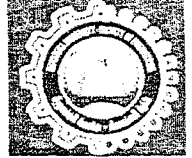
 Mansoura University	 Faculty of Engineering	Biomedical Engineering (BME) Program
		Time allowed: 120 min
		Exam is four pages
		Assume any missing data, use clear assumptions
		Include and name all steps

Question #1 [15 points, equally distributed] Fill in the table below:

- 1.1. Measurements that are made by taking samples is called
- 1.2. A measurement of the acidity of blood (concentration of hydrogen ions in blood) is
- 1.3. If a moving average filter with length=3 is applied to the data signal $x(n)=\{1,3,2,5\}$, the output signal $y(n)$ will be
- 1.4. The job of a median filter if applied to a certain data is to
- 1.5. Electrical brain activities contributing in EEG signal are,, and
- 1.6. A normally distributed data with mean=100 and standard deviation=10. Then, around 95% of data samples are between and
- 1.7. The fluorescence process includes three stages,, and
- 1.8. The chemical reactions occurs for Ag/AgCl electrodes are, and
- 1.9. If the settling time of a 3-bit DAC is 2ms, and the DAC resolution is 0.5 v. If an input sample of 010 is inserted, then, after 2ms, its analog output will be betweenand
- 1.10. For a 3 bit ADC with a 1V resolution and power supply, $V_{cc}=8V$, the values stored in successive approximator register during the first three cycles for a given 3V sample are.....

1.1	
1.2	
1.3	
1.4	
1.5	
1.6	
1.7	
1.8	
1.9	
1.10	

Question #2 [15 points] Sketch in details the following in the blank areas:

a) ECE signal, heart rate =60 bpm (3 pts)	b) Fluorescence microscope (4 pts)
c) A flash ADC, 1V resolution, $V_{cc}=4V$ (4 pts)	d) 2-bit R-2R DAC, 2V resolution (4 pts)

3.3 Derive the relation between the magnitude of v_d and the Arduino converted digital output. To test the device, a known input with $v_d = 1\text{mV}$ was used. The **10-bit digital Arduino output** was 800, compute the **error in measuring this input** [5 points]

3.4 Design a circuit to be connected to Arduino **PIN 12** (a digital PIN) such that a **LED is** flashing (ON/OFF with a delay of 1 sec between ON and OFF) whenever the delivered signal to Arduino reads a **more than 512**. Note that **V_4 is connected to Arduino PIN 3 (an analog PIN)**. A LED to be ON needs **3V** across its terminals and consumes around **2mA**. Write the Arduino code [6 points]

Circuit	Arduino Code
	<pre>// Add comments whenever applicable void setup() { } void loop() { } }</pre>

Code appendix: pinMode(pin , mode); digitalWrite(pin , value); digitalRead(pin);
 analogRead(pin); analogWrite(pin , value); delay(time in ms); int x = digitalRead(pin, value)
 If (condition) {expression 1;} else {expression 2};

د. أحمد النقيب

خالص امنياتي بالتوفيق

تمت الاسئلة