

## Homework 1

October 1, 2013

Due date: October 15, 2013

- (24%) Convert the following binary numbers to hexadecimal numbers, unsigned integers and signed integers (with 2's complement).
  - $00001010_2$
  - $10110101_2$
- (24%) What are the binary representations of the following hexadecimal numbers? What unsigned and signed integers (with 2's complement) do they represent?
  - 5C
  - B2
- (16%) What are the 8-bit binary representations of the following signed decimal integers (with 2's complement representation)?
  - 42
  - 63
  - 124
  - 128
- (18%) Let  $Q = A + B(A + C) + AC$ . Prove that (a)  $Q = A + BC$ . (b) Implement this function with logic gates AND, OR and NOT. (c) Use only NAND gates to implement this function.
- (18%) (a) Create the truth table for the 3-input Boolean function, mod3, which returns  $X\%3$  for the input  $X$ . For example, if the input  $X_2X_1X_0 = 101$ , then the output  $Z_1Z_0 = 10$  since  $5\%3 = 2$ . (b) Implement this function with logic gates AND, OR and NOT.