CS 5420	**Visual Data Processing**	Test 1
Name:	Winter 2005	Max Pts: 47

Important: This is an open book test. You can use any books, notes, or paper, but not exchange anything with other students. You are not allowed to use any electronic/communication devices, including a calculator. *Do not log into the computer during the test*. Any calculations and rough work can be done on the back side of the test pages. You will lose five points for not writing your name.

1. [10 pt] How does an ultrasound device create an image of internal parts of body? How is it different from X-ray imaging?

2. [6 pt] What is scotopic vision? How does it differ from photopic vision? Name the specific organs that are responsible for the two types of vision.

3. [10 pt] Consider the following binary image.

```
0 0 0 0 0 0 0 1 1 0
1 0 0 1 0 0 1 0 C 1
1 0 A 1 0 1 1 0 0 0
0 0 1 1 1 0 0 0 0 0
0 0 1 1 1 B 0 1 1 1
```

   For the pixels labeled A, B, and C, give the Euclidean distance, city-block distance, and chessboard distance between each pair of points. Comment if any of these types of distance is not associative.

4. [6 pt] Differentiate between the terms sampling and quantization. Which one of these will be more important for fidelity of images in digital cameras?

5. [15 pt] A gray scale image has its PDF $p_r(r)$ given by $p_r(r) = 2 - 2r$. It is desired to transform the gray levels of this image so that they will have a new PDF given by $p_z(z) = 2z$. Assume continuous quantities and find the transformation in terms of r and z to achieve this goal. Hint: It may help to visualize the problem better if you plot the two PDFs.