25.a

i A fraction is represented in single precision floating point binary representation using a series of 32 binary digits.
The first digit, the sign bit, is used to indicate if the number is positive (0, zero) or negative (1). The next 8 bits represent the binary exponent which is found once the fraction has been translated to a binary fraction, this exponent is added to the figure 127 which is called a bias and allows for negative exponents.
The final section is a 23-bit mantissa which shows the binary fraction, with the leading 1 ignored.

25, a

ii $45_{10} = (2_{10} \times 16_{10}) + 13_{10}$

$\therefore 45_{10} = 20$

iii 1110 - 0111

Convert 0111 to its two's complement form:

1001

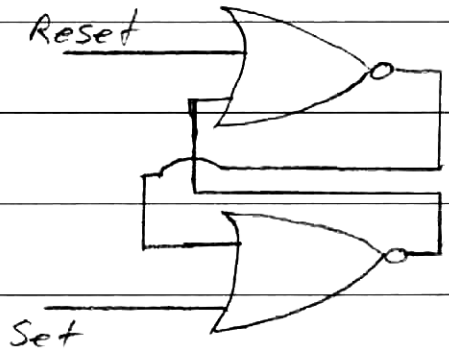
Add this result to 1110:

$$\begin{array}{r} 1110 \\ +\ 1001 \\ \hline 10111 \end{array}$$

The leading digit is ignored as we are using 4-bit binary representation. Therefore the answer is 0111.

25.b

i A flip-flop is a bistable device meaning that it can store a binary digit.
It does this by having the output of two logic gates, typically NOR or NAND, act as one of the inputs to the other and thus storing the signal as shown below.



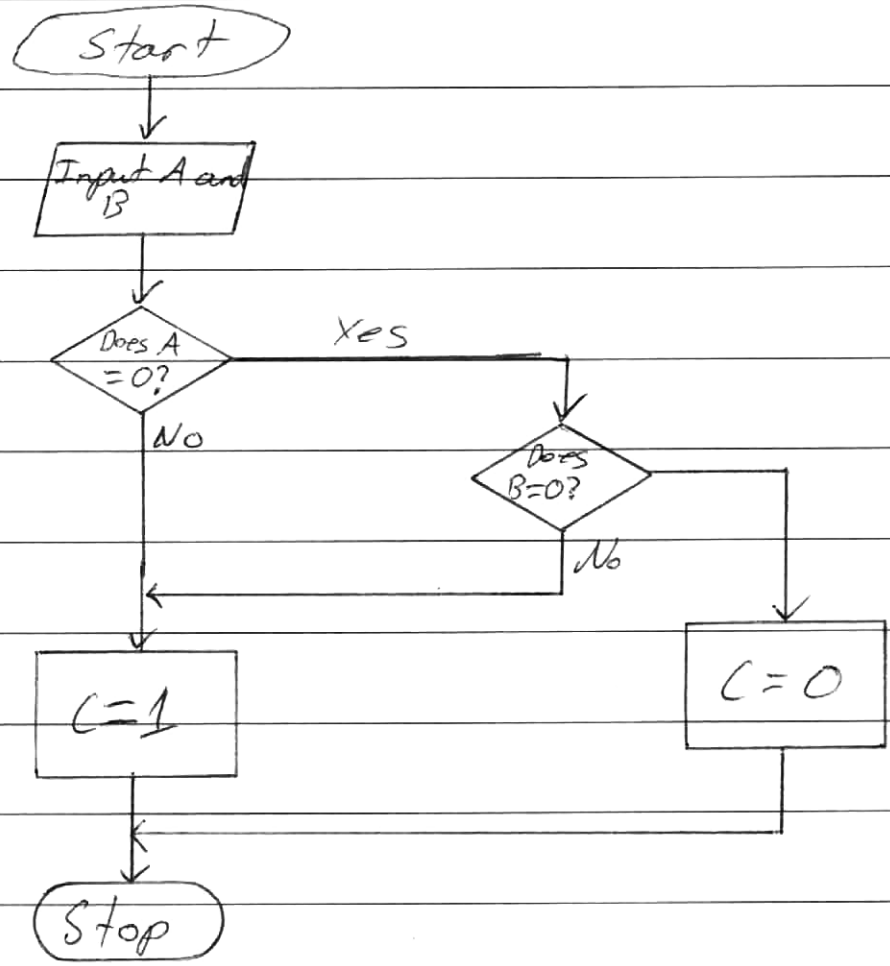
The device ~~ea~~ shown is a simple RS-NOR flip-flop, its data can be reset by a signal to the Reset control line and a new value supplied through the Set control line.

25.b

ii

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

OR Gate



25.c The information sent from the scanner to the central computer system would likely include the following:

Header: - Amount of data being sent
- Error checking data

Data characters: the fingerprint data that was scanned.

Trailer: - Error checking data
- End of stream sentinel

The information from the computer system to the door on the other hand would only be required if a match was found and so it would only require a control character in the data characters to open the door, the header and trailer would contain the same types of information however.