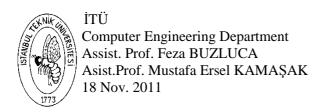
Number: Name Surname:



DIGITAL CIRCUITS 1st MIDTERM EXAM (Question 1)

Regulations:

- 1. Duration is 100 minutes.
- **2.** Asking questions to proctors is not allowed.
- **3.** Any cheating or any attempt to cheat will be subject to the University disciplinary proceedings. Cell phones are prohibited on the desk, they must be switched off.

QUESTION 1 (30 Points):

- **a.** A and B are two 8-bit, **signed**, binary integers. B is given as B=1001 1101. If we perform the operation A-B according to **2's complement** method overflow occurs and the most significant bit of the 8-bit result is 1.
- i) What is the sign of A (positive or negative)? Why?
- ii) Write the smallest possible integer A that can constitute this situation (result and overflow).
- **b.** A and B are two 8-bit, **unsigned**, binary integers. After the operation A-B according to **2's complement** method the obtained result is a 9-bit number: 1 1001 0110. Which is true A>B or A<B? Why?

Solution:

Number: Name Surname:

DIGITAL CIRCUITS 1st **MIDTERM EXAM (Question 2)**

QUESTION 2 (30 Points):

a. E and F are two expressions, which do not include the literal **a**. Write the expression in PoS form, of which E+F is the consensus term respect to **a**.

Note: To show complements put a dash over literals, such as \bar{a} .

- **b.** Write the consensus theorem for the obtained expression in PoS form (above) and prove it (in PoS form) using the axioms and theorems of the Boolean algebra.
- **c.** Minimize the given expression using the consensus theorem and other necessary theorems of the Boolean algebra. z = ab'c + ab + acd + a'bTo show complements put a dash over literals, such as \bar{a} . Implement the minimized expression using **only** 2-input NAND gates.

Number: Name Surname:

DIGITAL CIRCUITS 1st MIDTERM EXAM (Question 3)

QUESTION 3 (40 Points):

Expression of a function f(a,b,c,d) is given in 2nd canonical form that includes 6 maxterms. f(a,b,c,d) = (a+b+c+d')(a+b'+c+d')(a'+b'+c+d')(a'+b'+c+d')

a. Draw the Karnaugh map of the function f(a,b,c,d) and find all prime implicants. **b.** Find all prime implicants of the **complement** $(\bar{f}(a,b,c,d))$ of the function using the Quine-

McCluskey method.