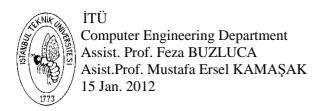
# **Number:** Name Surname:



# **DIGITAL CIRCUITS FINAL 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 (20 Points):**

a) Minimize the following function <u>using axioms and theorems</u>. f(A,B,C,D)=A'B'CD+AB'CD+AC'D+AC'D'+A'B'CD'+ABCD+ACD'

b) Write the simplest expression for the following function as <u>product of sums</u>. Draw the Karnaugh diagram. You do not need to use prime implicant chart.  $f(A,B,C,D)=U_1(0,1,2,3,6,8,9,10,11,14)+U_{\Phi}(12,15)$ 

# Number: Name Surname:

#### **DIGITAL CIRCUITS FINAL EXAM (Question 2)**

# **QUESTION 2 (40 Points):**

An incomplete logic function Z=f(A,B,C,D) is implemented by using a 4:16 decoder and a **NOR** gate. Don't care input values (A,B,C,D) is:**1100** 

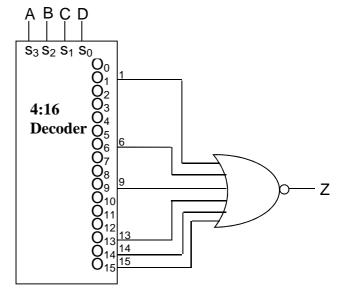
**a.** Draw the Karnaugh map of the function and find all prime implicants.

To show complements put a dash over literals, such as  $\overline{a}$ .

**b.** Construct the prime implicant chart.

The cost criteria: 2 units for each variable and 1 unit for each complement sign.

**c.** Simplify the prime implicant chart and find the cheapest expression of the function.



# Number: Name Surname:

# **DIGITAL CIRCUITS FINAL EXAM (Question 3)**

# **QUESTION 3 (40 Points):**

**a.** Analyze the given clocked synchronous circuit with two inputs (A,B) and one output (Z) and construct the State/Output table. Note:  $Q_1$  is the most significant state variable and  $Q_0$  is the least significant one. Show steps shortly, how you created the table.

Draw the state diagram of the circuit.

**b.** Design and draw the circuit with the same behavior (as in a.) by using D flip-flops and **only** 2-input NAND gates.

