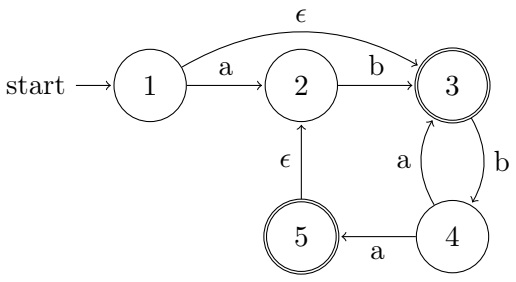
Language and Logic Assignment 1

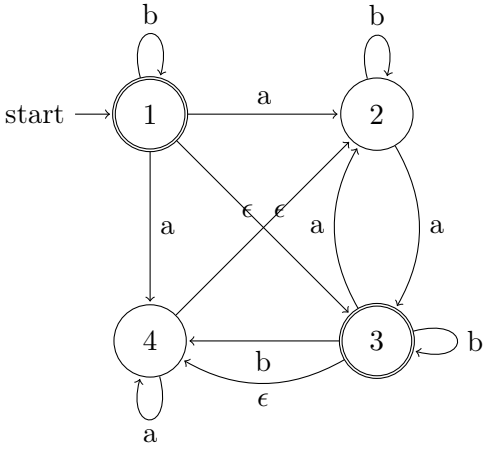
Please submit your solutions in a pdf file in addition to your commented code and executable files with instructions on how to execute them in uncompressed format.
The deadline for solutions is April 24 2018.
Note: Only typed solutions are acceptable. Reports that do not comply with the aforementioned requirements will not be considered.

1 Design an NFA for the following:

- All Hexadecimal numbers divisible by 6 with a remainder of 1 or 5.
- All strings over {a,b,c} with at least two occurrences of abc and an odd number of a's.
- All strings over {x,y,z} where x occurs an odd number of times or y and z occur an even number of times.
- L={w ∈ {0,1,2}*} where a string of exactly 5 symbols contains at least two 1's or at least one 2(but not both).

2 Convert the following NFAs to a DFAs and regular expressions:





3 Prove that the following languages are or are not regular.

- L is the language with alphabet {x,y} where the number of x's is equal to the number of y's.
- L is the language with alphabet {(,)} and balanced parentheses. i.e. (()) is accepted but ()) is not
- L = { $a^2b^3c^4b^lc^ma^nc^4b^3a^2$ | l,m,n ≥ 0 }

4 Game AI

Artificial Intelligence in video games is often implemented using Finite State Machines. Assume that in a turn-based video game there are two types of enemies, a zombie and an archer. At the beginning of each turn an enemy must choose what their action will be. The state is defined by the action the enemy was taking in the previous turn. The initial state for all enemies is idle. A zombie behaves in the following way:

- If the player is in sight and is alive but not close enough to bite it will chase the player.
- If the player is in sight, alive and close enough for the zombie to bite, it will do so.
- If the player is not in sight it will simply stay idle.

The process repeats until either the player or the zombie is dead.

The archer behaves a bit differently:

- If a player is in sight, alive and in range but not too close he/she will try to shoot the player.
- If a player is in sight, alive and not in range he/she will try to approach.
- If a player is too close he/she will try to evade
- If his/her hit points are low he/she will try to flee.
- If a player is not it sight he/she will stay idle as well.

This process again repeats until either the player or the archer is dead.

Design a NFA for each of the enemies.

5 HTML Scraping

An example of an HTML link is the following:

 Example.com

In that particular example the URL is: http://example.com/, and the protocol is http.

A URL can be:

- A link to an element with a specified id: Link to id
- Some other protocol, when the href part starts with an alphanumeric string followed by ":" i.e. https:// , ftp:// , mailto: , file: , etc.
- A script: i.e. href="javascript:alert('Hello');"

5.1 Design regular expressions that:

- Parse an HTML line and identify all HTML links it contains.
- For each URL
  - identify the protocol used if any
  - whether each URL points to an id within the page
  - is a script

5.2 **Implement this functionality for each line in an html file using a programming language of your choice.**

5.3 **Do you think it is possible to parse the whole HTML language with regular expressions? Why?**