Question 1:

a) Write down the code of Program \( P \) in the language \( L \) for which \( \#(P) = 38399 \).

b) What is the number of the following program?

\[
\begin{align*}
\text{IF } X \neq 0 & \text{ GOTO C} \\
Y & \leftarrow Y - 1 \\
[C] & Y \leftarrow Y + 1
\end{align*}
\]

You do not have to compute the numerical values of expressions such as \( 3^{27} \) that would result in huge numbers.

Question 2:

Do you remember how we used the pairing function and the Gödel numbering to associate each program in the language \( L \) with a unique natural number? To be precise, we demanded that every program in \( L \) is associated with unique number, and we also required that every natural number is associated with a valid program in \( L \). Now it is your task to develop such one-to-one mappings for other things. If you think that a mapping cannot be defined, please give a reason.

a) Define such a mapping for the set of rational numbers \( Q \).

b) Define such a mapping for the set of integers.

c) Define such a mapping for the set of letters of the English alphabet.