Fall 2016

BSM 203Logic Circuits

Homework #1

Instructions:

- The due date for this homework is ***November, 1,Tuesday at 5:00 pm***.
- You can hand in your homework before the class starts, drop it to room 1153, or send it via e-mail (saubsm203@gmail.com) with a subject line "BSM 445 – Homework 1 - <student name> - <student number>"with condition of handing in the hardcopies later.
    - Only the e-mail with proper subject line will be accepted
    - Student is responsible to check the attachment to emails. Instructor may not notice no-attachment e-mails and therefore cannot be hold responsible for warning student in time.
    - You can send photos of a handwritten homework, but have to hand in the hardcopies. Without hardcopies, homeworks will not be evaluated from photos. This is also valid for other types of e-mailed homeworks. Please write the following statement on to your late handed-in homework: "A softcopy of this homework is submitted before the deadline."
- Note that there are 4 questions in this homework.
- Homework will not be accepted after due date unless instructor suggested otherwise.
- All students are expected to work individually. Discussions among students are encouraged, but homework must be prepared, written, and submitted individually.
- Do not waste your time by googling the homework questions. Solving may take much shorter time.
- If the hardcopy homeworks has more than one paper sheet, then you should staple the sheets close to upper left corner such that no writings is blocked.

Honor code:
As student(s) who has/have signature(s) below, I/We pledge that I/we follow the rules of honor code below and directions above while doing the homework.

1-) Students can only share information (especially answers) within the group (if it is a group homework), but not with other students in class or in other programs. However methods can be discussed.
3-) Sharing questions or answers outside of institution, on social media, on homework websites, or any other similar medium is strictly forbidden.
4-) If honor code and directions are not followed, the instructor has right to pursue any legal actions specified in university regulations.
5-) Homeworks without signatures will not be accepted.

Student Number	Name and Surname	Signature	Date

Questions:

1) [15points] [Introduction to Number Systems and Conversion]

a) Add the first three digits of your student number to last 3 digits. Let A denote the result. For example, if your number is 121210102, then A = 121 + 102 = 223. Then convert A to
   i. Binary
   ii. Octal
   iii. Hexadecimal

b) Let*B* be the lastnon-zero digit of your number. Do following operations in binary system
   i. A + B
   ii. A – B
   iii. A x B

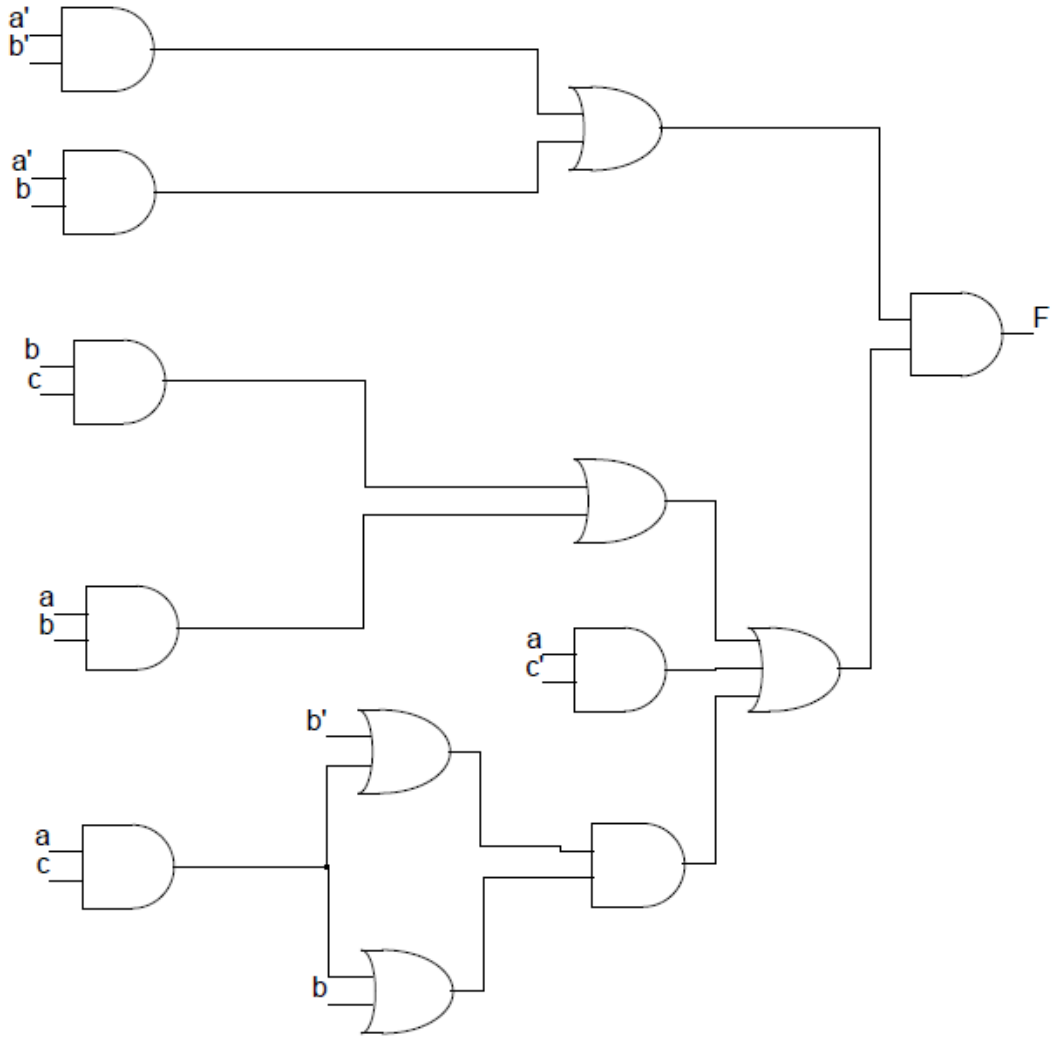
c) Calculate A – B without subtraction, but with addition of A to –B by using 2's complement.

d) Take the last five digits of your number. After the 3rd digit put a decimal point. Let *C* denote the result. For example, if your number is 121210102, then C = 101.02. Convert C to binary.

e) Show C in 8-4-2-1 code, 6-3-1-1 code, and Gray code.

2) [25points] [Boolean Algebra] Simply expression F for each question below. (F is a different function for each question.)

a) F is shown as logic circuit diagram.



b) F is given as truth table. (Since the table is too long, we show it in two parts. Right table is continuation of the left table.)

t	w	x	y	z	F
0	0	0	0	0	1
0	0	0	0	1	1
0	0	0	1	0	0
0	0	0	1	1	0
0	0	1	0	0	0
0	0	1	0	1	0
0	0	1	1	0	1
0	0	1	1	1	1
0	1	0	0	0	0
0	1	0	0	1	0
0	1	0	1	0	1
0	1	0	1	1	1
0	1	1	0	0	1
0	1	1	0	1	1
0	1	1	1	0	0
0	1	1	1	1	0

t	w	x	y	z	F
1	0	0	0	0	1
1	0	0	0	1	1
1	0	0	1	0	0
1	0	0	1	1	0
1	0	1	0	0	1
1	0	1	0	1	1
1	0	1	1	0	1
1	0	1	1	1	1
1	1	0	0	0	0
1	1	0	0	1	0
1	1	0	1	0	0
1	1	0	1	1	1
1	1	1	0	0	1
1	1	1	0	1	0
1	1	1	1	0	0
1	1	1	1	1	0

3) [35points] [Boolean Algebra]

a) F = k'm'p + nr + kpr + n'p + mpr
   i) Simplify it to sum-of-product form with minimum number of products.
   ii) Simplify it to product-of-sum form with minimum number of sums.

b) G = AC + BDE + A'B + BC'D' + BEF
   i) Simplify it to sum-of-product form with minimum number of products.
   ii) Simplify it to product-of-sum form with minimum number of sums.

c) H = (x' + w' + y') (x' + y + z')[y'z'(w' + x) + wy(x' + z)]'
   i) Simplify the expression *without* taken the dual form of it.
   ii) Now find the dual form of it (H_D) and simplify H_D and take the dual of H_D again to find the simplified version of H.

d) Simplify the following expression: [(D'+ E')(E + F)][(F'+ G')(D' + G')]

4) [25points] [Minterm and Maxterm Expansions]An automatic sprinkler system, which consists of temperature sensor, humidity sensor, a wifi module to receive weather forecast, and a time clock, goes on (F = 1) when

- When a rain is not forecasted and,
- The temperature is over 20◦C and time is before 6 pm or,
- The humidity of the soil is low, temperature is below 20◦C and time is before 6 pm.

Based on these rules;
a) construct the truth table for F with proper inputs.
b) find the simplest expression for F.
c) express F and F' as a minterm expansion.
d) express F and F' as a maxterm expansion.