	**UNIVERSIDAD CARLOS III DE MADRID** **FORMAL LANGUAGES AND AUTOMATA THEORY** **GRADO EN INGENIERÍA INFORMÁTICA** **THIRD PARTIAL ASSESSMENT** **Surname(s):**_____ **Name:**_____ **NIA:**_____ **Signature:**_____

Duration: 45 minutes **Maximum Mark: 1.2 points**

Problem (Maximum mark: 0.6 points)

Design a PDA_E to recognize the language $L = \{a^{3n+1}b^n \mid n \geq 0\}$. Include a brief explanation of the developed design, also detailing the different elements in the formal definition of the PDA.

n=0	a
n=1	aaaab
n=2	aaaaaaabb
n=3	aaaaaaaaaabbb

A possible Type-2 grammar to recognize this language is:

G = ({a, b}, {S, A}, S, P)
P:
S ::= a | aaaaAb
A :: = λ | aaaAb

An equivalent grammar in Greibach Normal Form is:

G' = ({a, b}, {S, A, C, U}, S, P')
P':
S :: a | aCCCAU |aCCCU
A:: aCCAU |aCCU
C::= a
U::= b

Now we just have to apply the algorithm to calculate an equivalent PDA_E given a Type-2 grammar in GNF (a PDA_F can also be obtained by means of the corresponding algorithm):

PDA_E = ({a, b}, {S, A, C, U}, {q}, S, q, f, Φ)
f:
f(q,a,S) = {(q,λ), (q, CCCU), (q, CCCAU)}
f(q,a,A) = {(q, CCAU), (q, CCU)}
f(q,a,C) = {(q,λ)}
f(q,b,U) = {(q,λ)}