STAT 131
7 Apr 20

[JJ office 1.5-hour session]

(i) P(win) =

$P(1^{ST}\ \text{ⓒ}) = \frac{13}{52} = \frac{1}{4} = 25\%$ (ⓒ = club)

(1) FLM? e.g.: well-shuffled ← natural language

problem: natural language → (math) → toward solution

↓ solve math → bring answer back to natural language

applied math problem-solving process

(ii) P(win) = $P(1^{ST}\ \text{ⓒ}$ or $2^{nd}\ \text{ⓓ})$ (ⓓ = diamond)

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

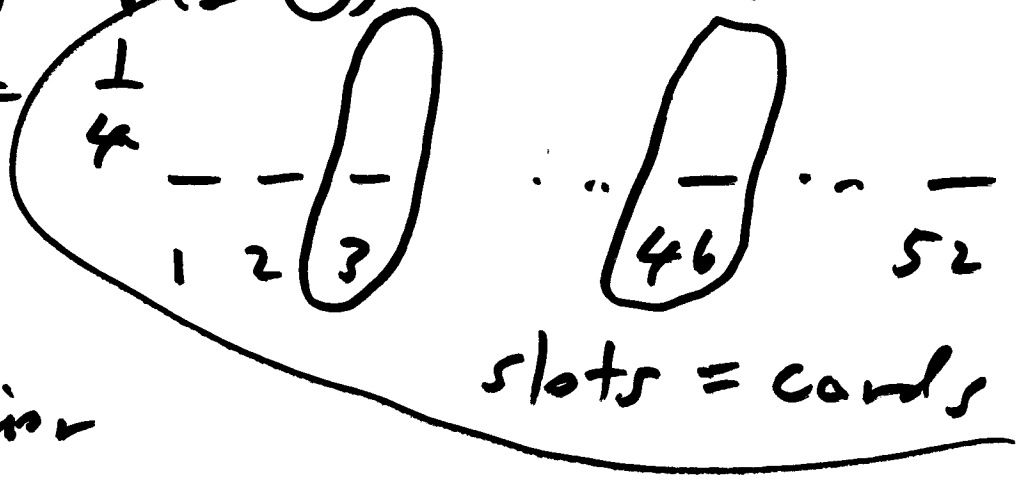
$$= \frac{1}{4} + P(2^{nd} \text{ ①})$$

$$\frac{1}{4} - P(1^{st} \text{ ② and } 2^{nd} \text{ ①})$$

depends on 1st card

$P(2^{nd} \text{ ①}) = P(1^{st} \text{ ②})$

$= \frac{1}{4}$



if well shuffled, pol. behavior in any single slot is <u>same</u> as in any other single slot (not knowing anything about what lands in what other slots)

A B

$P(1^{st} \text{ ② and } 2^{nd} \text{ ①}) = ?$

first second

$P(A \text{ and } B) = P(A) \cdot P(B|A)$ (3)

$= P(B) \cdot P(A|B)$ ✗

$= P(1^{ST}\text{ ♣}) \cdot P(2^{ND}\text{ ♣} \mid 1^{ST}\text{ ♣})$

$= \frac{13}{52} \cdot \frac{13}{51}$

(d)(ii) $P(\text{win}) = \frac{1}{4} + \frac{1}{4} - \frac{1}{4} \cdot \frac{13}{51}$

$= \frac{89}{204} \doteq 43.6\%$

$\doteq 44\%$

(d)(i) $P(\text{win}) = \frac{1}{4} = 25\%$ ← choose ♣

NNNNN	①	0 T-s	$1 = \binom{5}{0}$
TNNNN NTNNN ⋮ NNNNT	⑤	1 T-s	$\frac{5}{5} = \binom{5}{1}$

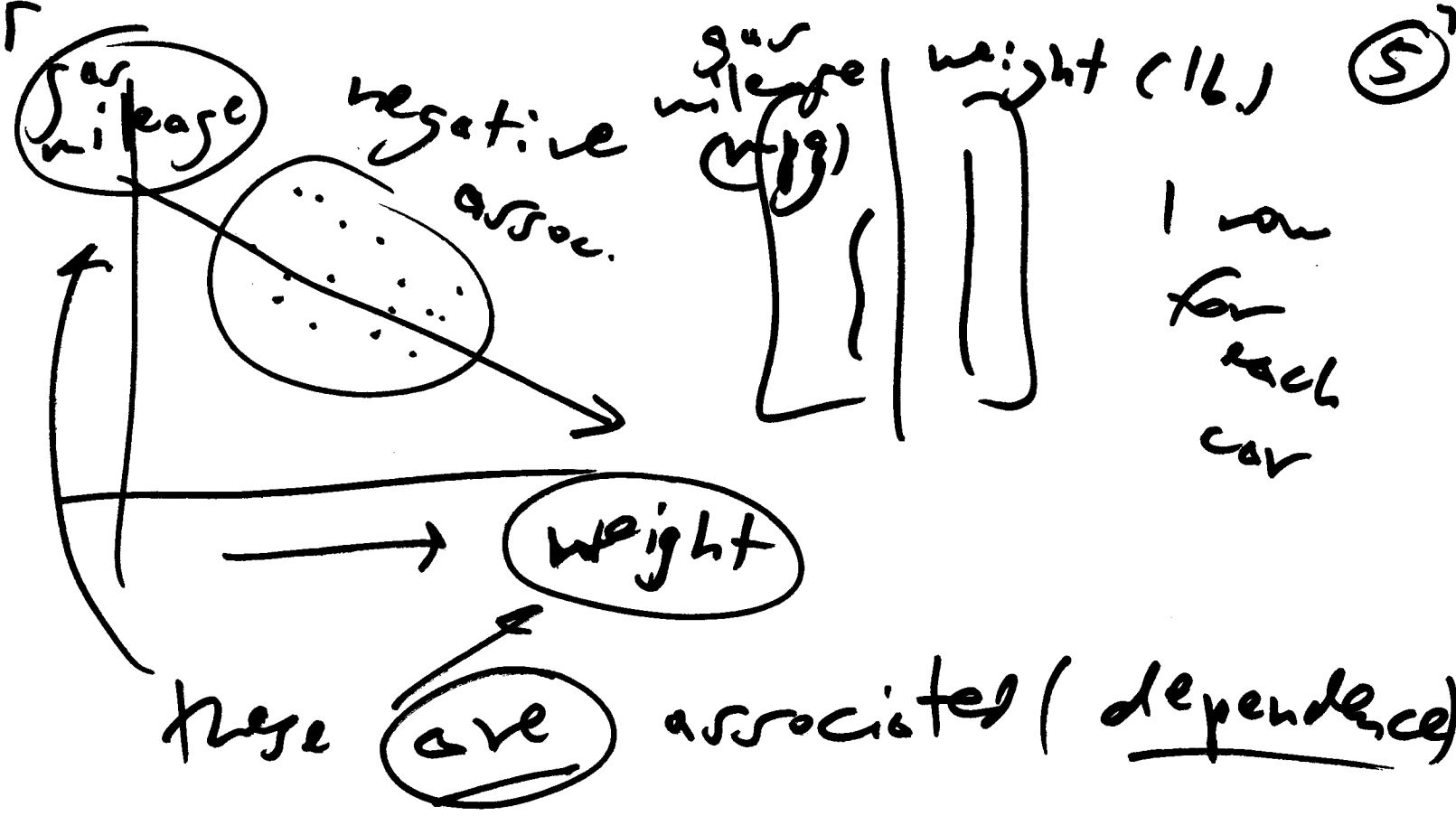
TTNNN
TNTNN
⋮
TNNNT
NTTNN (10)
⋮

2 T-s $\binom{5}{2} = 10$

$$
\begin{array}{c}
1 \\
1 \quad 1 \\
1 \quad 2 \quad 1 \\
1 \quad 3 \quad 3 \quad 1 \\
1 \quad 4 \quad 6 \quad 4 \quad 1 \\
1 \quad 5 \quad 10 \quad 10 \quad 5 \quad 1
\end{array}
$$

$\binom{5}{0}$ $\binom{5}{1}$ $\binom{5}{2}$ $\binom{5}{3}$ $\binom{5}{4}$ $\binom{5}{5}$

Whickham study | RCT? no
obs. study? yes < T, C



I (outcome): $\begin{cases} 1 & \text{if dead in 1992} \\ 0 & \text{else} \end{cases}$

I (SCF): $\begin{cases} 1 & \text{if current smoker in 1992} \\ 0 & \text{else} \end{cases}$

I_4 ((P)CF): $\begin{cases} 1 & \text{if 18-64 in 1992} \\ 0 & \text{else} \end{cases}$

Q: dog smoking cause ↑ in p(dead) in 1972 in 1992?

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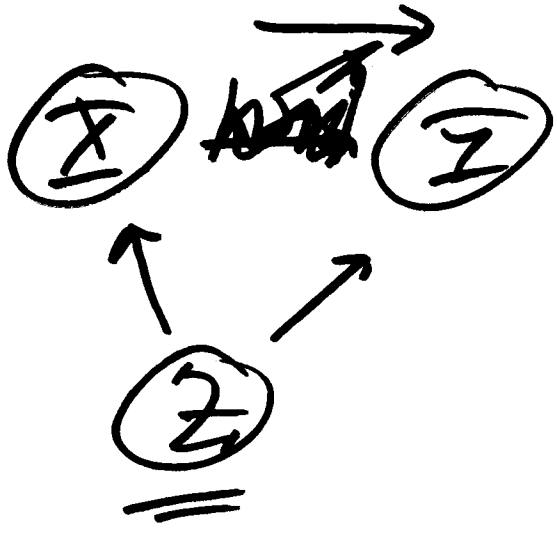
cause → effect

(smoking in 1972) → (dead in 1992)

(X) (Y)

Z is a (P)CF iff

- (1) Z, X assoc.
- (2) Z, Y assoc.



A — B

A, B assoc.

A → B

A is a cause of B

Q: Is age a PCF in this study?

A: plausible Z_1, X assoc? yes

(age in 1972) (smoking in 1992)

age ↑ P(smoker) ↓

Z_1, Y assoc?

(age in 1972) (dead in 1992)

age ↑ P(dead) ↑

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current smoker in 1972

$P(S) = \frac{582}{1314} \doteq 44.3\%$ (Table 2)

ELM? yes: randomly chosen women from table 3

(Table 1)

$P(S \mid 18\text{-}64) = \frac{533}{1072} \doteq 49.7\%$

(Table 2)

$P(S \mid 65+) = \frac{49}{242} \doteq 20.2\%$