Student Declaration of Authorship

HERIOT WATT UNIVERSITY
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Course code and name:	F29LP - Language Processors
Type of assessment:	**Individual**
Coursework Title:	CW1.2
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Student Signature *(type your name):* Lucca Anthony Marcondes Browning

Date: 28/02/24

Copy this page and insert it into your coursework file in front of your title page.
For group assessment each group member must sign a separate form and all forms must be included with the group submission.

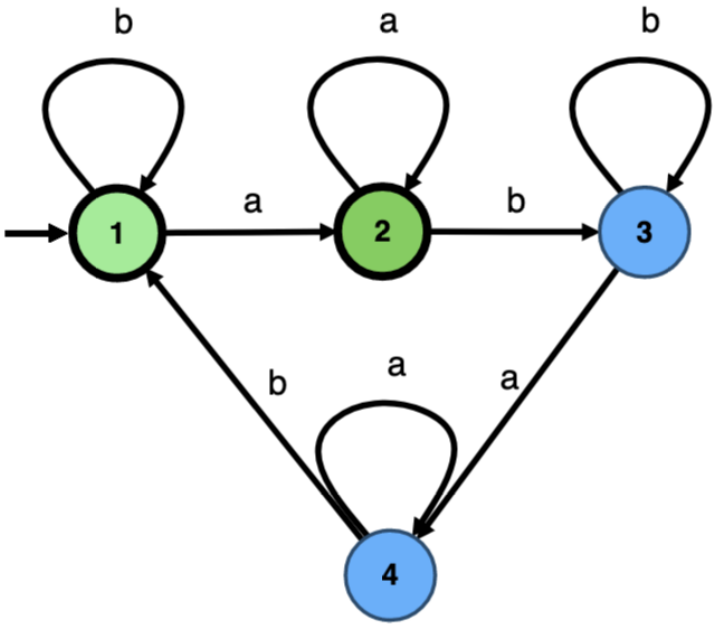
Part III: DFAs and NFAs

Submission: On Canvas, under Assignments
Marks: 12 marks possible (3% of final)
Deadline: Week 7, Thurs 29th Feb, 2023

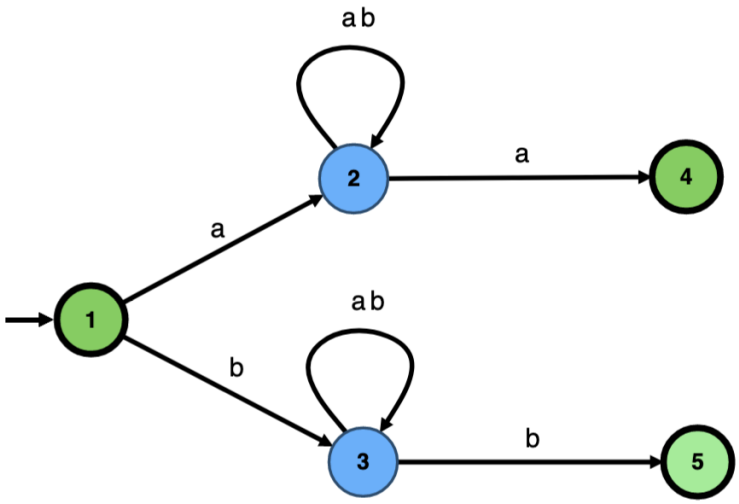
You may find draw.io useful for drawing automata. If you know of a similar and better tool, please let me know. You can insert images from https://automatonsimuator.com too as long as the edge annotations are clearly shown (note sometimes they are difficult to read). You can also insert screenshots from Automata Tutor.

1. Construct NFAs (possibly with ϵ-moves) to recognise the languages on alphabet {a,b} such that: *[4 marks]*

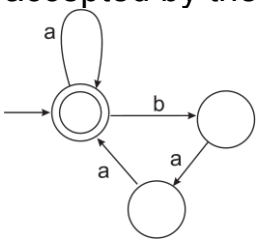
   1. $L=\{w \in \{a,b\}^* \mid w \text{ contains an even number of occurrences of } ab \text{ as a subword}\}$. So ϵ and a and b and $abab$ and $abaaba$ and $baaabab$ are in L, but ab and $ababab$ and $abaabab$ are not.



2. L={w∈{a,b}* | the first and the last letter of w are identical }



2. By writing a regular expression or a grammar, describe the language accepted by the NFA. *[2 mark]*

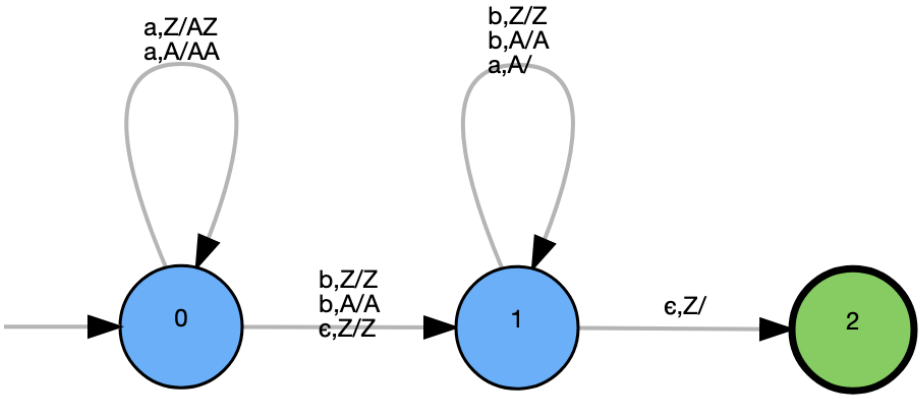


/(a*(baa)*)*/

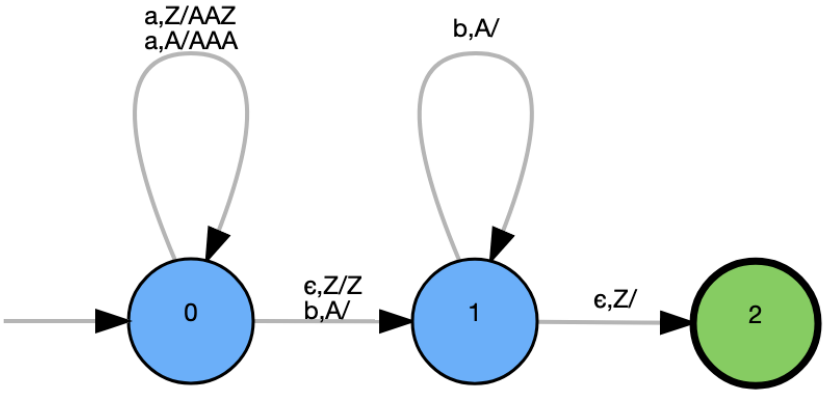
In the questions below, assume the alphabet is {a,b}. Your answer must state the acceptance mode used. In the questions below, the word *describe* means *draw a precise picture of* in the style I used in lectures or in the style of this webpage or this pdf, or just search the Internet for how to draw a PDA.

The acceptance mode used for Q3-Q5 is final state acceptance.

3. Describe a pushdown automaton that recognises $\{a^m b^n a^m | m,n \geq 0\}$ *[2 marks]*



4. Describe a pushdown automaton that recognises $\{a^m b^{2m} | m \geq 0\}$ *[2 marks]*



5. Describe a pushdown automaton that recognises $\{w | \#_a w = 2\#_b w\}$; where $\#_a w$ is the number of as appearing in w and $\#_b w$ is the number of bs appearing in w. *[2 marks]*

This works with all situations unless you input “a” first. It’s not perfect but I’ve put several hours into trying to figure this out.