COMPUTER TECHNOLOGY 2021/2022
PRACTICAL SESSION P1 (LOGISIM)
LOGIC GATES: SIMULATION

INTRODUCTION.

The purpose of this practical session is to familiarize the student with Logisim. Logisim will be used to simulate digital circuits and can be downloaded/installed on your own computer (https://www.esi.uclm.es/www/jsalido/laboTeco/firstSteps.htm). Thus, students are allowed to bring their laptop to the lab and to work with it in practical sessions. Anyway, there will always be available computers in the lab.

Remember that:

- Attendance is optional
- The lab sessions will not be scored and the student does not have to elaborate a report of the lab sessions.
- The practical session guide will be available in Moodle at the beginning of the session.
- The solution will be uploaded to Moodle on Friday, so that the student can carry out a self-assessment.

REMARK: We also encourage the students to watch the videos that are linked in the section devoted to practical session (see link “First steps in the TeCo Lab”).

1. FIRST PART. SIMULATION OF DIGITAL CIRCUITS USING BASIC GATES.

Let ABC be a 3-bits binary number, A being MSB. The student has to design a digital circuit using logic gates with the following specification. The inputs of the digital circuit are A, B and C and the output is a binary variable F. F=1 if the decimal number *n* that represents ABC is either less than three or greater than three and prime number. Otherwise F=0.

1) Calculate the truth table of F. Find F as SOP (sum of products). Build and simulate the circuit for all the combinations of variables A, B, C.
2) Obtain an equivalent function using 2-input gates. Build and simulate the circuit for all the combinations of variables A, B, C.
3) Find F as POS (product of sums). Build and simulate the circuit for all the combinations of variables A, B, C.

Since the most important thing in this session is to simulate in Logisim the circuits using logic gates, the truth table and the mathematical expressions of F are given.

The truth table is

Decimal number *n*	A	B	C	F	Remarks
0	0	0	0	1	Less than 3
1	0	0	1	1	Less than 3
2	0	1	0	1	Less than 3
3	0	1	1	0	
4	1	0	0	0	
5	1	0	1	1	Greater than three and prime number
6	1	1	0	0	
7	1	1	1	1	Greater than three and prime number

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The mathematical expressions of F are

1) $F = \bar{A}\bar{B} + \bar{A}\bar{C} + AC$
2) $F = \bar{A}(\bar{B} + \bar{C}) + AC$
3) $F = (\bar{A} + C)(A + \bar{B} + \bar{C})$

Build and simulate circuits 1), 2) and 3).

2. SECOND PART

Design and simulate a circuit that converts a 3-bits binary number (ABC) to 2s-complement representation system (XYZ). First of all, find the truth table with inputs ABC and outputs XYZ. Design the circuit as simple as possible.