

**Instructions:** This is an open-book, open-notes exam. There are 5 problems, worth 40 points in all. Put your name in the blanks above. **Show your work!** if there is not enough room, use the back page. Give all numerical answers as **fractions**, or as decimals, correct to at least **3 significant digits**.

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(1) A transmitter send binary bits, 60% 0's and 40% 1's. When a 0 is sent, the receiver will detect it correctly 90% of the time. When a 1 is sent, the receiver will detect it correctly 95% of the time.

(a) What is the probability that a 0 is sent and a 0 is received?

(b) If a 1 is received, what is the probability that a 1 was sent?

(c) If a 0 is received, what is the probability that a 1 was sent?

(2) The lifetime of a component, in years, has pdf  $f(t) = \frac{1}{(1+t)^2}$  and cdf  $F(t) = \frac{t}{1+t}$ , for  $t \geq 0$ .

(a) What is the probability that the component lives at least 3 years?

(b) What is the probability that a component that has lived 1 year will die before the age of 2 years?

(3) The probability of being dealt two pairs in a hand of poker is 0.047539. In a game of poker, you are dealt 40 hands.

(a) Find the probability that you will be dealt **exactly** 4 times two pairs.

(b) Find the probability that you will be dealt two pairs 3 times or more.

(4) At a large urban University, the average SAT score of an entering freshman is 1100, with a standard deviation of 100.

(a) What is the 75% percentile of the freshman class?

(b) What percentage of those scoring above 1000 have a SAT score over 1200?