CSE 505 Problem Set 1

Date: Wednesday, September 24th, 2003
Due date: Wednesday, October 1st, 2003

- **Problem 1**

Consider events A, B, and C with $P(A) > P(B) > P(C) > 0$. Events A and B are mutually exclusive and collectively exhaustive. Events A and C are independent. Can C and B be mutually exclusive?

- **Problem 2**

Find $P(A + (B' + C')')$ in each of the following cases:
a. A, B, C are mutually exclusive events and $P(A) = 3/7$.
b. $P(A) = 1/2$, $P(BC) = 1/3$, $P(AC) = 0$.
c. $P(A'(B' + C')) = 0.65$.

- **Problem 3**

Sonia and Norman are playing a friendly game of "Battleship" where each ship occupies only one square. Each player's grid is formed of $N \times N$ squares.

Sonia places two ships on her grid, one after the other, in the following manner: for each ship, she makes an equally likely choice among all available squares in the grid. What is the probability that the two are adjacent? Note that adjacent squares are squares that share a common *edge*, sharing a common point is not adjacency. In other words, squares on the same diagonal are not considered to be adjacent.

- **Problem 4**

A communication system transmits one of three signals s_1, s_2, and s_3 with equal probabilities. The reception is corrupted by noise, potentially causing the transmission to be changed according to the following table of conditional probabilities:

	s_1 received	s_2 received	s_3 received
s_1 sent	0.8	0.1	0.1
s_2 sent	0.05	0.9	0.05
s_3 sent	0.02	0.08	0.9

For example, if s_1 is sent, then the probability of receiving s_3 is 0.1. The entries of the table list the probability of s_j received, given that s_i is sent i.e., $P(s_j \text{ received}|s_i \text{ sent})$.
a. Compute the (unconditional) probability that s_j is received for $j = 1, 2, 3$.
b. Compute the probability $P(s_i \text{ sent}|s_j \text{ received})$ for $i, j = 1, 2, 3$.