

Homework 1: Signal Detection Theory
20 Points: Due at the beginning of class, Thursday, 13 September 2001

There are two parts to this homework assignment. Each part counts 10 points. Late homework will receive a grade of zero.

Part 1:

Two radiologists were tested on their ability to detect cancer from x-ray photographs. They were shown 100 x-rays without cancer and 100 with cancer and were asked to say whether or not cancer was present. The resulting 2 x 2 contingency tables for each are presented below:

		Radiologist A Response		Radiologist B Response	
		“yes”	“no”	“yes”	“no”
Cancer present in x-rays		69	31	84	16
Cancer absent in x-rays		31	69	50	50

Using the **equal-variance** signal detection theory model determine the sensitivity (“d-prime”) and response bias (“c”) of the radiologists for the detection of cancer. Present your calculations in an orderly fashion. Which radiologist would you want to evaluate your x-rays? Why?

Part 2:

Below is a set of **hit rates** and **false alarm rates** computed from the confidence judgments of a one subject in a signal detection experiment.

	1	2	3	4	5
Hit Rate	0.2898	0.5477	0.7169	0.8275	0.9229
False Alarm Rate	0.0135	0.0829	0.2386	0.4146	0.7056

Plot two ROC graphs from these data: one graph in linear probability coordinates (ranging between 0.0 and 1.0), the other in Gaussian z-score coordinates (ranging from -2.5 to +2.5). Make the x- and y-axes of your graph equal in length so that each graph forms a square. Take care to properly label your graphs and to make them neat. Using a linear regression on the z-score values, what are the mean and standard deviation of the best-fitting Gaussian signal detection model? What is your opinion about how well this model describes these data? In four sentences or less explain your answer.