Tampere University of Technology
Department of Signal Processing

SGN-3507 Introduction to Medical Image Processing **Antti Happonen**

Exam 9.5.2011.
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)

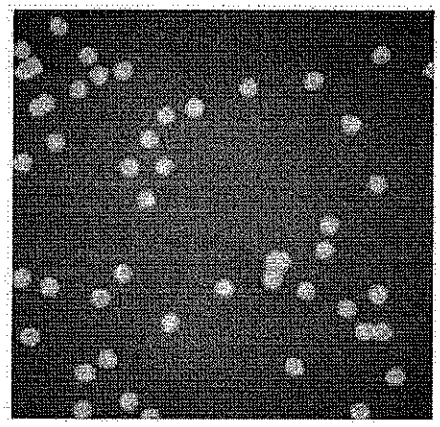
2. The projection slice theorem (or Fourier slice theorem) can be written as

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

   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)