Question:

This landmark experiment in genetics investigated whether, for a certain kind of sweet pea plant, the traits "flower color" and "pollen grain type" are inherited independently or not. Flower color can be purple (P) or red (R), but the purple color is dominant) and Grain type can be Long (L) or Round (R), but long grain type is dominant. According to Mendel's law of independent segregation, the genes for these two traits segregate independently and the "flower color" and "pollen grain type" combinations-P&L, P&R, R&L and R&R are expected in 9:3:3:1 ratio. The following are the observed frequencies for each combination when the experiment was carried out on 256 sweet pea plant.

| "flower color" and "pollen grain type" combinations | Observed Frequencies |
|---|---|
| P&L | 177 |
| P&R | 15 |
| R&L | 15 |
| R&R | 49 |

Write your conclusion at 5% level of significance.

Report:

**H0**: The distribution is as the ratio.

**H1**: The distribution is not as the ratio.

**Null distribution**: Chi-square test with 3 degree of freedom.

The expected count based on the ratio is:

| P&L | 9/(9+3+3+1)*(177+15+15+49)=144 |
|---|---|
| P&R | 3/(9+3+3+1)*(177+15+15+49)=48 |
| R&L | 3/(9+3+3+1)*(177+15+15+49)=48 |
| R&R | 1/(9+3+3+1)*(177+15+15+49)=16 |

And then I will calculate $x^2$ by doing the operation below:

(177-144) ^2/144+(15-48) ^2/48+(15-48) ^2/48+(49-16) ^2/16

The answer is 121.

The **expression of p-value**: $P\{X^2>121\}$

The degree of freedom is 4-1=3.

And then:

    1-pchisq(121,3)

The answer is 0 which is smaller than 0.05.

So reject H0 at 5% level of significance.

Thus the distribution is not as the ratio.