Review Questions for Exam

Number Systems, Operations and Codes

1. Convert the decimal number 417.3125 to
   a) binary b) hexadecimal c) octal

Yanıt 1

a)
$417 = 2^8+2^7+2^5+2^0$.

0.3125 x 2=0.625	0
0.625 x 2 = 1.25	1
0.25 x 2 = 0.5	0
0.5 x 2 = 1.00	1

110100001.0101

b) **1A1.5**

c) **641.05**

2. Show the decimal equivalent of each of the numbers if they are interpreted as

Signed Numbers (negatif)	1 0 1 1 0 0 0 0	0 1 0 0 1 1 1 1
Signed-magnitude system	1 0 1 1 0 0 0 0 $-(2^5+2^4) = -48$	79
1's complement system	1 1001111 $-(2^6+2^3+2^2+2^1+2^0) = -79$	79
2's complement system	1 1001111 +1 1010000 $-(2^6+2^4) = -80$	79
Gray code	1 0 1 1 0 0 0 0 Gray 1 1 0 1 1 1 1 1 Binary $(2^6+2^6+2^4+2^3+2^2+2^1+2^0) = 223$	117
BCD code	X0 Geçersiz kod.	4X Geçersiz kod.

3. Determine the signed 8 bits binary values of the numbers of the decimal -18 and +33 in the following systems:

Signed-magnitude system	10011000	10110011
1's complement system	11101101	00011110
2's complement system	11101110	00011111

4. The following **6-bit two's complement numbers** were found in a computer. What **decimal** number do they represent?
   001011 **11**
   111010 **-6**

5. Perform multiplication for binary numbers 01010011 and 11000101 without converting to decimal. The binary numbers listed have a sign in the left most position and, if negative, are in 2's complement form. Find decimal equivalents of the results.

   Multiplication (10 bits result)

Yanıt 5

Biri pozitif biri negative olduğu için sonucun negative olacağı öngörülebilir.
Negatif sayının hangi sayının eksisi olduğunu bulmak için asıl haline çeviriyoruz.

11000101 2's complement → 00111011

0101011 x 00111011 = 1001100100001

2's complement 0110011011111
İşaret bitini sayının başına ekliyoruz. 1 0110011011111

6. Perform division for binary numbers 01100100 and 00011001 without converting to decimal. The binary numbers listed have a sign in the left most position and, if negative, are in 2's complement form. Find decimal equivalents of the results.

   İkisi de pozitif. Sonucun pozitif olacağını öngörebiliyoruz.

   Bölünenden böleni 0 olana kadar çıkararak kaç tane olduğunu yani bölümü buluyoruz.
   Dividend + 2's complement of divisor 01100100 + 11100111 = 01001011
   Bölüm ilk değer olarak 0 alıyor ve her çıkarmada bir ekliyoruz.
   …
   0 olana kadar tekrarlayın.

   En son ortaya çıkan böüm: 00000100

7. Convert the decimal numbers 676 and 377 to **BCD** and **add them**.

676 → 0110 0111 0110

377 → 0011 0111 0111

Eğer topladığımızın iki sayının değeri 9'u geçiyorsa, 10'luk sistemde basamak değerini br sonraki basamağa aktarabilmek için 6 ekliyoruz.

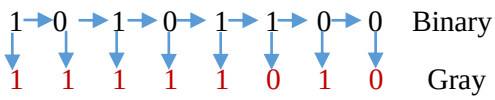
SUM → 0110 + 0111 = 1101 + 0110 (6) = 0011 + 0001 sol basamağa gönderilecek.

0111 + 0111 = 1110 + 0001 = 1111 + 0110 (6) = 0101 + 0001 sol basamağa gönderilecek.

0110 + 0011 = 1001 + 0001 = 1010 + 0110 (6) = 0000 + 0001 sol basamağa gönderilecek.

0001 0000 0101 0011 = **1053**

8. Convert binary **1 0 1 0 1 1 0 0** to Gray code



9. Hexadecimal numbers 7F and C5 will be transferred with a parity bit. What are the **even** parity bits?

   01111111 → 1'ler tek sayıda olduğu için çift sayıda 1 elde edebilmek için başına 1 ekliyoruz.

   1 01111111

   11000101 → 1'ler tek sayıda olduğu için zaten koşulu sağlıyor, başına 0 ekliyoruz.

   0 11000101

10. Convert the decimal number – **1.02325 x 10 ^{3}** to a single-precision floating-point binary number

    – 1.02325 x 10 ^{3} → 1023.25 = 1111111111.01 = 1.11111111101 x 2^{9}
    9+127 = 136 = 10001000

1	1 0 0 0 1 0 0 0	1 1 1 1 1 1 1 1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 0

11. Find the decimal value for the following single precision floating point number:

1	1 0 0 0 0 1 0 1	1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

İşaret(sign) = 1

***Üs(exponent)** = 10000101= 133*

Büyüklük(mantissa) = 0.00100100000000000000000

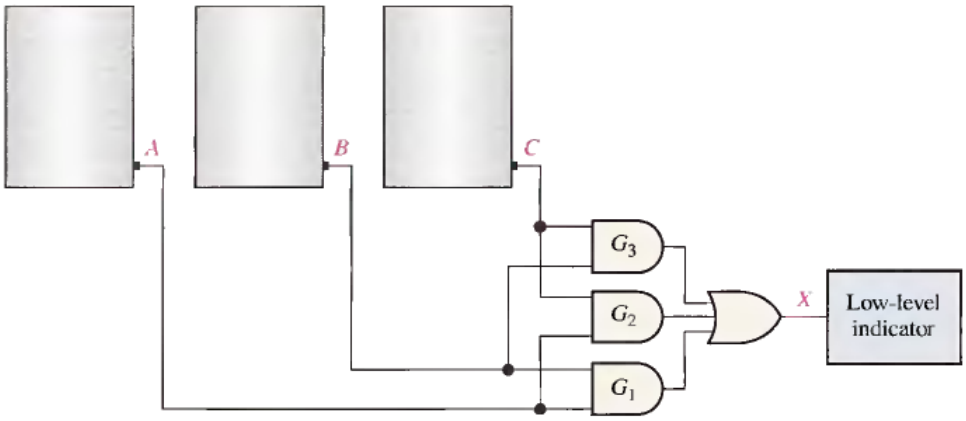
***Sayı** = $(-1)^{S}$ (1+M) (2^{E-127})*

- ➔ *$(-1)^{1}$ (1.00100000000000000000000) ($2^{133-127}$)*
- ➔ *= −1100100.00000000000000000. = −100*

Logic Gates

1. In a certain chemical-processing plant, a liquid chemical is used in a manufacturing process. The chemical is stored in three different tanks. A level sensor in each tank produces a HIGH voltage when the level of chemical in the tank drops below a specified point.
   Design a circuit that monitors the chemical level in each tank and indicates when the level in any two of the tanks drops below the specified point.

   A,B,C tanklarından gelen sensor sinyalleri şekildeki devrenin girdileri olarak alınıyor. G1 adlı AND kapısı A ile B, G2 adlı AND kapısı A ile C, G3 adlı AND kapısı B ile C tanklarının kontrolünü yapıyor. Herhangi iki tankın kimyasal seviyesi düştüğü zaman AND kapılarının iki girdisi de YÜKSEK voltaj olduğu için OR kapısı yardımıyla çıktının YÜKSEK sinyal olarak verilebilmesini sağlıyor. Böylece uyarı oluşturabilecek lamba, sesli alarm vb. mekanizma çalışabilir.



Boolean Algebra and Logic Simplification

1. Find the simplest form of the given expression by using only Boolean Algebra
   A + B(A+C) +AC

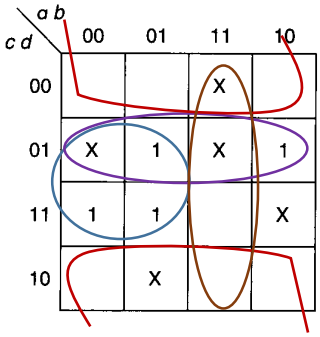
   A + B(A+C) +AC → from distribution
   A+ AB + BC + AC → from A + AB = A
   A + BC + AC → from A + AB = A
   =A + BC

2. Given f (a,b,c,d) =Σm(0,2,5,7,8,10,13,15). Find the minimum POS and SOP expressions.

AB / CD	00	01	11	10
00	1	0	0	1
01	0	1	1	0
11	0	1	1	0
10	1	0	0	1

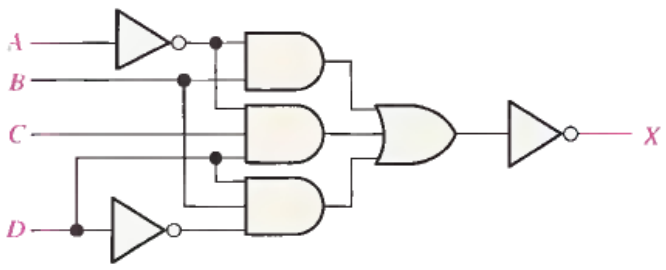
SOP = B'D' + BD
POS = (B'+ D)(B+D')

2. For the following Karnaugh map, find both minimum sum of products and minimum product of sums expressions.



Min SOP = A'D + C'D
Min POS = D (A'+B')

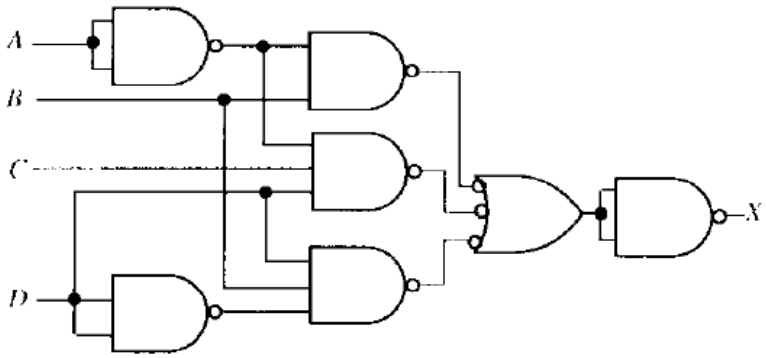
3. Answer the questions



a) Write the output expression for the circuit in the figure

F = (A'B + ACD+ DBD')' = (A'B + ACD)

b) Implement the logic circuits in the figure using only NAND gates.



4. The following Boolean function (with its don't cares) is given:

F (A,B,C,D) = Σm (2, 3, 5, 7, 8, 14, 15)

d (A,B,C,D) = Σm (0, 1, 4, 6, 9, 10, 11)

a) Find the most simplified Boolean expression using Karnaugh map simplification method.

b) Draw the combinational circuit for this function using only NAND gates.

c) This function can be implemented by using 4-to-1 multiplexer? Show the circuit if it is possible.

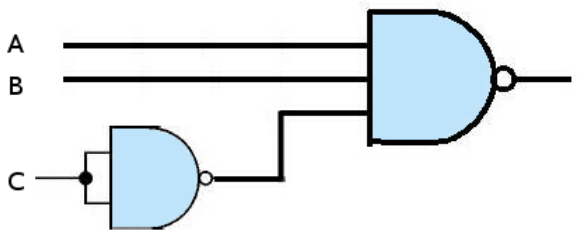
d) Is it possible to implement the function above if we have only 2 X 4 decoders?

a)

CD AB	00	01	11	10
00	X	X	1	1
01	X	1	1	X
11	0	0	1	1
10	1	X	X	X

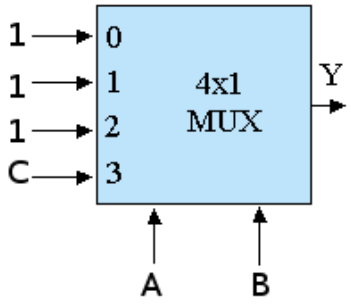
Min SOP = A' + B' + C

b) [(A' + B' + C)']' = '(A.B.C')'



c)

A	B	C	F	
0	0	0	1	**1**
0	0	1	1	
0	1	0	1	**1**
0	1	1	1	
1	0	0	1	**1**
1	0	1	1	
1	1	0	0	**C**
1	1	1	1	



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