

Homework 1: Signal Detection Theory
20 Points: Due at the beginning of class, Tuesday, 7 June 2005

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

Part 1:

The FBI last year administered polygraph tests to civilian officials in the Pentagon in an effort to learn who could have revealed certain highly classified intelligence information to former Iraqi exile Ahmad Chalabi. Mr. Chalabi has been accused of giving this secret information to the Iranian government. Below are data from two professional polygraph operators who were tested on their ability to detect liars. They tested 100 people: 50 of them lied about committing a crime and 50 told the truth. The resulting 2 x 2 contingency tables for each operator are presented below:

	Operator A			Operator B	
	“Liar”	“No”		“Liar”	“No”
Telling Lies	20	30	Telling Lies	40	10
Telling Truth	10	40	Telling Truth	30	20

Using the **equal-variance** signal detection theory model determine the sensitivity for detecting liars (“d-prime” using Equation 9c) and the response bias (“c” using Equation 12) of each polygraph operator. Present your calculations in an orderly fashion. If you were guilty of giving Mr. Chalabi the classified intelligence information, and you did **not** want to be caught, which polygraph operator would you want to examine you. 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. What is your opinion about how well the Gaussian signal detection model describes these data? In four sentences or less explain your answer.