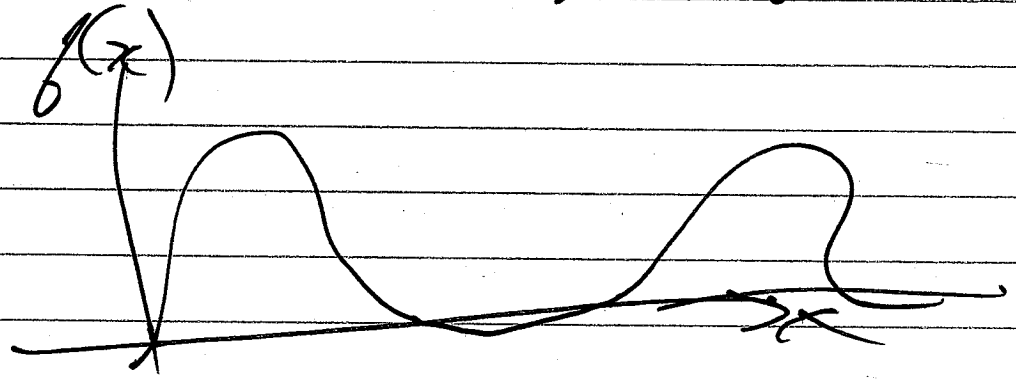
CI4 3/2/20 - 1

MARKOV - NONNEGATIVE DIST

KNOW MEAN



$$P[X \geq a] \leq \frac{E[X]}{a}$$

AVERAGE HT OF STUDENT = 1.5 m.

$$P[H > 2m] \leq \frac{1}{2}$$

$$E[t] = \int_0^\infty t f(t)\,dt$$

$$= \int_0^a t f(t)\,dt + \int_a^\infty t f(t)\,dt$$

$$E[t] = \int_a^\infty t f(t)\,dt$$

$$\geq \int_a^\infty a f(t)\,dt$$

$$E[t] \geq a \underbrace{\int_a^\infty f(t)\,dt}_{P(X \geq a)}$$

$$P(X \geq a) \leq \frac{E[X]}{a}$$

~~CHEBYSHEV~~

$$P[|X - m| > a] \leq \frac{\sigma^2}{a^2}$$

SAT $\mu = 500$ $\sigma = 100$ 3

$P[X - 500 \mid \geq 200] \leq \frac{10000}{40000} = \frac{1}{4}$

4.7 TRANSFORM

SKIP

LIKE FOURIER ETC.

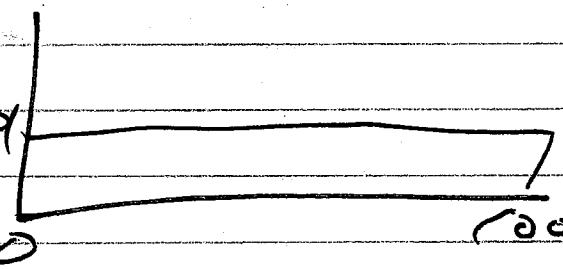
4.8 p 189

~~PROBL~~

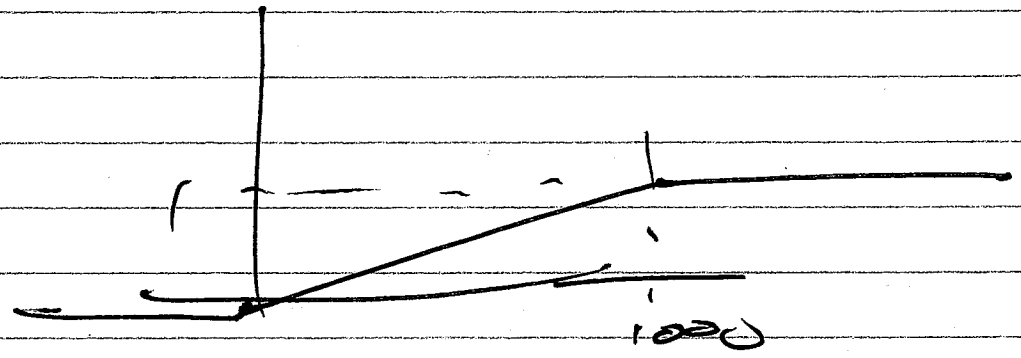
WANT PROB DIST FOR BULB'S LIFETIME GIVEN IT'S GOOD AFTER 500 HRS.

$f(t)$ $F(t)$ t: LIFETIME.

$f(t)$:



$$F(t) = \begin{cases} 0 & t \le 0 \\ \frac{t}{1000} & 0 \le t \le 1000 \\ 1 & t > 1000 \end{cases}$$



$R(t)$ RELIABILITY

$= P[T \ge t] = 1 - F_T(t)$

$R(750) = \frac{1}{4}$

MTTF = EXPECTED VALUE OF LIFETIME

$E[T] = \int_0^{1000} f(t)\,dt$

$= \int_0^{1000} .001\,dt = 500$

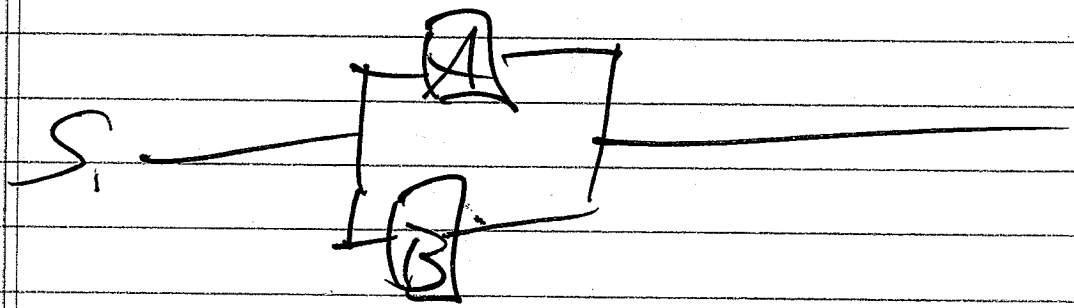
$$E[T] = .001 \int_0^{1000} dt$$

$$t \Big|_0$$

5

4.8.2. RELIABILITY OF SYSTEMS

- PUT 2 SYSTEMS IN PARALLEL
NEED 1 TO WORK



$R_A(t) = P[A \text{ WORKS @ } t]$

R_B . . . .

$R[S] = P_S[T > t] =$

$1 - R[S] = P[T \leq t]$

$= P_A[T \leq t] \; P_B[T \leq t]$

6

$$1-R_S[t] = \left(1-R_A[t]\right)\left(1-R_B[t]\right)$$

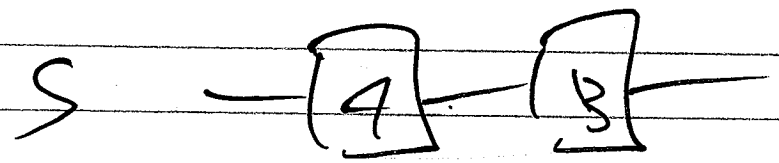
MAYBE $R_A(t) = .9$

$R_B(t) = .9$

$1-R_S[t] = (1-.9)(1-.9) = .01$

$R_S[t] = .99$

SERIES

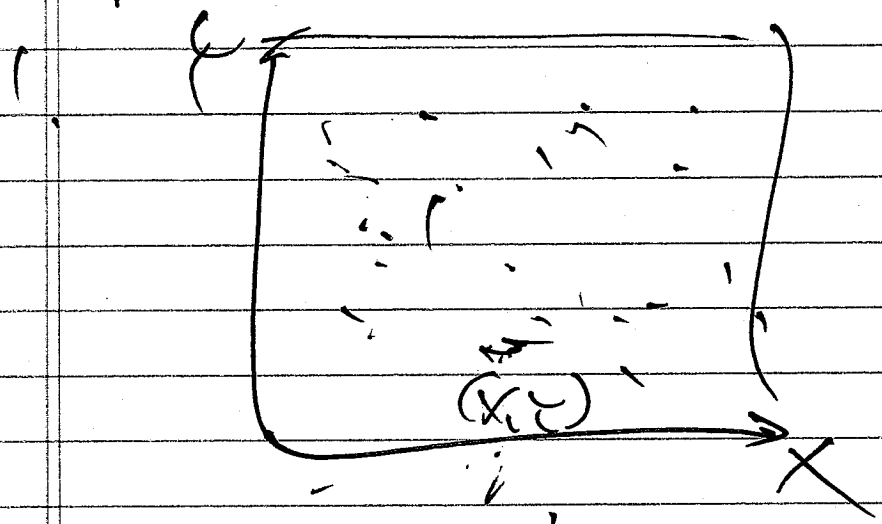


NEED BOTH A & B WORKING.

$R_S[t] = R_A[t]\,R_B[t]$

$= .9 * .9 = .81$

2.3 & 2.5 PAIRS OF R.V.



Ex. TOSS 2 DICE

EACH S. $\{1 \ldots 6\}$

NOT CORRELATED.

X, Y $U[0,1]$

$f_X(x) = 1 \quad 0 \le x \le 1$

0 ELSE.

$Z = MIN(X,Y)$

WHAT IS $f_Z(3)$

$$F_Z(z) = P[Z \le z]$$
$$= P[MIN(X,Y) \le z]$$
$$= P[X \le z \mid Y \le z]$$
$$= P[$$

IDEA: USE COMPLEMENT

$$P[MIN(X,Y) \ge z] = 1 - F_Z(z)$$
$$= P[X \ge z \text{ and } Y \ge z]$$
$$= P[X \ge z]\, P[Y \ge z]$$
$$1 - F_Z(z) = (1 - F_X(z))(1 - F_Y(z))$$

z

$1 - z$

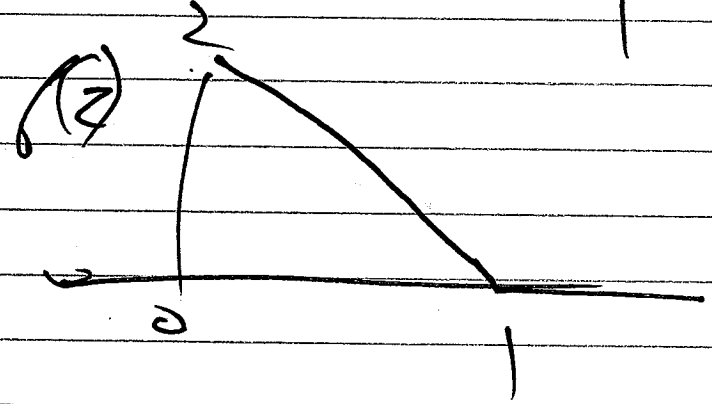
$(1-z)^2$

$$F_Z(z) = 1 - (1-z)^2 = 2z - z^2$$
$$f_Z(z) = 2 - 2z$$

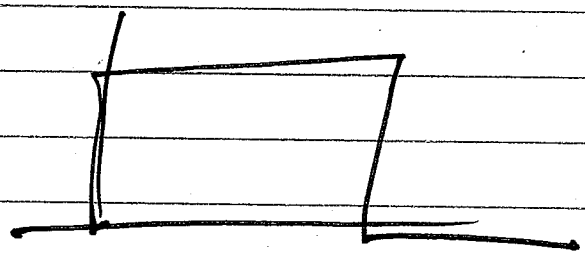
$f_Z(z)$

$\uparrow$

$MIN(X, Y)$



f_X, f_Y



DEFINE $W = MAX(X, Y)$

$F_W(w) = w^2$

$f_W(w) = 2w$