Lab exam
Combinational Circuits

The scoring of this lab exam is 1,2 points

Important information

Download the files `LabExam1_eng.doc` and `LabExam1_eng.circ` from Moodle and rename them as `A_surname_name.doc` and `A_surname_name.circ`, respectively. For example, `A_martinez_pedro.doc` and `A_martinez_pedro.circ`.

After finishing the lab exam, the student must submit to Moodle the file `A_surname_name.zip (or .rar)` including:

1) The file `A_surname_name.doc` with the responses of Part 1.

2) The file `A_surname_name.circ` with the designs corresponding to subcircuits of Parts 2 and 3 and the *main* circuit.

Don't use switches for constant signals, instead use Logisim constants 0 and 1 (in *Wiring*).

Lab exercise

A particular function *F(A,B,C,D)* has been assigned to each student according the ID number in `FuncionF.pdf`. In the first column of `FuncionF.pdf` the student can identify the row corresponding to his/her ID. The rest of the columns on the right contain the positions of the truth table in which F takes value 1. This search can be easily done by typing < Ctrl + f >.

Part 1 (20%). (Write your answers in the next page)

a) Find the simplified expression of F as SOP
b) Find the simplified expression of F as POS. using Karnaugh maps (fill the K-maps and write the corresponding expressions):

Part 2 (30%). Design in Logisim subcircuits 2.1, 2.2 and 2.3

a) (*subcircuit 2.1*). Digital circuit of F using AND/OR/NOT gates.
b) (*subcircuit 2.2*). Digital circuit of F using NOR gates.
c) (*subcircuit 2.3*). Digital circuit of F using an active-high output DEC 4x16 and the necessary 3-input gates. Take the decoder from the Logisim library.

Part 3 (50%). Design in Logisim subcircuits 3.1, 3.2 and main:

a) (*subcircuit 3.1*) Digital circuit of F using a MUX 8x1 and the necessary gates. Take the selection inputs freely.(20%)
b) (*subcircuit 3.2*) Digital circuit of F using several DEC 2x4 and the necessary gates. Important remark: put the property *Disabled Output* of the decoders to Zero. (20%)
c) (*main*) Design the *main* circuit that integrate the aforementioned 5 subcircuits with common inputs A, B, C and D, and include a display that visualizes the number represented in the binary code ABCD.(10%)

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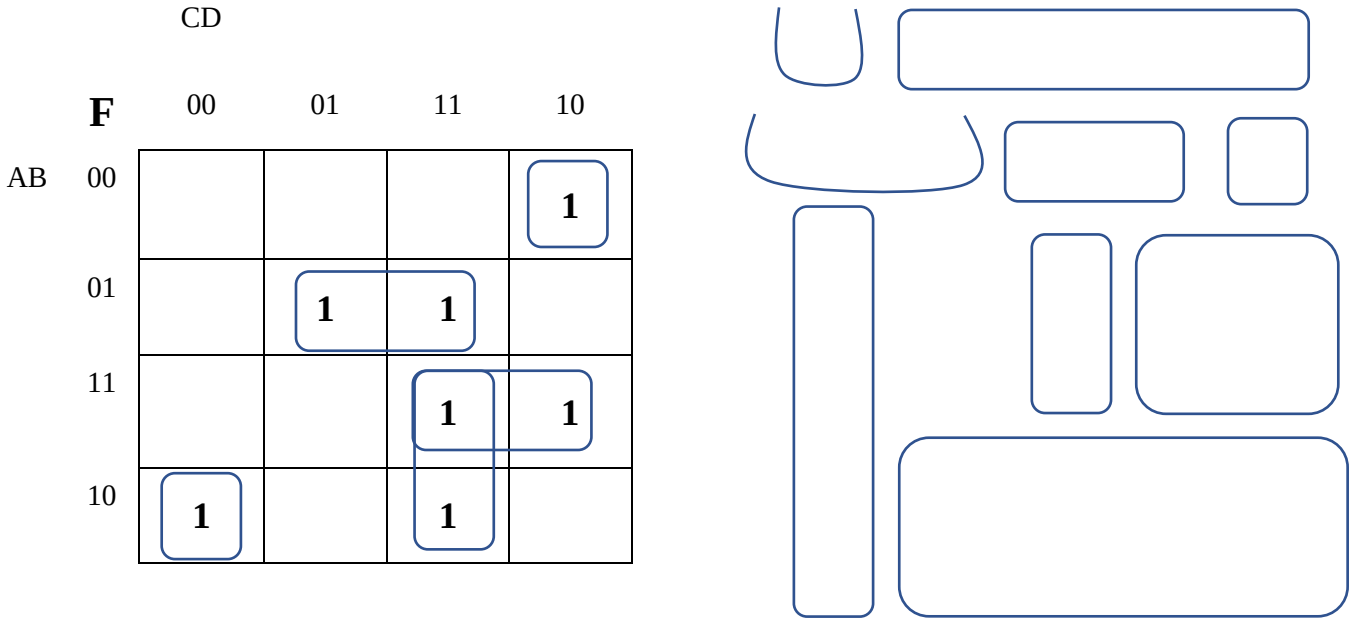
Part 1 (20%). Write your answers in this page

	Positions in which function F takes value 1					
2	5	7	8	11	14	15

a) Find the simplified expression of F as SOP. **Fill the Karnaugh Map and takes the necessary figures (copy, paste, drag and rotate (if necessary)) for grouping**:

Write here the expression F(A,B,C,D) = (A'B'CD')+(AB'C'D')+(A'BD)+(ABC)+(ACD)



a) Find the simplified expression of F as POS. **Fill the Karnaugh Map and get the necessary figures (copy, paste, drag and rotate (if necessary)) for grouping**:

Write here the expression F(A,B,C,D) =
(A+B+C)(A+B+D')(A+B'+C'+D)(A'+B+C'+D)(B'+C+D)(A'+B'+C)(A'+C+D')

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