Discussion Section #4

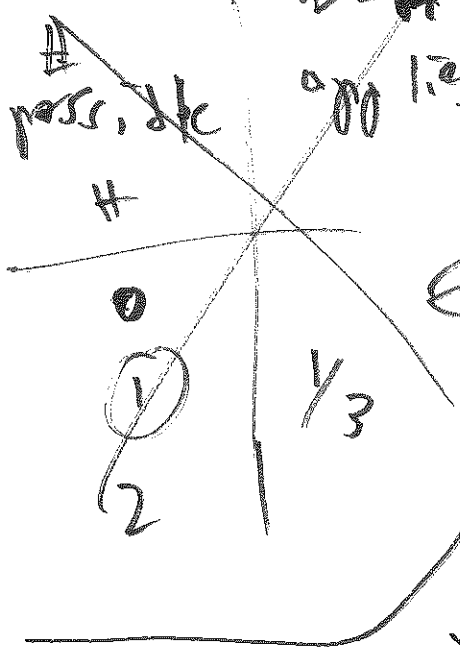
Problems from Discussion Section 3, pp. R-38 →

AMS 7 3A Fall 18

#5(a) R-39

P(exactly 1 H in 2 tosses, fair coin) = P(A)

if ELM



but ELM doesn't apply in this argument

is bogus

P(H) = 50% toss independ.

2nd toss

1st toss	H	T
H	HH	HT
T	TH	TT

ELM? yes

So P(A) = 2/4 toss = 50% ; problem statement true

P(A) = P(1st toss H & 2nd toss T (no overlap mutually ↓ excl. 1st toss T & 2nd toss H) or)

= P(1st H & 2nd T) + P(1st T & 2nd H)

(indep) = P(1st H) · P(2nd T) + P(1st T) · P(2nd H)

(fair) = 1/2 · 1/2 + 1/2 · 1/2

= 1/2

5 (b) P-40

P(3 on any single dice roll) = ? ②

2nd die

sum

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

1st die

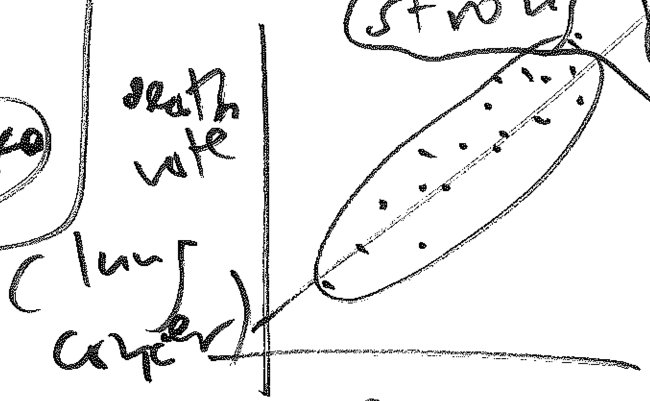
Q: ELM on these 36 possibilities?

A: yes

$$P(3) = \frac{2}{36} = \frac{1}{18} \doteq 5.6\%$$

$$P(7) = \frac{6}{36} = \frac{1}{6} \doteq 16.7\%$$

6 p. R-40



strong positive association

R. Doll 1958

1 dot for each country

CS = constitutional story

$$P\left(\begin{array}{c}\text{both smokers} \\ \text{d.e first}\end{array} \middle\| CS\right) = P(HH) = \frac{1}{4} = 25\%$$

fair coin

$P(\text{all 9 smokers die first of CHD} \mid CS) = P(\underbrace{H\,H \cdots H}_{9})$

= coronary heart disease

$= P(H_{1st} \,\&\, H_{2nd} \,\&\, \ldots \,\&\, H_{9th})$

$\overset{\text{indep}}{=} P(H_{1st}) \cdot P(H_{2nd}) \cdots P(H_{9th})$

$\overset{\text{IID}}{=} P(H)^9 \longleftarrow 9 \longrightarrow$

$\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\cdots\left(\frac{1}{2}\right)$

$= \frac{1}{2^9} = \frac{1}{512} \doteq 0.2\% = 0.00195$

we temporarily pretend (CS) is true; but if (CS) true, data that we observe is extremely unlikely; therefore (CS) is probably false. (probability version of proof by contradiction)