a)i) Floating point uses 32 bits. The first is the sign, simply weathe the final number is positive, represented by a zero, or negative, reprented by a one.

The next eight bits are the exponant in 127 excess form.

The mantissa, in the final Bits will be multiplied by 2 to the power of ~~the~~ the exponant to receive the true number. This is represented as an eight bit binary number gained by taking the true exponant and adding 127 to it, hence 127 excess. This must be deducted to convert backwards.

The remaining bits are the mantissa, or fractional part. the original decimal is 1 point whatever the mantissa is, to the exponant. The first mantissa bit is 2^{-1}, or $\frac{1}{2}$, the second 2^{-2}, or $\frac{1}{4}$ and so on. So the final number, converted from 32 ~~decimal~~ binary bits comes out as

sign 1.mantissa $\times 2^{\text{exponant}}$

or something like

$+1\frac{13}{85} \times 2^{8}$

ii) 45 to binary

128 64 32 16 8 4 2 1
0 0 1 0 1 1 0 1

0 0 1 0 1 1 0 1

1st nibble

0 0 1 0 = 2 in hex

2nd nibble

1 1 0 1 = 13 (D in hex)

$\therefore 45_{10} = 2D_{16}$

iii) 1's compliment

0 1 1 1 =

1 0 0 0 + 2's compliment
1

1 0 0 1

Add 1

1 1 1 0 +
1 0 0 1

0 1 1 1

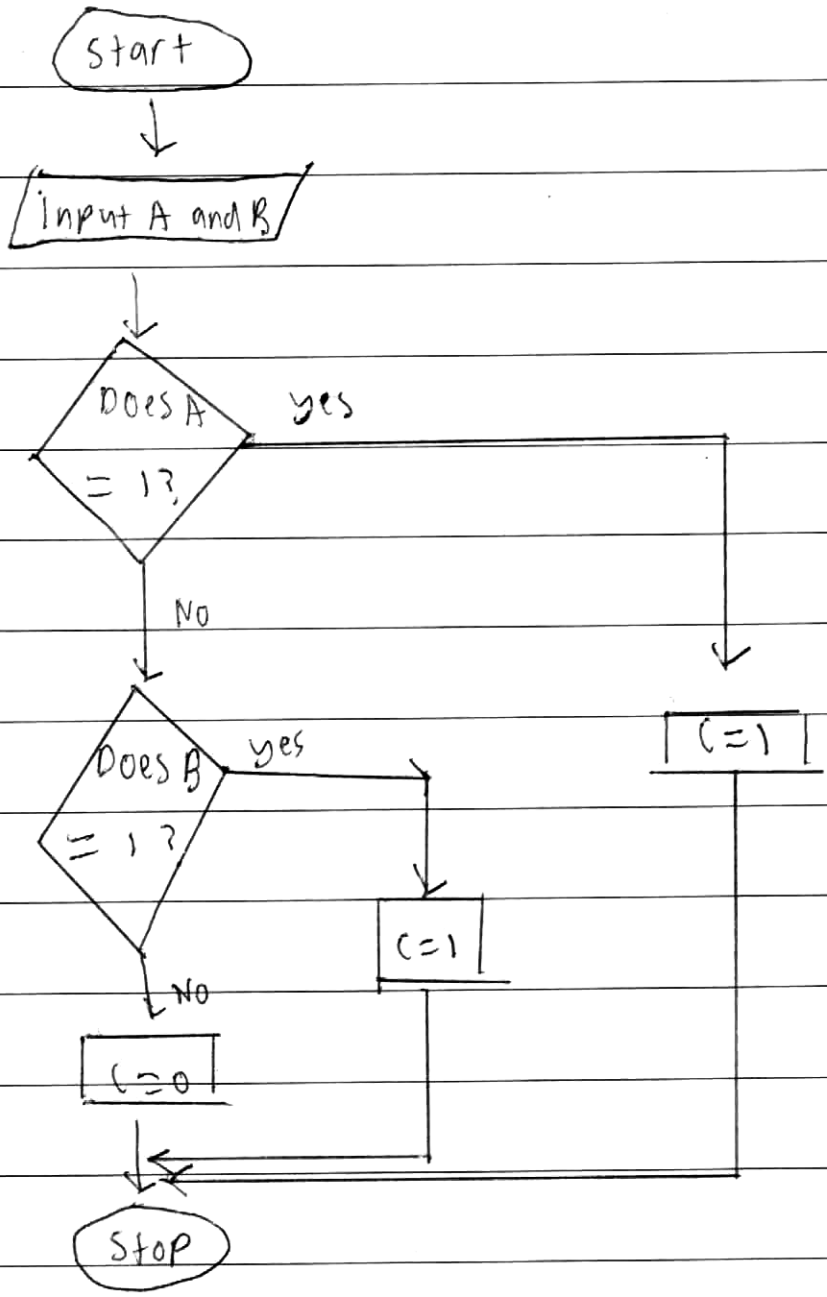
$\therefore 1110 - 0111 = 0111$

b)i) A flip-flop is used to store data. It consists of two not gates, two inputs labeled Set and Reset and two outputs. Setting both Set and Reset to on is not allowed. By setting Set to 1, output 1 will become 1, and output 2 will become 0. Setting Reset to 1 does the opposite, making output 1, 0 and output 2 = 1. Finally, By making both inputs zero, the output will not change from their current state. In this way, one flip-flop will store one bit of data.

ii) AND gate

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

OR Gate



c) The first data stream, that sent from the scanner to the central computer will be much larger. The header will include information that identifies the data stream as a fingerprint scan. it likely also includes information such as the time of day, so the computer can store all attempted entries. Next will be the largest part, the data characters themselves. This will be large as it will need to include the entire digitised fingerprint image taken by the scanner. The trailer information would likely only be the essential, telling the computer the data stream is finished. Each individual packet will also include information as to what order the packets belong in, so the central computer doesn't receive the packets in the wrong order and produce an error. The trailer information may include error checking, such as a Parity, checksum, or CRC valve.

The data stream sent to the door will be much smaller and less complecated. The header will simply identify the stream, include the packet number and allow the door to correctly receive the transmission. The main data characters will Basically be one of two instructions - "fingerprint correct, open door"

or "Fingerprint wrong, do not open door!". Finally, the trailer information will state that the transmission is over, and possibly include error checking information.