Prior to the 1999-2000 NBA season, rules were changed in an effort to increase scoring and make the game more exciting. Previously, the league averaged 183.2 points per game. In a random sample of 20 games, we got \( \bar{x} = 195.88 \) pts and \( s = 20.27 \) pts. Use an improper prior but act like a Bayesian to test whether the new rules have made the average points per game increase.

(Note: we assume here that \( \alpha_0 = 0.05 = \frac{\omega_1}{\omega_0 + \omega_1} \).)

**Solution**

From equation 7.6.21, we know the posterior distribution of

\[
\frac{n^{1/2}(\mu - \bar{x})}{s} = \frac{20^{1/2}(\mu - 195.88)}{20.27} = 0.2221 \mu - 43.217
\]

is distributed according to a \( t \) with 19 degrees of freedom.

Our test is:

\[
H_0 : \mu \leq 183.2 \text{ pts per game} \\
H_1 : \mu > 183.2 \text{ pts per game}
\]

So, we reject \( H_0 \) if the posterior probability of \( H_0 \) is less than or equal to \( \alpha_0 \).

\[
P(\mu > 183.2 | \bar{x}) = P\left( \frac{n^{1/2}(\mu - \bar{x})}{s} \leq \frac{n^{1/2}(183.2 - \bar{x})}{s} \right | \bar{x}) = P(t_{19} \leq -2.798) = 0.00574
\]

Our posterior probability of \( H_0 \) is sufficiently low to reject the null hypothesis. We believe that the average number of points per game has indeed gone up since the rule changes. (Note that I didn’t say because of the rule changes. There could easily have been another causal factor... like a large number of good defenders being injured.)