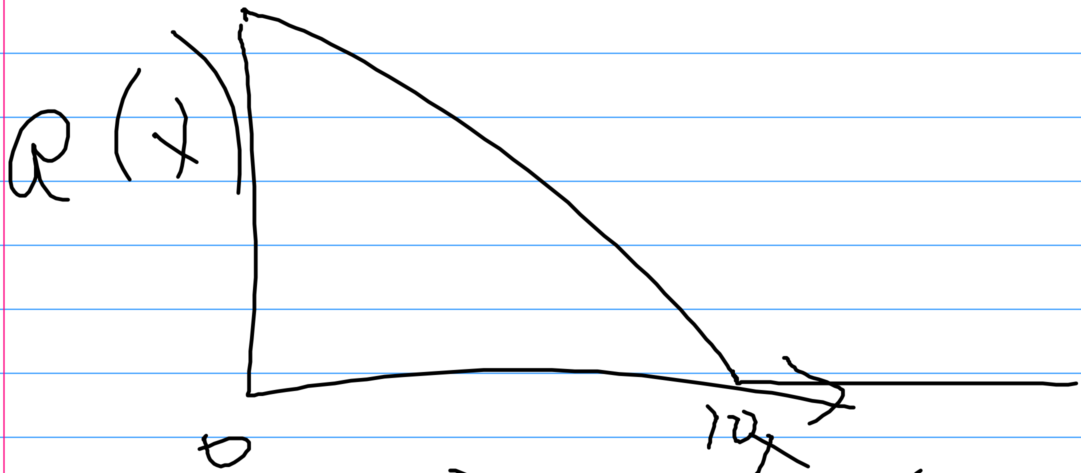
Reliability for U[0,10]

f(x) = .1 in 0..10
F(x) = x/10 for 0<=x<=10
0 for x<0
1 for x>10

R(x) 1-x/10 R(5) = .5 R(9) = .1



$$R(x) = 1 - F(x)$$

f(x)·dx = prob dies between time x and time x+dx for small dx

event: object dies

P[dies between 1 and 2] = f(x) dx = .1 * 1 = .1

P[dies between times a and b] = $\int_a^b f(x)\,dx$

Max of 2 r.v.

Your car has 2 headlights. You can drive at night so long as at least one works. Analyze this. What's the prob dist of the max life?

r.v. of 1st headlight dies is U[0,100]. Call that r.v. X.

Y is r.v. for 2nd.

define Z=max(X,Y).

def of F_Z(z) = P[Z<z]   = P[max(X,Y)<z] = P[X<z & Y<z]

assuming two bulbs are independent

P[X<z & Y<z] = P[X<z] P[Y<z] = F_X(z) F_Y(z)

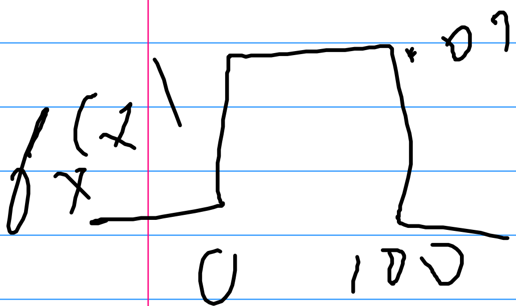
F_Z(z) = F_X(z) F_Y(z)

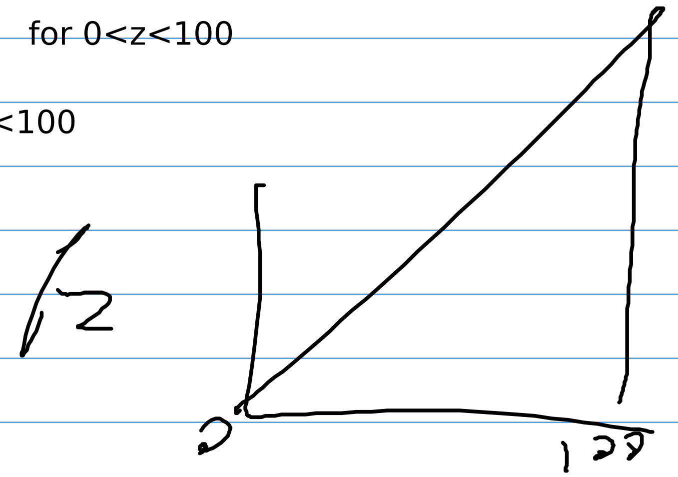
f_X(x) = .01   so F_X(x) = x/100   for 0<x<100

= F_Y(x)

F_Z(z) = z^2 / 10000   for 0<z<100

f_Z(z) =   z/5000   for 0<z<100



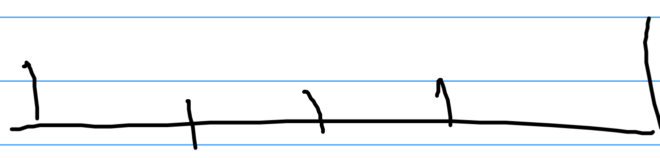


uppercase P means probability. Uppercase E means expected

E[Z] =

$$\int_0^{100} \frac{z^2}{5000}\,dz = \frac{z^3}{15000}\Bigg|_0^{100}$$

$= 67$



define Z to be max of N uniform r.v.   U[0,1]

F_Z(z) = z^N

f_Z(z) = N* z^(N-1)   E[Z] = N/(N+1)

I have a bulb and a spare.   I use the 1st until it fails than swap in the 2nd and use it until it fails. Then start worrying about the grue.

X, Y are r.v. for two bulbs.   Define Z = X+Y.   X,Y defined to be U[0,1]. What is f_Z(z)?

Aside: let r.v. be discrete.   Each r.v. is # heads for 1 coin toss. That's Bernoulli.
Z = sum of N coins. That's Binomial.   /aside

f_Z(z) $= \int_0^2 f_X(x) f_Y(z-x)\,dx$

$= \int_0^1 f_X(x) f_Y(z-x)\,dx + \int_1^z f_X(x) f_Y(z-x)\,dx$

$F_Z(z) = P[x+y < z]$

suspend this until next class. I'll get a nice motivating example.

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failure rate: assume X: U[0,1].