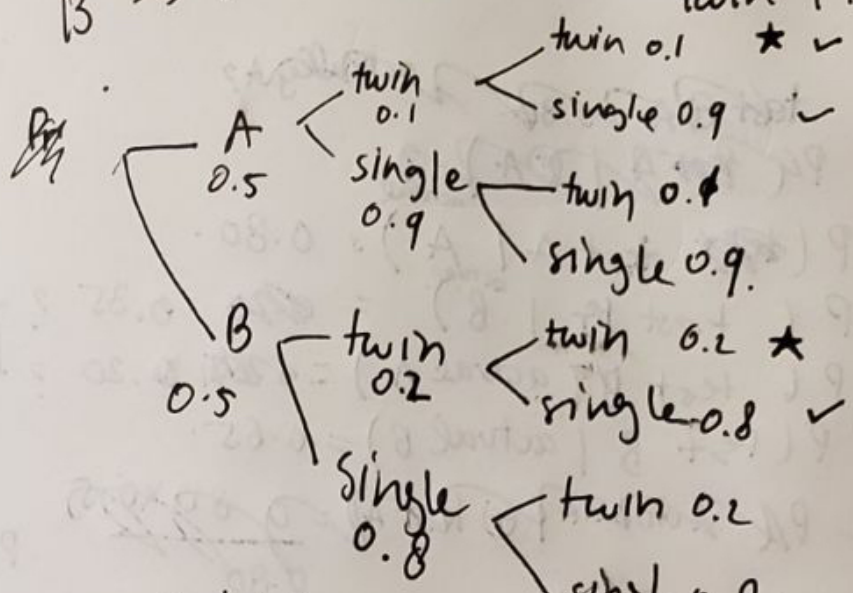
Panda: 2 species, look alike.

2H1. A → twins 10%. B → twins 20%.

$\Pr(\text{next birth twin} \mid \text{first birth twin})$.



$$\Pr(\text{next birth twin} \mid \text{1st birth twin}) = \frac{0.5(0.1^2+0.2^2)}{0.5(0.1\times0.9+0.2\times0.8)+0.1^2+0.2^2)}$$

$$= 16\%$$

2H2. $\Pr(A \mid \text{1st birth twin}) = \frac{0.5(0.1)}{0.5(0.1+0.2)} = \frac{1}{3}$?

2H3. cont'd 2H2, 2nd birth: single.

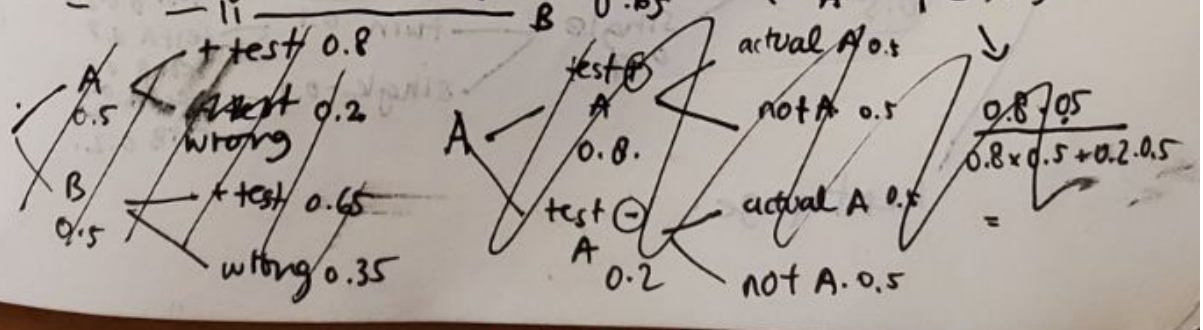
$$\Pr(A \mid \text{1st birth twin, 2nd birth single}) = \frac{0.5(0.9\times0.1)}{0.5(0.9\times0.1+0.2\times0.8)}$$

$$= \frac{0.09}{0.09+0.16} = \frac{0.09}{0.25} = 36\%$$

2H4. imperfect test

⊢ correctly identifies spec. A 0.8, B 0.65

$\Pr(\text{actually A} \mid \text{test} \oplus A)$?



2H4 imperfect test

correctly identifies A 0.8 } incorrectly identifies A, actual B = 0.2?
B 0.65 }

~~test ⊕A 0.80~~ ~~actually A?~~

~~P(test A | ⊕A)~~ actual ?

P(~~test~~ test A | A) = 0.80.

P(test A | actual B) = ~~0.20~~ 0.35 ? } not the other way around

P(test B | actual A) = ~~0.80~~ 0.20 ?

P(test B | actual B) = 0.65.

~~P(actual A | ⊕ test A) = 0.80 × 0.5~~ P(A | test A)?
0.80

$$P(A \mid \text{test A}) = \frac{P(\text{test A} \mid A) \cdot P(A)}{P(\text{test A})}$$

$$P(\text{test A}) = P(\text{test A} \mid A)\,P(A) + P(\text{test A} \mid B)\,P(B)$$

$$= 0.8 \times 0.5 + 0.35 \times 0.5$$

$$= 0.4 + 0.175 = 0.575$$

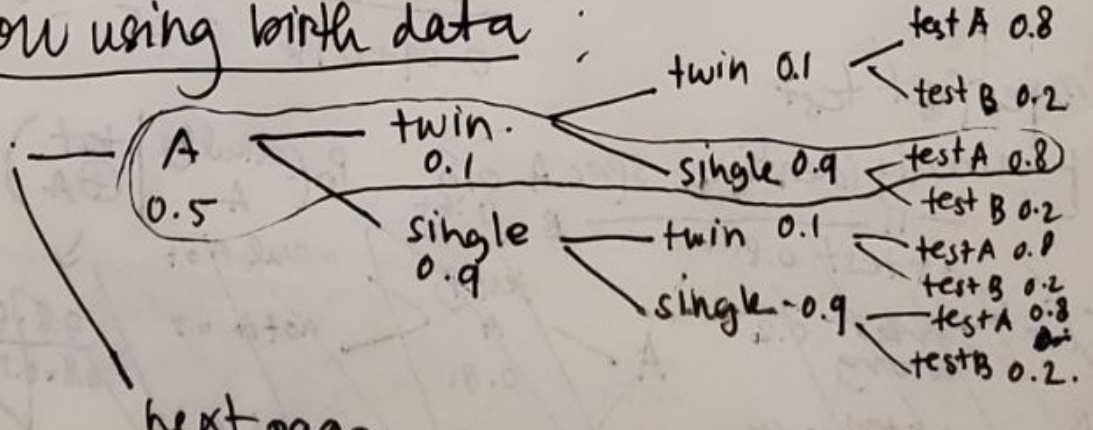
$$P(A \mid \text{test A}) = \frac{0.8 \times 0.5}{0.575} = \frac{0.40}{0.575} = 69\%$$

but if it were the other way around -

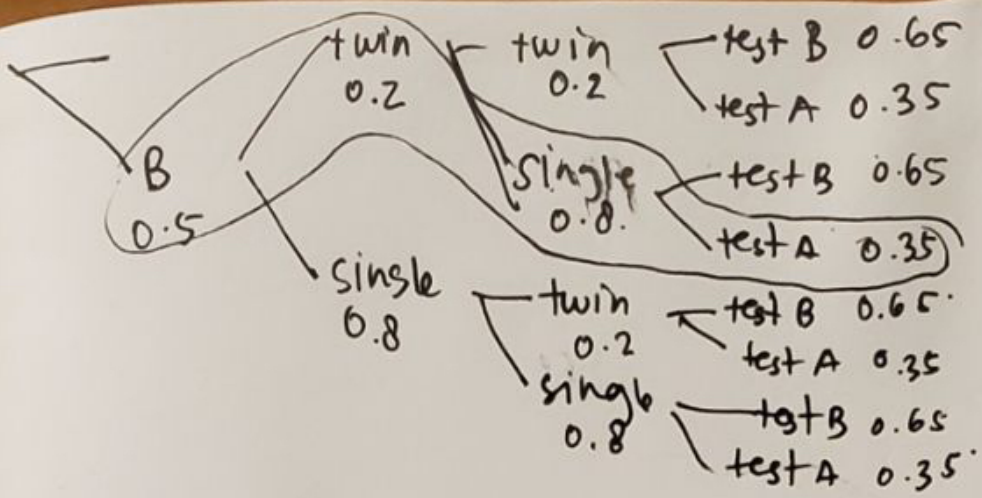
$$P(\text{test A}) = 0.8 \times 0.5 + 0.2 \times 0.5 = 0.5 \;\; ??$$

$$P(A \mid \text{test A}) = 0.8 \;\; ??$$

Now using birth data:



next page.



$P(A \mid \text{test A})$?

$P(\text{twin, single, test}) \rightarrow$ actually A, given test A?

$$\frac{0.5 \times 0.1 \times 0.9 \times 0.8}{0.5 \times 0.1 \times 0.9 \times 0.8 + 0.5 \times 0.2^2 \times 0.8 \times 0.35} = \frac{0.72}{0.72 + 0.56}$$

$$= 0.5625$$