HOMEWORK 6: EE145B, BioE 165: April 2002

1.   A sample has a T1 of 1.0 seconds. If the net magnetization is set equal to zero, how long will it take for the net magnetization to recover to 98% of its equilibrium value?!

2.   A sample has a T2 of 100 ms. How long will it take for any transverse magnetization to decay to 37% of its starting value?!

3.   A hydrogen sample is at equilibrium in a 1.5 Tesla magnetic field. A constant B1 field of 1.17x10-4 Tesla is applied along the +x'-axis for 50 microseconds. What is the direction of the net magnetization vector after the B1 field is turned off?!

4.   There are two adjacent tissues in an image with a T2 of 30 and 50 ms. You wish to produce a spin-echo image of the tissues such that the contrast between the tissues is maximized. What TE should be used?

5.   There are two adjacent tissues in an image with a T1 of 375 and 850 ms. You wish to produce a spin-echo image of the tissues such that the contrast between the tissues is maximized. What TR
 should be used?

6. You are provided with a set of 7 images namely E19642S005_V*X*.int2 where *X* goes from 0 to 6. The images are 256 x 256 , represent a field of view of 24 cms, and a slice thickness of 10 mm. The data is integer *2 data so you shuld be able to read it.

Image where *X*   is 0: Is acquired at a TR of 2500 ms TE =20 ms
Image where *X*   is 1: Is acquired at a TR of 2500 ms TE =40 ms
Image where *X*   is 2: Is acquired at a TR of 2500 ms TE =60 ms
Image where *X*   is 3: Is acquired at a TR of 2500 ms TE =80 ms
Image where *X*   is 4: Is acquired at a TR of 1000 ms TE =20 ms
Image where *X*   is 5: Is acquired at a TR of 500 ms TE =20 ms
Image where *X*   is 6: Is acquired at a TR of 250 ms TE =20 ms

Calculate T1 and T2 for a region of interest (square or rectangular or circular as you wish) in the intervertebral disc, vertebrae, in the spinal cord, and in the subcutaneous fat.

Generate an image which shows the regions (shape, size, location) that you have picked for measuring T1 and T2. Generate a table of T1 and t2 values.

Write a program to calculate T1 and T2 on a per pixel basis, for a small image (to reduce computation time) such as this:
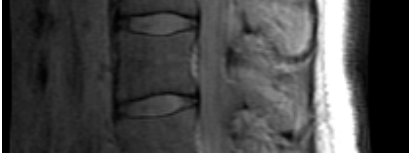
Make sure you do not cut your image down so that you do not sample all the different tissue types.
What problems do you face?