

DEVELOPMENT OF DIGITAL SYSTEMS

Midterm Examination
24. 1. 2012

1. Demonstrate the procedure of integer division upon a given example:

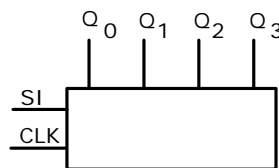
$$47_{10}/9_{10}$$

2. Implement following functions using an imaginary PAL3L3 circuit:

- $f_1 = x_1 \oplus x_2$
- $f_2 = x_1 \cdot x_2 \cdot x_3$
- $f_3 = \text{majority function of three variables.}$

Imaginary circuit PAL3L3 is PAL-like structure with 3 inputs and 3 outputs. Each OR gate has 4 AND gates at its input. Designation L denotes inverted outputs. Draw the PAL3L3 structure and mark the programming points in the AND matrix.

3. Implement a four bit SIPO (serial in – parallel out) shift register using T type flip-flops and multiplexers 2/1. The register has a serial input (SI) and parallel output (Q_0, Q_1, Q_2, Q_3).



4. Draw a state transition table of a Moore type finite state machine, which controls the operation of a coffee vending machine. The price of coffee is 15 cents. We can pay using 5 or 10 cent coins. The vending machine control circuit has:

- input $5cent$, which becomes '1', when user inserts a 5 cent coin into machine,
- input $10cent$, which becomes '1', when user inserts a 10 cent coin into machine,
- output p , which becomes '1', when user inserts a total sum of 15 cents

The machine does not return any money and stays in the final state upon payment of 15 cents. Simultaneous insertion of two coins is not possible.

Examination duration is 60 minutes. Each assignment is worth 10 points.

Please sign your answer sheet using your enrollment number. Solutions will be published on the course web page. Examination results will be announced on: <https://estudent.fri.uni-lj.si/>