Two equivalent perspectives on p-values

	P-values are computed from the data
(1) For the purpose of evaluating a reported result	the p-value is the threshold value for interpretation of significance. I have my preferred significance level requirement α. If the p-value is less than my α, REJECT the Null. Otherwise we fail to reject.
(2) For the purpose of computing a p-value	The p-value of a data set is the probability of observing this outcome or something more rare assuming the null hypothesis is true. (respecting the one- or two-sidedness of the test) Plug the data into your test statistic and use tables to evaluate the probability of the tail(s)

For the purpose of reporting data results

Example

Computing a p-value

Below are the results of a study where the data is assumed to be normal with a true standard deviation of 5. The null hypothesis is

$H_0: \mu = 50$

$H_1: \mu \neq 50.$

If there are 36 samples and $\bar{x} = 48$, then what is the p-value for this result?

Solution

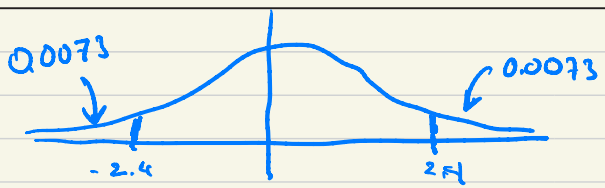
Since the population standard deviation is known $\sigma = 5$, and we are testing the sample mean, the test statistic is

TS: $z = \dfrac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$

μ_0: mean assuming H_0 is true

$$z = \frac{48 - 50}{5/\sqrt{36}} = \frac{-12}{5} = -2.4$$

$$\text{p-value} = P(Z < -2.4) + P(Z > 2.4)$$
$$= 2 \cdot 0.0073$$
$$= \boxed{0.0146}$$



For the purpose of interpreting reported results.

Example
Interpreting a reported p-value

In your lab, your threshold for rejecting/accepting H_0 is 0.02.

You read a paper in which a normally distributed population with unknown variance is examined to estimate the true mean.

You infer from the paper that
$H_0: \mu = 100$
$H_1: \mu < 100$
The reported mean is 98.7 with a p-value of 0.001.

What is your interpretation?

Because $0.001 < 0.02$, the data provides sufficient evidence to reject the null hypothesis.

I believe the true mean is less than 100.