Probability

uncertainty is pervasive

reason anyway

exploit it.

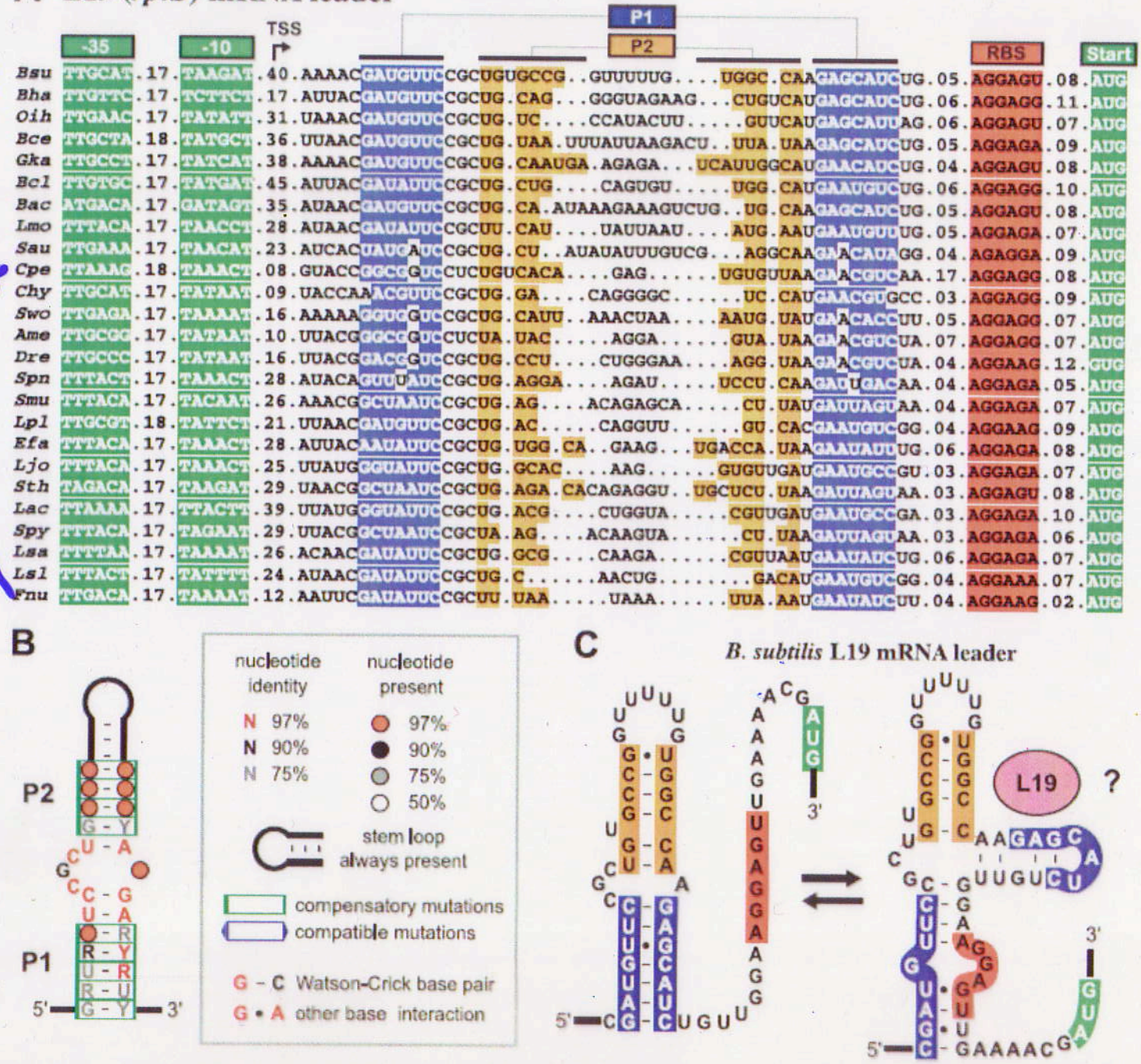


Figure 3. Putative Autoregulatory Structure in L19 mRNA Leaders

Sample Space S a set

Probability Distribution

$$p : S \to \mathbb{R}$$

$$\forall s \in S \quad 0 \le p(s) \le 1$$

$$\sum_{s \in S} p(s) = 1$$

Uniform distribution $p(s) = \frac{1}{|S|}$

$\{H, T\}$

$\{1, 2, \ldots, 6\} = S_{dice}$

an Event $E \subseteq S$

$E = \{1, 3, 5\} \subseteq S_{dice}$

$P(E) = \frac{1}{2}$ $\quad P(E) = \sum_{e \in E} p(e)$

$$S = \{1..6\} \times \{1..6\}$$

$$E_0 = \{(1,1)\}$$

Assuming uniform

$$P(E_0) = \frac{1}{36}$$

$$E_1 = \{(i,j) \mid i+j = 7\}$$

$(1,6)\ (2,5)\ (3,4)\ (4,3)\ (5,2)\ (6,1)$

$$P(E_1) = \frac{6}{36} = \frac{1}{6}$$

Cards
4 suits, 13 values

4 of a kind among 5 cards

$$\frac{C(13,1) \cdot C(4,4) C(48,1)}{C(52,5)} = \frac{13 \cdot 48}{2.6M}$$

"Full House" 3 of one kind
& 2 of another

$$\frac{P(13,2)\,C(4,3)\cdot C(4,2)}{C(52,5)}$$

$$= \frac{3744}{2.6M}$$

$$\overline{E} = S - E$$

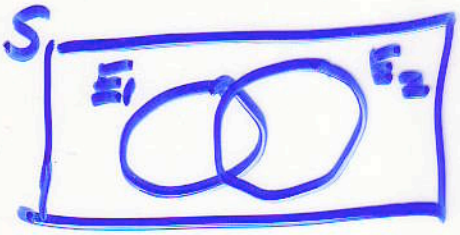
$$P(\overline{E}) = 1 - P(E)$$

E = 10 bit strings with at least one 0.

$\overline{E}$ = 10 bit strings all 1's

$$P(\overline{E}) = 1/1024$$

$$P(E) = 1 - 1/1024$$



$P(E_1 \cup E_2)$

$= P(E_1) + P(E_2) - P(E_1 \cap E_2)$

$S = \{1, 2, \ldots 100\}$

$P($ random $i \in S$ is divisible by 2 or $5)$

$E_1 = \{i \mid 2 \mid i\} = 2, 4, 6, \ldots 100$

$E_2 = \{i \mid 5 \mid i\} = 5, 10, 15 \ldots 100$

$|E_1| = 50$

$|E_2| = 20$

$|E_1 \cap E_2| = |\{10, 20, \ldots\}| = 10$

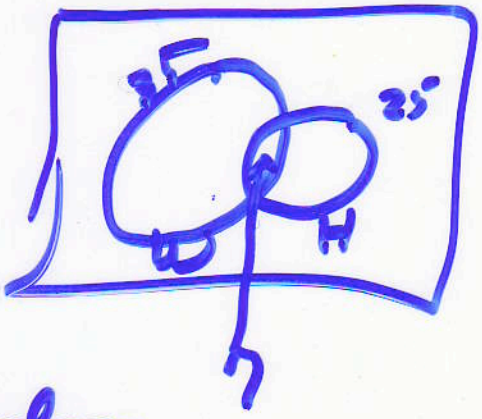
$P(E_1 \cup E_2) = \frac{50 + 20 - 10}{100} = .6$

100 people

35 workaholics

25 high blood pressure

7 both



For a random individual X

P(X is a workaholic) = P(W) = $\frac{35}{100}$

P(H) = $\frac{25}{100}$

P(X has h.b.p given X is workaholic)

$P(H \mid W) = \frac{7}{35} = \frac{1}{5}$

↑ "given"

defn

$$P(H \mid W) = \frac{P(H \cap W)}{P(W)}$$

Strings of 4 bits

$P($ 2 consecutive 0's $\mid$ 1st bit is 0 $)$

T | F

$P(T \cap F) = 5/16$

0000
0001
0010
0011
0100

5

$P(F) = 1/2$

$$P(T \mid F) = \frac{5/16}{1/2} = 5/8$$