below.



Take any random analog signal and explain each step of analog to digital conversion with necessary illustrations. **(15 Marks)**

4. Answer all sections.

Flood during the rainy seasons has become a major natural disaster in Sri Lanka. This has caused a lot of life and property damages during the past couple of years. Authorities have identified that with a proper flood warning system, the damage can be reduced. As a solution, they are proposing an IoT system to predict floods and warn people. According to the proposed system, they are planning to setup a hardware device which acts as the sensor node in every 50Km along the river. These devices will continuously observe the water flow along the river and push that information to a central cloud server for processing. For the observation, the water level height and the speed of the water flow will be considered.

At the central cloud server, it'll process the readings received from all the sensor nodes and do the prediction. If there is a 5% increment in the water level height and 10% increase of the water flow speed compared to a normal day, the system will predict it as a flood condition.

If the system detects a flood condition, the system should notify everyone living close to the river as soon as possible.

As a student who knows the fundamentals of IoT, you have been assigned to develop this proposed system.

- a) What are the sensors you would propose to use for this system? **(5 Marks)**
- b) With the help of a diagram, explain how you are going to place the sensors and components of the whole system. **(5 Marks)**
- c) Explain how the communication link works in between the central server and the sensor nodes. Mention the technologies you are going to use. **(5 Marks)**
- d) Draw an IoT architecture for the proposed system. The data sensed, the conditions, the controllers and the actions required need to be clearly mentioned. You are free to make any assumptions and they need to be clearly mentioned. **(10 Marks)**

END