# TFE4141 Design of Digital Systems 1

## Assignment 1: Terms and definitions used among digital designers

**Q1: What is $01000_2 + 01001_2$?**

**Q2: Which number do $1111_2$ represent?**
   a) In 4-bit unsigned format
   b) In 4-bit signed format
   c) In 4-bit signed format (2's complement)

**Q3: What does "dynamic range" in the context of number representation mean?**

**Q4: What has highest dynamic range of a 32 bit floating point number and a 32 bit fixed point number?**

**Q5: How are floating point numbers and fixed point numbers spaced across the dynamic range?**

**Q6: Add the numbers from Q1 in the same way as you learned at school.**

**Q7: A Boolean function can be constructed for computing the LSB in the addition of two fixed-point numbers (as done in Q6).**
   a) What is a Boolean function?
   b) Create a truth table for the LSB Boolean function.
   c) Create the Boolean function based on the truth table

**Q8: What is a half-adder and what is a full-adder?**

**Q9: Draw symbols for the logic AND, NOR, and XOR gates.**

**Q10: What is combinational logic?**

**Q11: What is sequential logic?**

**Q12: D flip flop**
   a) What is a D flip-flop?
   b) Draw the symbol commonly used for representing a D flip-flop.
   c) Why do some flip-flops have reset?
   d) Find VHDL code for a D flip-flop with synchronous reset.

**Q13: Latch (The evil cousin of the D flip-flop)**
   a) What is a latch.
   b) Try googling "unwanted latches". Do you find anything?

**Q14: What is a register and how are registers related to D flip-flops?**

**Q15: Draw a 4-bit register**

**Q16: Draw a 4-bit shift-register**

**Q17: What is a Mux?**

**Q18: What is a state-machine and what role do they play in digital circuits?**

**Q19: Google "CPU datapath", print out one example Datapath and explain what we are looking at.**

**Q20: What is the purpose of pipelining in computing?**

**Q21: What is static timing analysis (STA)?**

**Q22: Is negative slack a good thing?**

**Q23: What does "critical path" mean?**

**Q24: What does the terms "setup-time" and "hold-time" for a flip-flop mean?**

**Q25: What is logic synthesis?**

**Q26: What is high-level synthesis?**

**Q27: What does EDA stand for in the context of digital design?**

**Q28: What does "place & route" refer to?**

**Q29: What does "design for testability" (DFT) mean?**

**Q30: What is a scan chain?**

**Q31: What is formal verification?**

**Q32: There are 10 kinds of people in the world. Those who understand binary and those who don't.**