LESSON MAKER PRO

False Alarm Decisions

Use test results to weigh evidence and risk.

HIGH SCHOOL · MM.D3D.C.20.d

MM.D3D.C.20.d "Interpret the significance level of a test in the context of error probabilities, and use the results to make strategic decisions."

NAME _____ DATE _____

THE DECISION RULE

The significance level, α, sets an upper limit on the long-run chance of rejecting a true null hypothesis. This mistake is a false alarm. Reject the null hypothesis when the p-value is less than or equal to α, and choose α with the cost of a false alarm in mind.

WORKED EXAMPLE

A club tests whether a new signup message increases attendance. The null hypothesis says it does not. Use the table to decide and state the false-alarm limit.

TEST RESULTS

α	p-value
0.07	0.03

1. Compare: 0.03 ≤ 0.07.
2. Reject the null hypothesis.
3. If the message does not increase attendance, the false-alarm rate is at most 7% in the long run.

Answer: Reject the null hypothesis; the false-alarm limit is 7%.

PRACTICE 4 problems

1 A test uses α = 0.05 and gives p = 0.01. Reject or do not reject the null hypothesis? State the false-alarm limit.

ANSWER _____

2 A test uses α = 0.10. If the null hypothesis is true across 100 repeated tests, what is the average false-alarm limit?

ANSWER _____

3 A test uses α = 0.02 and gives p = 0.06. Reject or do not reject the null hypothesis?

ANSWER _____

4 Choose α = 0.01 or α = 0.05 to lower the false-alarm limit. How much lower is that limit per 100 tests?

ANSWER _____

APPLY IT Show your work

1 A video club tests whether posting at a new time boosts views. The null hypothesis says it does not. Switching times costs nothing. With $\alpha = 0.05$ and $p = 0.04$, should the club switch? State the false-alarm limit.

WORK SPACE

ANSWER _____

2 A school tests whether a pricey tutoring app raises scores. The null hypothesis says it does not, and $p = 0.02$. If a false alarm would be costly, choose $\alpha = 0.01$ or $\alpha = 0.10$. Does the test support buying the app?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two independent tests have true null hypotheses. Each has a 5% chance of a false alarm. Find the chance of at least one false alarm. If each chance were 1% instead, find the new chance and choose the safer plan.

WORK SPACE AND ANSWER

ANSWER KEY

False Alarm Decisions

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A test uses $\alpha = 0.05$ and gives $p = 0.01$. Reject or do not reject the null hypothesis? State the false-alarm limit.	**Reject the null hypothesis. The false-alarm limit is 5%.**
2	A test uses $\alpha = 0.10$. If the null hypothesis is true across 100 repeated tests, what is the average false-alarm limit?	**At most 10 false alarms per 100 tests on average.**
3	A test uses $\alpha = 0.02$ and gives $p = 0.06$. Reject or do not reject the null hypothesis?	**Do not reject the null hypothesis.**
4	Choose $\alpha = 0.01$ or $\alpha = 0.05$ to lower the false-alarm limit. How much lower is that limit per 100 tests?	**Choose $\alpha = 0.01$. Its limit is 4 fewer false alarms per 100 tests on average.**

PART 2 · APPLY IT

1. **Yes, switch times. The false-alarm limit is 5%.** Since $0.04 \leq 0.05$, reject the null hypothesis. If the new time does not boost views, this rule has a false-alarm rate of at most 5%.
2. **Choose $\alpha = 0.01$. Do not reject the null hypothesis, so the test does not support buying the app.** The lower α limits false alarms to at most 1% in the long run. Since $0.02 > 0.01$, do not reject the null hypothesis.

CHALLENGE

At 5% each: $1 - (0.95)(0.95) = 9.75\%$. At 1% each: $1 - (0.99)(0.99) = 1.99\%$. The 1% plan has the lower chance of a false alarm.

Accept equivalent percentages or decimals. Do not accept a claim that α is the probability the null hypothesis is true.