Miscellaneous: The Golden Compass

The challenge gives us two attachments, locked-scroll.zip (which has a password) and the_golden_compass.pdf. Looking at the PDF:

Given the following Truth Table, find **p ^ q**.

p	q	r	(p ∧ (q ∧ r))
F	F	F	**F**
F	F	T	**F**
F	T	F	**F**
F	T	T	**F**
T	F	F	**F**
T	F	T	**F**
T	T	F	**F**
T	T	T	**T**

Hint: The zipped folder can be unlocked by finding all possible truth values of **p ^ q**.

How to get p ^ q?

To get p ^ q, we need to know what ^ means. The PDF contains a truth table, with 3 inputs p, q and r and a secret operator '^'. Observe that all of the outputs are all False (F), except for the one with the input with 3 Trues (T). This suggests that ALL of the 3 inputs has to be T before the output can be T, which lets us come to mind the AND operator. So, what (p ^ (q ^ r)) actually means is p AND (q AND r), and that ^ represents AND. More information can be found here on truth tables and operations:

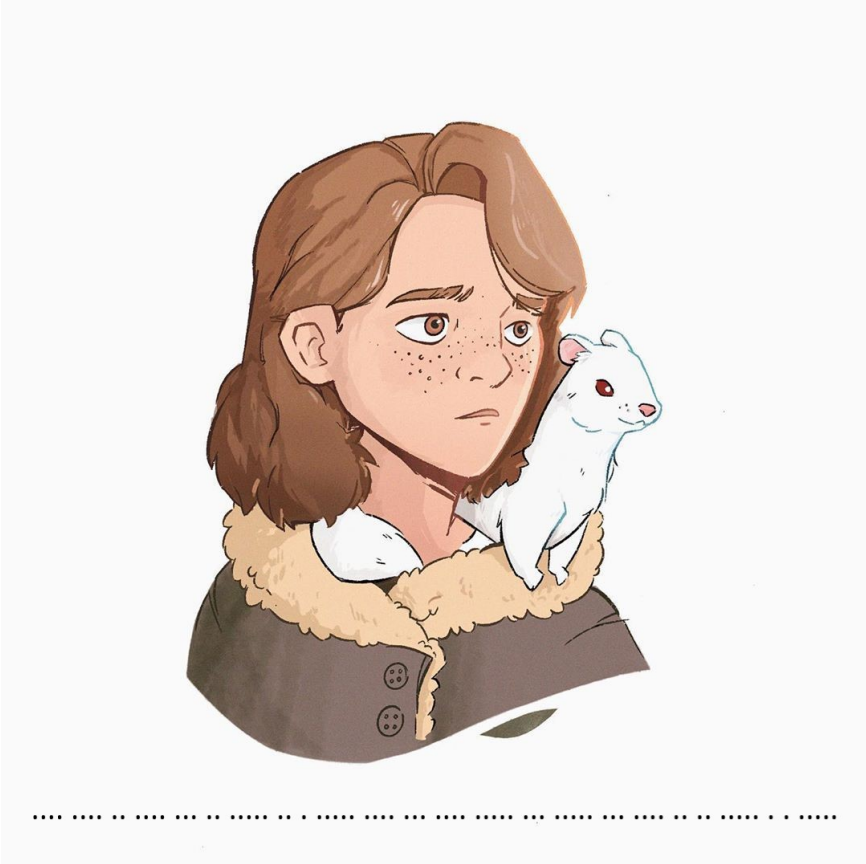
https://en.wikipedia.org/wiki/Truth_table#:~:text=A%20truth%20table%20is%20a,taken%20by%20their%20logical%20variables.

After knowing what ^ does, we can find all possible truth values of p ^ q. We make a truth table of p ^ q as below:

p	q	p ^ q (p AND q)
F	F	F
F	T	F
T	F	F
T	T	T

So the values are: F,F,F,T
Thus, the password to locked-scroll.zip is F,F,F,T.

How to get the flag?
In the zip file, we see lyra.jpg, with a line of dots at the bottom of the image:



If we zoom in closely at the dots, it will look like this:

```
.... .... .. .... ... .. ..... .. . ..... .... ... .... ..... ... ..... ... .... .. .. ..... . . .....
```

It does not contain any dashes (-) so we can rule out morse code. Let's neaten it up by grouping the dots in the cluster size to get:

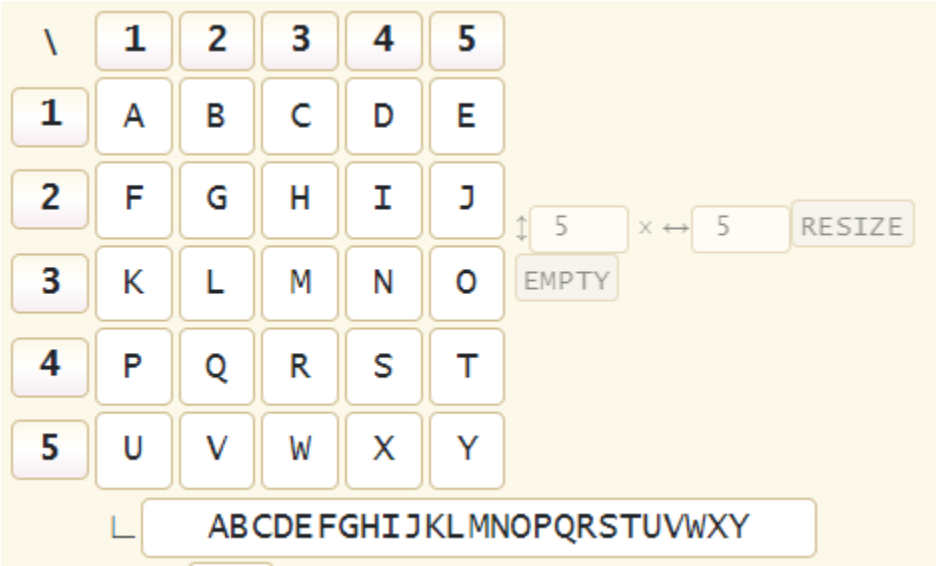
4 4 2 4 3 2 5 2 1 5 4 3 4 5 3 5 3 4 2 2 5 1 1 5

Let's further analyse this:

- All the numbers are more than 0 and capped at 5 (Very small range)
- The number of digits here is even numbered
- We need to ensure that somehow these numbers are able to fit the range of the number of alphabets (knowing the answer is in alphabets), which is around ~26 letters

One possible way to get to 26 letters, is to do a multiplication of the range of numbers, 5 * 5 to get 25, which is close to the wanted 26. After looking up for some ciphers, you would be able to find the Polybius cipher: https://www.dcode.fr/polybius-cipher

Since there are no keys given, we can just assume the key to be as such, omitting z:



By pairing up the numbers consecutively, to represent the row followed by the column:

The first pair of numbers is 4 4, so the first letter would be S
The next pair of numbers is 2 4, so the second letter would be I
The third pair of numbers is 3 2, so the third letter would be L

Repeat the process, and you would get **SILVERTONGUE** as the flag.