Dear Professor Mayo, here is the question I was trying to ask during the seminar, but I didn't explain it well, so I'll give it another go!

Consider the following two cases.

Case 1 (from p.143). We are trying to estimate the mean μ_A of a population A. We know the standard deviation of this population is $\sigma_A = 10$. We take a sample of size N=100. We believe the sampling distribution of the mean is normal i.e. $\bar{X}_A \sim N(\mu, \frac{10}{\sqrt{100}})$ so $\bar{X}_A \sim N(\mu, 1)$.

We observe $\bar{x}_A = 152$.

We want to calculate the severity with which the claim $\mu_A > 151$ passes this test with the data we have observed. So we need to calculate $\Pr(\bar{X}_A \leq 152; \mu_A \leq 151)$. As you write in the book, we only need to evaluate severity at the point $\mu_A = 151$ (because the probability is greater for all values of μ less than this). From table on p.144. $\Pr(\bar{X}_A \leq 152; \mu_A = 151) = 0.84$ so severity = 0.84.

Case 2. We are trying to estimate the mean μ_B of a population B. We know the standard deviation of this population is $\sigma_B = 10000$. We take a sample of size N=100. We believe the sampling distribution of the mean is normal i.e. $\bar{X}_B \sim N(\mu_B, \frac{10}{\sqrt{10000}})$ so $\bar{X}_B \sim N(\mu_B, \frac{1}{10})$.

We observe $\bar{x}_B = 151.1$

We want to calculate the severity with which the claim $\mu_B > 151$ passes this test with the data we have observed. So we need $\Pr(\bar{X} \leq 151.1; \mu_B = 151) = 0.84$ (if I have done this correctly!).

So in both tests the claims that the mean of the populations (A and B) are greater than 151 pass with the same severity (i.e. 0.84). And what I am a little troubled by (just a little!) is the following:

Although the claims pass with the same severity,

$$\Pr(\bar{X}_B \leq 151.1; \mu_B = a) > \Pr(\bar{X}_A \leq 152; \mu_A = a)$$

for all $a < 151$. (I think!)

So intuitively because of this fact (if it's true) it seems that the second claim passes with a severity higher than the first. But perhaps my intuitions are wrong and even if they are right I don't think there would be a way to cash out this intuition in a satisfactory way. But I was just wondering what you thought about this! Thank you again!