Arithmetic circuits

Exercises:

1. Download the ICs datasheets needed for measurements (7442 (7445) BCD-DEC decoder, 74138 3-to-8 decoder, 74139 double 1-to-4 demultiplexer, 7485 4 bit digital comparator datasheets; puma.unideb.hu/~misak, http://alldatasheet.com).

2. Read and learn:

- dataselector circuits ([1], P.331-342);
- arithmetic circuits ([1], P.296-316, 342-345).

3. Design and implement:

- 2 line to 4 line decoder with Enable input! Design this problem exclusively by the use of exclusively NOR and NOT gates! Implement this circuit without Enable input, examine its operation! Compare its practical operation with expected (planned) operation! Describe and write your experiences in measurement protocol!
- $Y = \sum^{4}(1,2,5,6,7,8,10,12,13,15)$ logic function by 8-to-1 multiplexer and one inverter!

Write solutions to the measurement protocol! Propose IC types for problems realization! Examine the designed circuits by Tina circuit simulator! Describe circuit operation and write your experiences in measurement protocol!

4. Build 1-to-2 demultiplexer with 2-input NAND gates! Examine its operation!

5. Get acquainted in practice with 7442 IC operation!

6. Check the 7442 IC function in practice! Show, how to use this decoder as 1:8 demultiplexer! Implement a 3-variable logic function by this decoder! Examine the circuit! Compare its practical operation with expected (planned) operation! Describe and write your experiences in measurement protocol!

7. Transform a double 2:1 multiplexer to 4:1 decoderless multiplexer! For implementation use additional transistors and switches! Examine its operation! Compare its practical operations with expected (planned) operation! Describe and write your experiences in measurement protocol!

8. Build a 1 bit half-adder by 2 input NAND gates! Examine its operation! Compare its practical operation with expected (planned) operation! Describe and write your experiences in measurement protocol!

9. Build a 1 bit full adder by 2 input NAND gates! Examine its operation! Compare its practical operation with expected (planned) operation! Describe and write your experiences in measurement protocol!

10. Design and implement a 1 bit comparator circuit! For realization use 7400 and 7414 ICs!

11. Get acquainted in practice with 7485 IC operation!

BIBLIOGRAPHY

[1] Floyd T. L. Digital fundamentals. New Jersey: Pearson Prentice Hall, 2006.
[2] Szász Cs. Digital electronics basics (Laboratory handbook), Debrecen: DE MFK, 2003 (in Hungarian).
[3] Magyari B. Digital ICs (74xx series). Budapest: Műszaki Könyvkiadó, 1982 (in Hungarian).