

Part B Probability

$$\text{Sensitivity} = 0.993 = P(+|d)$$

$$\text{Specificity} = 0.9999 = P(-|nd)$$

$$P(d) = 0.000025$$

d = disease

nd = no disease

+ = positive test

- = negative test

→ looking for has disease given positive test or $P(d|+)$ ←

$$\text{Use Bayes' Rule: } P(d|+) = \frac{\underset{\substack{\uparrow \\ \text{sensitivity}}}{P(+|d)} \times \underset{\substack{\uparrow \\ \text{disease}}}{P(d)}}{\underset{\substack{\uparrow \\ \text{use total probability rule}}}{P(+)}}$$

$$P(+)=P(d) \times P(+|d) + P(nd) \times P(+|nd)$$

$$\rightarrow P(nd) = 1 - P(d) = 0.999975$$

$$\rightarrow P(+|nd) = 1 - \text{specificity} = 1 - 0.9999 = 0.0001$$

$$P(+)= (0.000025 \times 0.993) + (0.999975 \times 0.0001) = 0.0001248225$$

→ Put back into Bayes' formula

$$P(d|+) = (0.993 \times 0.000025) / 0.0001248225 = 0.1989 \text{ or}$$

19.89% probability of disease given positive test