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Mid-Term Exam I, Fall 2002  
EECE-340, Probability and Statistics  
Department of E.E.C.E.  
University of New Mexico, Albuquerque  
Instructor: Balu Santhanam  
Date: 10/04/02, Duration: 50 min.

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### **Instructions**

1. Closed book, closed notes, 1 sheet of notes
2. Calculators allowed
3. Show calculations to obtain partial credit
4. UNM academic honesty policy is in effect.

## Problem # 1.0

The circuit shown in the following represents a telephone communication link. Switches  $\alpha_i; i = 1, \dots, 6$  are open or closed and operate independently of each other. The probability that a switch is closed is  $p$ . Let  $A_i$  represent the event that switch  $i$  is closed.

- (a) In terms of the  $A_i$ 's write the event that there exists at least one closed path from point 1 to point 2.
- (b) Compute the probability of there being at least one closed path from point 1 to point 2.

## Problem # 2.0

The time-to-failure in months,  $X$ , of the light bulbs produced at two manufacturing plants  $A$  and  $B$  obey, respectively, the following CDF's

$$F_X(x) = (1 - e^{-\frac{x}{5}})u(x) \text{ for plant } A$$

$$F_X(x) = (1 - e^{-\frac{x}{2}})u(x) \text{ for plant } B$$

Plant  $B$  produces three times as many bulbs as plant  $A$ . The bulbs, indistinguishable to the eye, are intermingled and sold. What is the probability that a bulb purchased at random will burn at least (a) two months ; (b) five months; (c) seven months?

### Problem # 3.0

A digital communication system transmits binary data but because of noise in the channel the detected symbol at the receiver end is sometimes in error. The probability that a received 1 came from a transmitted 1 is 0.9 and the corresponding probability that a 0 being detected at the receiver actually came from a 0 is 0.95. Assume that a zero is transmitted with probability 0.45. Determine (a) the channel transition matrix  $\mathbf{P}$ , (b) the a posteriori probabilities of ones and zeros, (c) the probability that a one was transmitted given that a one was received.