31343 Introduction to Programmable logic Controllers
Exercise 2 : “ex2_digital”

Purpose:
This exercise will illustrate different aspects of working with digital systems to represent data and to do logic operations. Most PLC programming is done in the digital domain but many measurements are analog and it is therefore important to realize the implications of this.

Task 1:
Calculate the signed 8 bit binary representation using two’s complement of the following decimal numbers:

- 12
- -64
- 0
- -127

Look up the binary32 format and explain the following

- What is the largest number it is possible to represent in this format ?
- Write down the bit pattern of the largest number.

Task 2:
Look up the LM35DZ temperature sensor. This sensor will output an analog voltage proportional to the measured temperature.
A PLC with a 16 bit analog converter module is used to read data from the LM35DZ sensor. The converter module uses 0-24 V range.

- Calculate the step size in volts of the analog module.
- Calculate the smallest change in °C it is possible to measure with the LM35DZ directly connected to the PLC.
- If temperatures in the range of 0-40°C should be measured, what amplification would you use ? (Explain why).

Task 3:

- How can a SR-latch be build using standard logic gates ?
- Is the logic system driving a typical traffic light combinational logic or sequential logic ? (Explain why).

Hand-in:
The hand-in should include answers to all questions and calculations above. The assignment should be delivered on Campusnet in the appropriate exercise folder.