Tampere University of Technology Department of Signal Processing

SGN-3507 Introduction to Medical Image Processing

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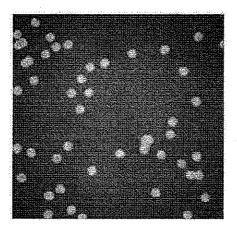
Calculators are allowed (B and C). You may keep the examination paper (no return needed).

- 1. Explain briefly
 - a. PVE or partial volume effect (1 point)
 - b. Phantom (1 point)
 - c. Transmission tomography, i.e. what does transmission mean in this context (1 point)
 - d. PET/CT scanner (1 point)
 - e. DICOM standard (1 point)
 - f. Back-projection (1 point)
- 2. The projection slice theorem (or Fourier slice theorem) can be written as

$$F(u,v) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(x,y)e^{-j(ux+vy)} dx dy,$$

where f(x,y) is a two dimensional object. Why is this theorem so important in image reconstruction from projections? Discuss also discrete implementation of the theorem. Illustrate your answer graphically. (6 points)

- 3. Explain advantages and disadvantages of the two different image reconstruction approaches: filtered back-projection (FBP) algorithm and iterative reconstruction methods, such as MLEM or MRP. (6 points)
- 4. Your task is to analyze a microscopic cell image shown below. Explain the different steps in the image analysis procedure. What would you quantify or measure (as a result of the analysis) from the shown image? (6 points)



5. Your task is to build an image archiving system for a health unit. Which kinds of aspects you should take into account in your task (technical, legal, etc.)? (6 points)