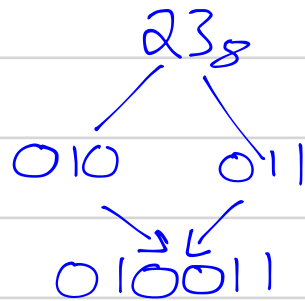


# Test solutions

## Question 1

1a)  $23_8 \rightarrow$  binary.

$$\begin{aligned} 23_8 &= 2 \times 8 + 3 = 19_{10} \\ &= 16 + 2 + 1 \\ &= 010011 \end{aligned}$$



b)  $101111011 \rightarrow$  decimal  
 $= 1 + 2 + 8 + 16 + 32 + 64 + 256$   
 $= 379$

c)  $-12.34_{16} \rightarrow$  signed binary.

$$\begin{aligned} 1 \times 16 + 2 + 3 \times 16^{-1} + 4 \times 16^{-2} &= -18.203125_{10} \\ &= -1 \times (16 + 2 + 2^{-3} + 2^{-4} + 2^{-6}) \\ &= -1 \times (010010.001101) \quad 00010010.001101 \\ &= 101101.110010 + \text{LSB} \\ &= 101101.110011 \end{aligned}$$

d)  $110.011_{2 \text{ signed}} \rightarrow$  decimal

$$\begin{aligned} &= -4 + 2 + 2^{-2} + 2^{-3} \\ &= -1.625 \end{aligned}$$

$$1e) -31.5 \rightarrow \text{signed binary} \\ = 100000.1$$

$$2a) 2$$

$$b) \text{Order of MSB in } 200.021 = 2$$

$$c) 22222_3 \rightarrow \text{decimal } (4=4) \\ 3^{n+1} - 1 = 242$$

$$d) 3_{10} \text{ or } 0.5 \text{ (not } \frac{1}{3}).$$

either a decimal digit  $> 2$  or a fraction not a multiple of  $3^{-m}$ .

$$3a) 11011.011 + 011011.11$$

$$\begin{array}{r} 1111011.011 \\ + 011011.110 \\ \hline [1] 0110011.001 \end{array} \quad \begin{array}{l} -4.625 \\ +55.75 \\ \hline 51.125 \checkmark \end{array} \quad \text{carry, no overflow.}$$

$$b) 01101.110 - 101.01 \text{ in } Q_{4.3s}$$

$$\begin{array}{r} 01101.110 \\ - 1101.010 \\ \hline [1] 10000.100 \end{array} \quad \text{carry, overflow.}$$

$$c) \begin{array}{r} 011010010 \\ - 11111010 \\ \hline [1] 011011000 \end{array}$$

$$\text{carry, no overflow.}$$

$$\begin{aligned} \text{3d) } & 11.01 \times 0100.11 \\ & = -1 \times (00.11 \times 0100.11) \end{aligned}$$

$$= \quad 0011 \quad Q1.2$$

$$\quad \underline{010011} \quad Q3.2$$

$$\begin{array}{r} \Sigma \\ \quad \quad 0011 \\ \quad \quad 00110 \end{array}$$

$$\underline{000110000}$$

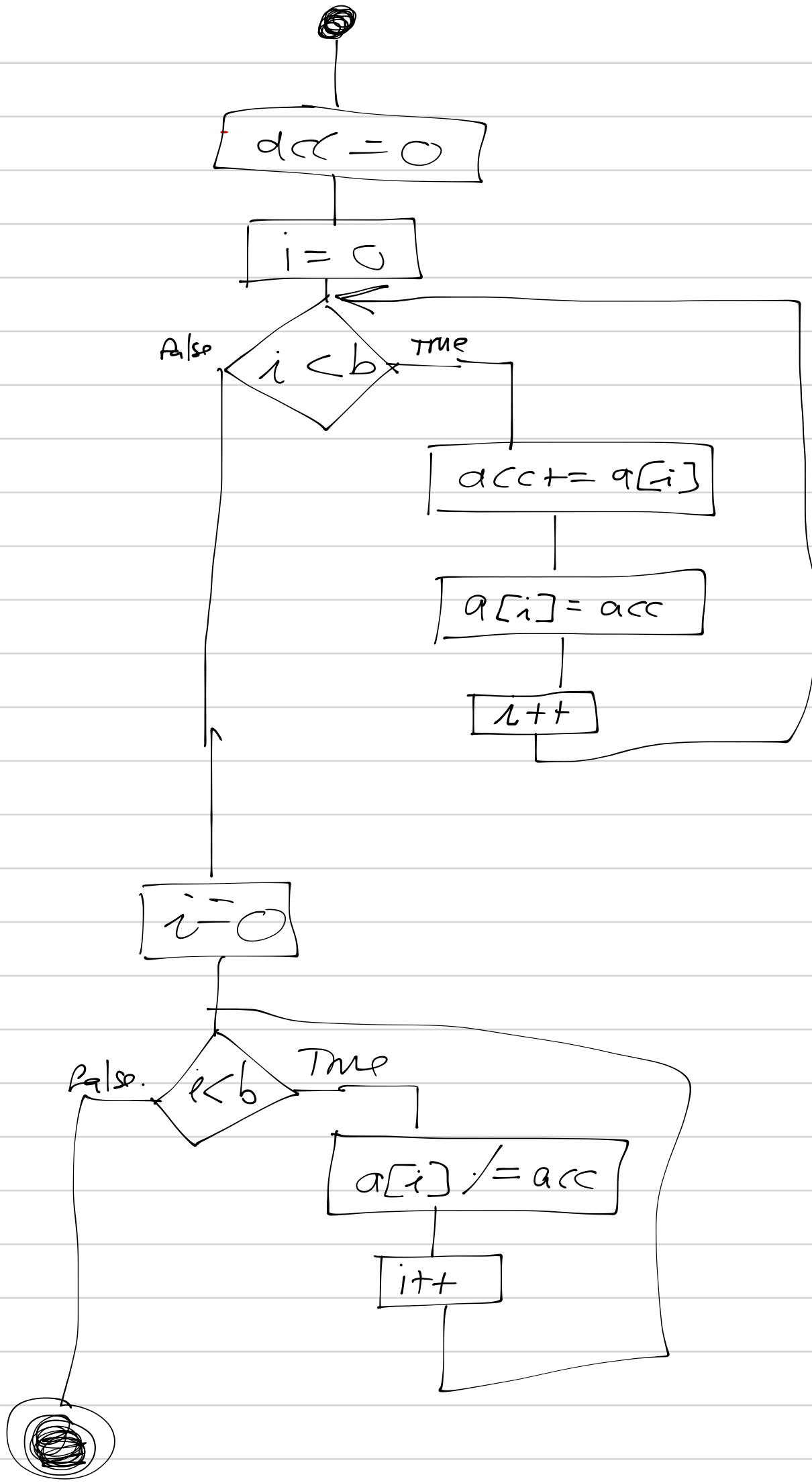
$$00011.001 \quad Q(4.4)$$

$$\text{MCOR } 11100.0110$$

+ LSB  $\rightarrow$  Add 1 to LSB.

$$= \underline{11100.0111} \rightarrow Q4.45$$

```
float acc=0;  
for (int i=0;
```



2) T registers — Temporary.  
P registers for program.  
S registers for general storage  
\$zero for init.

NB: check up on various micro and co-processor status registers.