



Universidad Carlos III de Madrid
Digital Electronics. 1st partial exam. March, 2012
Groups 65,69,79,95.

Surname, Name:

Group:

Time: 1h. 15'

Hand in the solutions of questions 1 and 3 together, in this sheet of paper.

Hand in question 2 separately, in a different set of sheets.

Question 1 (3 pts)

Obtain the representation of +1Fh and -2Ah in decimal, binary and octal systems and encode them using 2s-complement code. Encode +1Fh in BCD and Gray's codes.

Hexadecimal	+1Fh	-2Ah
Decimal system	+31	-42
Binary system	+11111	-101010
Octal system	+37	-52
BCD	110001	-----
Gray's code	10000	-----
2s-complement	011111	1010110

Question 2 (4 pts)

Given the following boolean function:

$$f(a, b, c, d) = \prod_4 (0, 2, 7, 8, 9, 15) + \Delta(1, 4, 10)$$

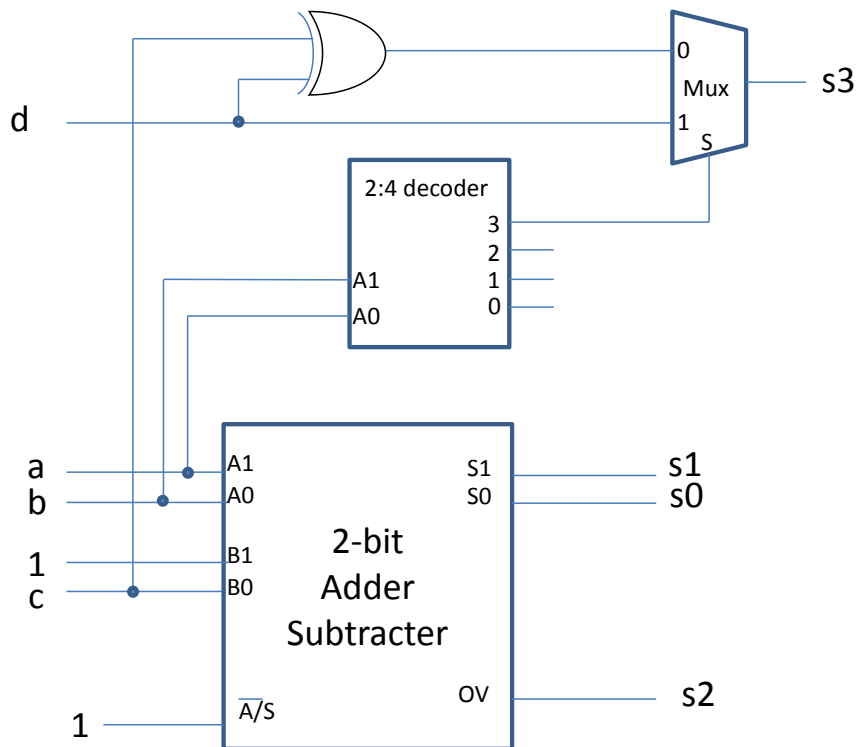
- Find a simplified expression for f as a product of sums.
- Find a simplified expression for f as a sum of products.
- Find an expression using only NAND operations (it is not required to show the graphical representation of the circuit).
- Implement f with a decoder with active-low outputs. Point out first which is the most suitable size for the decoder.
- Implement f with a MUX2 (multiplexer with 4 data inputs) and additional logic if needed (only one MUX2).

Important note: In the correction it will be considered if the solutions have the minimum possible number of components.



Question 3 (3 pts)

Fill out the truth table for the following circuit with inputs a,b, c, d and outputs s0, s1, s2 and s3 :



								Hint:			
a	b	c	d	s3	s2	s1	s0	A	B	A-B	S
0	0	0	0	0	1	1	0	0	-2	2	0
0	0	0	1	1	1	1	0	0	-2	2	0
0	0	1	0	1	0	0	1	0	-1	1	0
0	0	1	1	0	0	0	1	0	-1	1	0
0	1	0	0	0	1	1	1	1	-2	3	0
0	1	0	1	1	1	1	1	1	-2	3	0
0	1	1	0	1	1	1	0	1	-1	2	0
0	1	1	1	0	1	1	0	1	-1	2	0
1	0	0	0	0	0	0	0	-2	-2	0	0
1	0	0	1	1	0	0	0	-2	-2	0	0
1	0	1	0	1	0	1	1	-2	-1	-1	0
1	0	1	1	0	0	1	1	-2	-1	-1	0
1	1	0	0	0	0	0	1	-1	-2	1	1
1	1	0	1	1	0	0	1	-1	-2	1	1
1	1	1	0	0	0	0	0	-1	-1	0	1
1	1	1	1	1	0	0	0	-1	-1	0	1