

Confidence Intervals Short Questions

1. Given is a confidence interval $[x_1, x_2]$ of a parameter x at a confidence level α . What is the frequentist, what is the Bayesian interpretation of this interval?
 - *Frequentist Interpretation:*
 - If the same experiment is repeated many times, $100 \times \alpha\%$ of the constructed confidence intervals will contain the true parameter value.
 - *Bayesian Interpretation:*
 - Confidence Intervals are credibility intervals.
 - Credibility intervals contain the true parameter with a probability α , based on the posterior probability density function (PDF).
2. What role does the prior in Bayesian statistics play?
 - The prior represents the initial assumptions about the parameter before observing the data.
 - The choice of the prior can significantly impact the resulting credibility interval.
3. What freedom is there in choosing these intervals?
 - One can choose:
 - symmetric interval around the expectation $x_+ - \mu = \mu - x_-$
 - shortest interval, minimizing $x_+ - x_-$
 - central interval given by $\int_{-\infty}^{x_-} P(x) dx = \int_{x_+}^{\infty} P(x) dx = \frac{1-\alpha}{2}$
4. What happens in the special case of symmetrical PDF?
 - For symmetric PDFs, all these intervals are equivalent.
5. What is the difference between intervals and upper/lower limits?
 - *Confidence Intervals*
 - Provide a range within which the parameter is believed to lie with a certain confidence level.
 - Example: A 95% confidence interval means there is a 95% probability that the interval contains the true parameter value.
 - *Upper/Lower Limits*
 - Indicate bounds above or below which the parameter lies with a certain confidence level.
 - Example: A 95% upper limit means there is a 95% probability that the true parameter value is below this limit.

