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Eighth Semester B.E. Degree Examination, Dec.2013/Jan.2014

Biomedical Signal Processing

Time: 3 hrs.

Max. Marks:100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART - A

1. a. With the help of a block diagram, explain the objectives of biomedical signal analysis. (06 Marks)
- b. Explain the following biomedical signals. Draw the waveforms and give the frequency ranges relevant to these signals: i) ECG, ii) EEG. (08 Marks)
- c. Explain three difficulties encountered in biomedical signal analysis and acquisition. (06 Marks)
2. a. Starting from mesh equations of potential difference between the limbs RA, LA and LL, derive the expressions for av_R , av_L and av_F . Also represent relationships between these standard and augmented lead voltages using vector diagram. (08 Marks)
- b. Draw a diagram to illustrate the electrode placements for the frank VCG lead system. Also write the resistor network for combining the body surface potentials to produce three time varying scalar leads of the frank VCG lead system. (06 Marks)
- c. Draw and explain ECG signal characteristics. (06 Marks)
3. a. What is a digital filter? What are the different elements of a digital filter? Mention advantages of digital filters over analog filters. (10 Marks)
- b. If the output sequence of a digital filter is $\{1, 3, 2\}$ in response to a unit impulse, what is the transfer function of this filter? Draw the poles and zeros of this transfer function mentioning the ROC. (10 Marks)
4. a. What are the advantages of an adaptive filter? Design an adaptive filter using LMS algorithm. (10 Marks)
- b. Discuss briefly any two applications of adaptive filter. (04 Marks)
- c. Explain how a sine wave model is used for 60 Hz adaptive cancellation. (06 Marks)

PART - B

5. a. Show that a signal averaging improves the signal to noise ratio by a factor of \sqrt{m} . (10 Marks)
- b. Mention the characteristics of noise and signal in signal averaging techniques. Explain with block diagram typical signal averager. Draw the flow chart of a program for averaging an ECG signal. (10 Marks)
6. a. Given a sequence of 28 data points $\{1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 6, 6, 7\}$, illustrate Huffman coding. (06 Marks)
- b. What is a data reduction algorithm? Explain lossy and lossless data compression. Classify the four data reduction algorithms into these categories. (06 Marks)
- c. With an example, illustrate and explain turning point algorithm. Also show the table for choosing the samples. (08 Marks)
7. a. Explain QRS detection algorithm. (10 Marks)
- b. Write a note on different template matching techniques used in ECG analysis. (10 Marks)
8. a. With a block diagram, explain the portable arrhythmia monitor. (08 Marks)
- b. Describe the differences between a general purpose microprocessors and DSPs. (06 Marks)
- c. Write a note on ST segment analysis. (06 Marks)