Name:

Problem	Points	Score
1	30	
2(a)	20	
2(b)	10	
3	30	
4	10	
Total	100	

Notes:

- (1) The exam is closed books and notes except for one double-sided sheet of notes.
- (2) Please indicate clearly your answer to the problem.
- (3) If I can't read or follow your solution, it is wrong and no partial credit will be awarded.

(30 pts) Problem No. 1 (9.16): A government agency received many consumers' complaints that boxes of cereal sold by a company contain less than the advertised weight of 20 oz of cereal with a standard deviation of 5 oz. To check the consumers' complaints, the agency bought 36 boxes of the cereal and found that the average weight of cereal was 18 oz. If the amount of cereal in the boxes is normally distributed, test the consumers' complaint at the 0.05 level of significance. At what confidence level would your decision change?

Confidence Level	99.99%	99.9%	99%	95%	90%	80%
k	3.89	3.29	2.58	1.96	1.64	1.28

**Problem No. 2 (10.28)**: Assume that V(t) and W(t) are both zero-mean wide-sense stationary random processes and let the random process M(t) be defined as follows: M(t) = V(t) + W(t).

(20 pts) (2a) If V(t) and W(t) are jointly wide-sense stationary, determine the power spectral density of M(t) (Hint: find the autocorrelation function):

(10 pts) (2b) If V(t) and W(t) are orthogonal, determine the power spectral density of M(t):

(30 pts) Problem No. 3 (11.25): Consider the system shown to the right in which an output sequence Y[n] is the sum of an input sequence X[n] and a version of X[n] that has been delayed by one unit and scaled (or multiplied) by a factor *a*. Find the cross-power spectral density  $S_{XY}(\Omega)$ .



(10 pts) **Problem No. 4:** You are given a black box with a Gaussian white noise generator connected to it. You are told the box is a linear system. You are asked to go in the lab and measure the power spectral density. Explain how you would do this and how these techniques differ from what you learned in your Signals and Systems course (e.g., ECE 3512).