

	<b>UNIVERSIDAD CARLOS III DE MADRID</b>
	<b>FORMAL LANGUAGES AND AUTOMATA THEORY</b>
	<b>COMPUTER SCIENCE DEGREE. CONTINUOUS ASSESSMENT - PARTIAL 3</b>
	Last name(s): _____
First name: _____	
NIA: _____	

**Duration: 45 minutes**

**Exercise 1 (3 points)**

- Construct a Turing Machine to add the parity bit to a binary string. The TM must add a “0” if the number of 1s of the input string is odd and a “1” if this number is even.
- Represent formally the transitions for the input string “10011”.
- For the Following Turing Machine,  $TM = (\{0,1,b\}, \{0,1\}, b, \{p,q\}, p, f, \{q\})$  where  $f$  is defined by the following transition function

f	1	0	b
p	q1R	p0R	pbS
q	p1S	p1S	qbS

Which is the condition to accept input words (i.e., required state and input symbol in the tape)?

**Exercise 2 (4 points)**

Given the grammar

$$G = (\{S, A\}, \{x, y, z\}, S, P), \text{ with } P:$$

$$S ::= xyAS \mid z$$

$$yAx ::= xyA$$

$$yAy ::= yyA$$

$$Az ::= z$$

- Which is the type of grammar in the Chomsky hierarchy? Explain it in detail.
- Determine the language that is generated by the grammar.
- Find an equivalent Type-2 grammar.
- Determine an equivalent Push-Down automaton for the grammar obtained in the previous section.

- e. Explain in detail if it is possible to represent this language by means of the following formal machines and structures: a Turing Machine, a Deterministic Finite Automaton, a Type-1 grammar.