German University in Cairo
Faculty of Media Engineering and Technology
Spring 2020

CSEN 1099 – Introduction to Biomedical Engineering
Problem Set #3

Question 1

Determine how to place limb and augmented limb leads to obtain ECG recordings at a medical angle of:
a) $+180°$ b) $+270°$ c) $+30°$

Question 2

In a rare case, a patient has his heart oriented towards the right side instead of the left side. Determine how to change the placement of the 12-lead system to get the corresponding ECG recordings.

Question 3

Consider the following ECG recorded on lead aVR (medical angle $-150°$) and aVF (medical angle $+90°$). From the figures, compute the recorded ECG on lead I (medical angle $0°$).
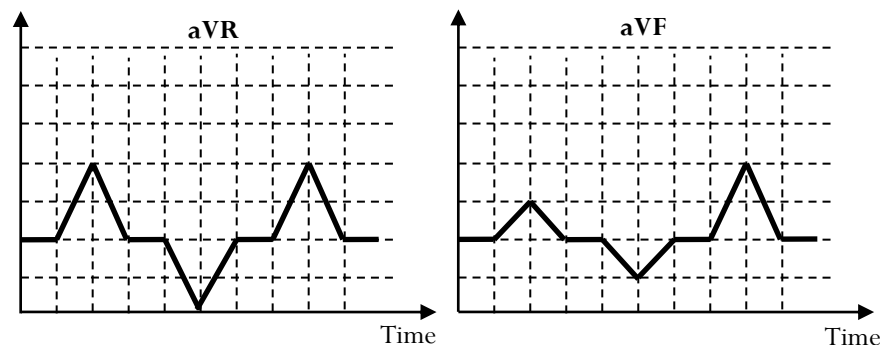
Question 4

Explain what will happen to the heart and the recorded ECG in each of the following cases:

i – The pacemaker cells in the Sinoatrial node do not depolarize.

ii – The pacemaker cells in the Sinoatrial node depolarize but the Atrium does not contract.

iii – The pacemaker cells in the Sinoatrial node depolarize and the Atrium contracts but the ventricles do not contract.

Question 5

Write the pseudocode of an algorithm that can be used to detect QRS waves that correspond to premature ventricular contractions explained in lecture.

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Question 6

Consider an ECG signal with R waves occurring at 1 sec, 1.8 sec, 2.5 sec, 3.4 sec and 4 sec. Assume that the durations of the P-wave is 0.1 sec, QRS-complex is 0.1 sec and T-wave is 0.15 sec.

i – Draw the corresponding ECG signals showing the exact timing of each wave.

ii – Draw the RR interval plot of the ECG signal. Find the heart rate in beats per minute (bpm).