Week 1
Problem 5

Part A

2,050 Emergency calls in 12 Months

$E(X)$ $2050/12 = 170.8$

Estimate calls/month: 171 calls

Part B

Estimated variation $171 - 170.8 = 0.2$

$E(X)^2$ $0.2^2 = 0.4$

$171 + 0.4 = 171.4$ monthly range 170.6 to 171.4 calls

$171 - 0.4 = 170.6$

Part C

Yearly range of calls 2047.2 to 2056.8

[redacted] Our estimate is within this range.

Part D

$171 \cdot 0.4 = 68.4$ 69 Years

Week 1 Problem 6

I really have no clue how to do this Anna tried explaining but it's not making sense in my head.

Part A $E = \sum_{x=0}^{\infty} x \cdot p(x) = \sum_{x=0}^{\infty} \frac{x \cdot e^{-\lambda} \lambda^{x}}{x!} = e^{-\lambda} \sum_{x=1}^{\infty} \frac{\lambda^{2}}{(x-1)!}$

$= e^{-\lambda} \sum_{y=0}^{\infty} \frac{\lambda^{y+1}}{y!}$ where $y = x-1$

$= \lambda e^{-\lambda} \sum_{y=0}^{\infty} \frac{\lambda^{y}}{y!} = e^{-\lambda} \cdot \lambda e^{\lambda}$

$E = \lambda = np$

$EN_t = \lambda t$

[redacted] $V = E(X)^2 - E(X)^2$

$= \sum_{x=0}^{\infty} x^2 p(x) - \lambda^2$ λ = mean of poisson

$= \cancel{\sum_{x=0}^{\infty} x^2 \cdot \frac{e^{-\lambda}\lambda^{x}}{x!} - \lambda^2 = e^{-\lambda} \sum_{x=1}^{\infty} \frac{x \cdot \lambda^{x}}{(x-1)!} - \lambda^2}$

$= \cancel{e^{-\lambda} \sum_{x=1}^{\infty} ((x-1)+1) \cdot \frac{\lambda^{x}}{(x-1)!} - \lambda^2}$

$= \cancel{e^{-\lambda} \left[\sum_{x=1}^{\infty} \frac{(x-1)\lambda^{x}}{(x-1)(x-2)!} + \sum_{x=1}^{\infty} \frac{\lambda^{x}}{(n-1)!} \right] - \lambda^2}$

$= \cancel{e^{-\lambda} \sum_{x=2}^{\infty} \lambda^{x}}$

Part B $P(N=18) = \frac{e^{-2}(\lambda)^{n}}{n!} = \frac{e^{-171}(171)^{18}}{18!}$

in R essentially $\emptyset$

Part C 95% level interval

np

Part D The method in part C reminds me of the first book proof in part a $x \cdot p(x)$.

Week 1
Problem 11

16 Bombers

		Exposure
2 Options:	Low- air defense missile exposure	1 min
	High- surface to air missile exposure	5 min

3 Stages: 1) Detect Target 2) Acquire Target (Lock on)
3) Hit Target

AD Type	P_{detect}	$P_{acquire}$	P_{hit}	Firing Rate	
LOW	0.90	0.80	0.05	Guns	20 shells/min
HIGH	0.75	0.95	0.70	M.I.	3/min

Part A

L = time flying low (mins)
H = time flying high (mins)
Goal: maximize ~~time~~ # of bombers that survive (I'm going to flip this and minimize the probability a bomber is detected, targeted and hit.
Pall = prob. bomber is detected/targeted/hit
Pall.low = 0.036
Pall.high = 0.498
To maximize the number of bombers that survive, the optimal flight path is low. It is the least casualty producing as it has the smaller Pall value.

Part B

D = chance the bomber destroys the target
Goal: determine chance of success (target destroyed for this mission
S = chance of success

- the only time D is applicable is before the bomber meets Pall.low or Pall.high, so that will be shown as 1-Pall.low and 1-Pall.high (i.e. the time before the bomber is hit)
- the chance of success will be time bomber is not hit times the chance the bomber destroys the target

1-Pall.low = 0.964
1-Pall.high = 0.502

S.low = not.Pall.low • D = 0.6748

S.high = not.Pall.high • D = 0.3514

Since we determined the optimal path for this mission is to fly low, the probability that the bomber successfully makes it to the target w/o being detected/acquired/hit and then destroys the target is 0.6748

Part D

D = 0.70, that an individual bomber can destroy the target

((not.Pall.low)•D)•B = 0.95

Look at the sensitivity when changing D

Sensitivity Analysis on R

While the values do change when hovering around a 70% destroy chance, they don't more too much and all around still have a high success rate for the mission.

Part C

Goal: determine the min. number of bombers necessary for a 95% chance of success

Thought: if each bombers success is individual of the others then we could determine the # necessary by solving 0.6748 • B = 0.95 where B is the number of Bombers 0.95/.6748 = B

B = 1.4 Since we can't have .4 of a bomber, the minimum number of bombers necessary is 2.

Part E

Bad weather decreases Pdetect and D. They are reduced in the same proportion.

Pdetect cut in half, now 0.45. Pall.low.new = 0.018 is the probability the bomber is taken down.

1 - 0.018 = 0.982

D is cut in half now 0.35 0.982 • .35 = 0.3437

Probability target is successfully destroyed = 0.3437

The bomber defeating the target has an advantage.