

Starter Quiz

1. $P(A \cap B) = 0.12$ and $P(B) = 0.3$. Find $P(A \mid B)$.
- _____
2. Prevalence 10%, sensitivity 80%, specificity 90%. Find $P(D \mid +)$ to three decimal places.
- _____
3. Each of 100 independent observations has standard deviation $\sigma = 20$. What is the standard error of their mean?
- _____
4. If $P(A) = 0.5$, $P(B) = 0.4$ and $P(A \cap B) = 0.2$, then A and B are independent.
- ☐ True ☐ False
5. Holding the common observation variance fixed for independent observations, multiplying the sample size by 4 changes the mean standard error by a factor of
- ☐ 2
- ☐ 1/2
- ☐ 1/4
- ☐ 4
6. A first card drawn from a standard 52-card deck is an ace and is not replaced. Find the probability the second is an ace, to three decimal places.
- _____
7. Two disjoint events, each with positive probability, can be independent.
- ☐ True ☐ False
8. In the original hypothetical 2% model, 20 of the 9,330 negative results have the condition. Find the probability of the condition given a negative result, to six decimal places.
- _____
9. When can two test false-positive rates of 0.05 be multiplied to obtain a joint false-positive rate of 0.0025?
- ☐ Whenever the same test is used twice.
- ☐ Whenever the condition is rare.
- ☐ Whenever the two results are taken on different days.

10. The mean of any finite iid sample with finite variance has an exactly normal distribution.

☐ True ☐ False

1. **0.4**

$P(A \mid B) = P(A \cap B) / P(B) = 0.12 / 0.3 = 0.4$.

2. **0.471**

The positive routes are $0.10 \times 0.80 = 0.08$ and $0.90 \times 0.10 = 0.09$, so the posterior is $0.08 / (0.08 + 0.09) = 8/17 \approx 0.471$.

3. **2**

The standard error of the mean is $\sigma / \sqrt{n} = 20 / \sqrt{100} = 20/10 = 2$.

4. **True**

True. A and B are independent exactly when $P(A \cap B) = P(A)P(B)$, and $0.5 \times 0.4 = 0.2$.

5. **1/2**

$\sqrt{4} = 2$ in the denominator.

6. **0.059**

Three aces remain among 51 cards, so the conditional probability is $3/51 = 1/17 \approx 0.059$.

7. **False**

Their intersection has probability zero but the product of their probabilities is positive.

8. **0.002144**

The negative result defines the denominator: $20/9330 \approx 0.002144$. This is not the false-negative rate $20/200$.

9. **When the results are independent conditional on absence of the condition.**

The multiplication is within the group without the condition, so independence must hold conditional on absence, with each conditional rate 0.05. Merely using the same test on a new day does not establish it.

10. **False**

For Bernoulli observations a finite sample mean is discrete. The standard error identity can be exact while a normal approximation is only approximate.