

Bayesian Claims versus NHST Claims

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

1. An NHST calculation gives $p=0.073$. A separate Bayesian model with stated priors gives $P(H_0|data)=0.0248$. Compare the meanings; may the two numbers be substituted for one another?

Assumptions: The Bayesian model uses the displayed prior and likelihood; NHST treats the parameter as fixed.

Reference: p conditions on H_0 and ranges over repeated data. The posterior conditions on observed data and depends on the prior.

Bayesian Claims versus NHST Claims

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

2. Before a test, $P(H_0)=0.68$. The test has significance $\alpha=0.05$ and power= 0.8 for the stated alternative. Given that H_0 was rejected, find $P(H_0 \mid \text{reject})$.

Assumptions: The prior places all probability on the stated null and alternative models; α and power apply to this test.

Reference: Bayes: $P(H_0|R)=P(H_0)P(R|H_0)/[P(H_0)P(R|H_0)+P(H_A)P(R|H_A)]$.

Bayesian Claims versus NHST Claims

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

3. Classify each statement: (A) "If the fixed null value were true, this rejection rule errs with probability 0.1." (B) "Given these data and a stated prior, the null model has probability 0.2222."

Assumptions: The frequentist model treats the parameter as fixed across repetitions; the Bayesian model assigns probabilities to hypotheses through a prior.

Reference: Frequentist error rates condition on a fixed hypothesis. Posterior beliefs condition on observed data and a prior.

Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Bayesian Claims versus NHST Claims

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

4. A report based on a sample-mean statistic gives $p=0.106$. Is this $P(\text{data as or more extreme} \mid H_0)$, $P(H_0 \mid \text{data})$, or $P(H_A \mid \text{data})$? State the conditioning direction.

Assumptions: The test statistic and null sampling model were fixed before observing the data.

Reference: A p-value is a tail probability computed under H_0 ; it is not a posterior hypothesis probability.

Name the conditioning distribution, show the statistic and df, then state a contextual decision.

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5. Classify each statement: (A) "If the fixed null value were true, this rejection rule errs with probability 0.05." (B) "Given these data and a stated prior, the null model has probability 0.2."

Assumptions: The frequentist model treats the parameter as fixed across repetitions; the Bayesian model assigns probabilities to hypotheses through a prior.

Reference: Frequentist error rates condition on a fixed hypothesis. Posterior beliefs condition on observed data and a prior.

Bayesian Claims versus NHST Claims

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

6. An NHST calculation gives $p=0.128$. A separate Bayesian model with stated priors gives $P(H_0|data)=0.3684$. Compare the meanings; may the two numbers be substituted for one another?

Assumptions: The Bayesian model uses the displayed prior and likelihood; NHST treats the parameter as fixed.

Reference: p conditions on H_0 and ranges over repeated data. The posterior conditions on observed data and depends on the prior.

Bayesian Claims versus NHST Claims

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

7. Before a test, $P(H_0)=0.4$. The test has significance $\alpha=0.01$ and power= 0.7 for the stated alternative. Given that H_0 was rejected, find $P(H_0 \mid \text{reject})$.

Assumptions: The prior places all probability on the stated null and alternative models; α and power apply to this test.

Reference: Bayes: $P(H_0|R)=P(H_0)P(R|H_0)/[P(H_0)P(R|H_0)+P(H_A)P(R|H_A)]$.

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

- Assumptions: The test statistic and null sampling model were fixed before observing the data.
- Reference: A p-value is a tail probability computed under H_0 ; it is not a posterior hypothesis probability.

Bayesian Claims versus NHST Claims

Worked Answer Key

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

1. An NHST calculation gives $p=0.073$. A separate Bayesian model with stated priors gives $P(H_0|data)=0.0248$. Compare the meanings; may the two numbers be substituted for one another?

Assumptions: The Bayesian model uses the displayed prior and likelihood; NHST treats the parameter as fixed.

Reference: p conditions on H_0 and ranges over repeated data. The posterior conditions on observed data and depends on the prior.

Answer: They answer different conditional questions and cannot be substituted.

1. $p=P(\text{extreme data}|H_0)=0.073$.
2. Posterior= $P(H_0|data)=0.0248$; reversing conditioning changes the denominator.

Bayesian Claims versus NHST Claims

Worked Answer Key

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

2. Before a test, $P(H_0)=0.68$. The test has significance $\alpha=0.05$ and power= 0.8 for the stated alternative. Given that H_0 was rejected, find $P(H_0 \mid \text{reject})$.

Assumptions: The prior places all probability on the stated null and alternative models; α and power apply to this test.

Reference: Bayes: $P(H_0|R)=P(H_0)P(R|H_0)/[P(H_0)P(R|H_0)+P(H_A)P(R|H_A)]$.

Answer: $P(H_0|\text{reject})=0.1172$.

1. $P(\text{reject})=0.68(0.05)+0.32(0.8)$.
2. $P(H_0|\text{reject})=0.68(0.05)/P(\text{reject})=0.1172$.

Bayesian Claims versus NHST Claims

Worked Answer Key

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

3. Classify each statement: (A) "If the fixed null value were true, this rejection rule errs with probability 0.1." (B) "Given these data and a stated prior, the null model has probability 0.2222."

Assumptions: The frequentist model treats the parameter as fixed across repetitions; the Bayesian model assigns probabilities to hypotheses through a prior.

Reference: Frequentist error rates condition on a fixed hypothesis. Posterior beliefs condition on observed data and a prior.

Answer: A is frequentist; B is Bayesian. Neither statement is an unconditional probability that a fixed unknown value changes randomly.

1. A describes repeated-sampling Type I error $P(\text{reject}|H_0)$.
2. B describes posterior belief $P(H_0|\text{data})$ under the stated prior and model.

Bayesian Claims versus NHST Claims

Worked Answer Key

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

4. A report based on a sample-mean statistic gives $p=0.106$. Is this $P(\text{data as or more extreme} \mid H_0)$, $P(H_0 \mid \text{data})$, or $P(H_A \mid \text{data})$? State the conditioning direction.

Assumptions: The test statistic and null sampling model were fixed before observing the data.

Reference: A p-value is a tail probability computed under H_0 ; it is not a posterior hypothesis probability.

Answer: $p=P(\text{test statistic at least as extreme as observed} \mid H_0)$.

1. The condition after the vertical bar is H_0 .
2. No prior appears, so this is not $P(H_0 \mid \text{data})$ or $P(H_A \mid \text{data})$.

Bayesian Claims versus NHST Claims

Worked Answer Key

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

5. Classify each statement: (A) "If the fixed null value were true, this rejection rule errs with probability 0.05." (B) "Given these data and a stated prior, the null model has probability 0.2."

Assumptions: The frequentist model treats the parameter as fixed across repetitions; the Bayesian model assigns probabilities to hypotheses through a prior.

Reference: Frequentist error rates condition on a fixed hypothesis. Posterior beliefs condition on observed data and a prior.

Answer: A is frequentist; B is Bayesian. Neither statement is an unconditional probability that a fixed unknown value changes randomly.

1. A describes repeated-sampling Type I error $P(\text{reject}|H_0)$.
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6. An NHST calculation gives $p=0.128$. A separate Bayesian model with stated priors gives $P(H_0|data)=0.3684$. Compare the meanings; may the two numbers be substituted for one another?

Assumptions: The Bayesian model uses the displayed prior and likelihood; NHST treats the parameter as fixed.

Reference: p conditions on H_0 and ranges over repeated data. The posterior conditions on observed data and depends on the prior.

Answer: They answer different conditional questions and cannot be substituted.

1. $p=P(\text{extreme data}|H_0)=0.128$.

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Worked Answer Key

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

7. Before a test, $P(H_0)=0.4$. The test has significance $\alpha=0.01$ and power= 0.7 for the stated alternative. Given that H_0 was rejected, find $P(H_0 | \text{reject})$.

Assumptions: The prior places all probability on the stated null and alternative models; α and power apply to this test.

Reference: Bayes: $P(H_0|R)=P(H_0)P(R|H_0)/[P(H_0)P(R|H_0)+P(H_A)P(R|H_A)]$.

Answer: $P(H_0|\text{reject})=0.0094$.

1. $P(\text{reject})=0.4(0.01)+0.6(0.7)$.
2. $P(H_0|\text{reject})=0.4(0.01)/P(\text{reject})=0.0094$.

Name _____ Score _____ Teacher _____ Date _____

Bayesian Claims versus NHST Claims

Worked Answer Key

Write the conditioning direction of each probability. Use priors only when a posterior hypothesis probability is requested.

8. A report based on a sample-mean statistic gives $p=0.018$. Is this $P(\text{data as or more extreme} \mid H_0)$, $P(H_0 \mid \text{data})$, or $P(H_A \mid \text{data})$? State the conditioning direction.

Assumptions: The test statistic and null sampling model were fixed before observing the data.

Reference: A p-value is a tail probability computed under H_0 ; it is not a posterior hypothesis probability.

Answer: $p=P(\text{test statistic at least as extreme as observed} \mid H_0)$.

1. The condition after the vertical bar is H_0 .
2. No prior appears, so this is not $P(H_0|\text{data})$ or $P(H_A|\text{data})$.