README.md

Assignment 1

Important to note

When converting the Markdown to a PDF, the formatting of images is a bit off. Some images are rendered on a new page.

1 - Regular expressions, NFAs and DFAs

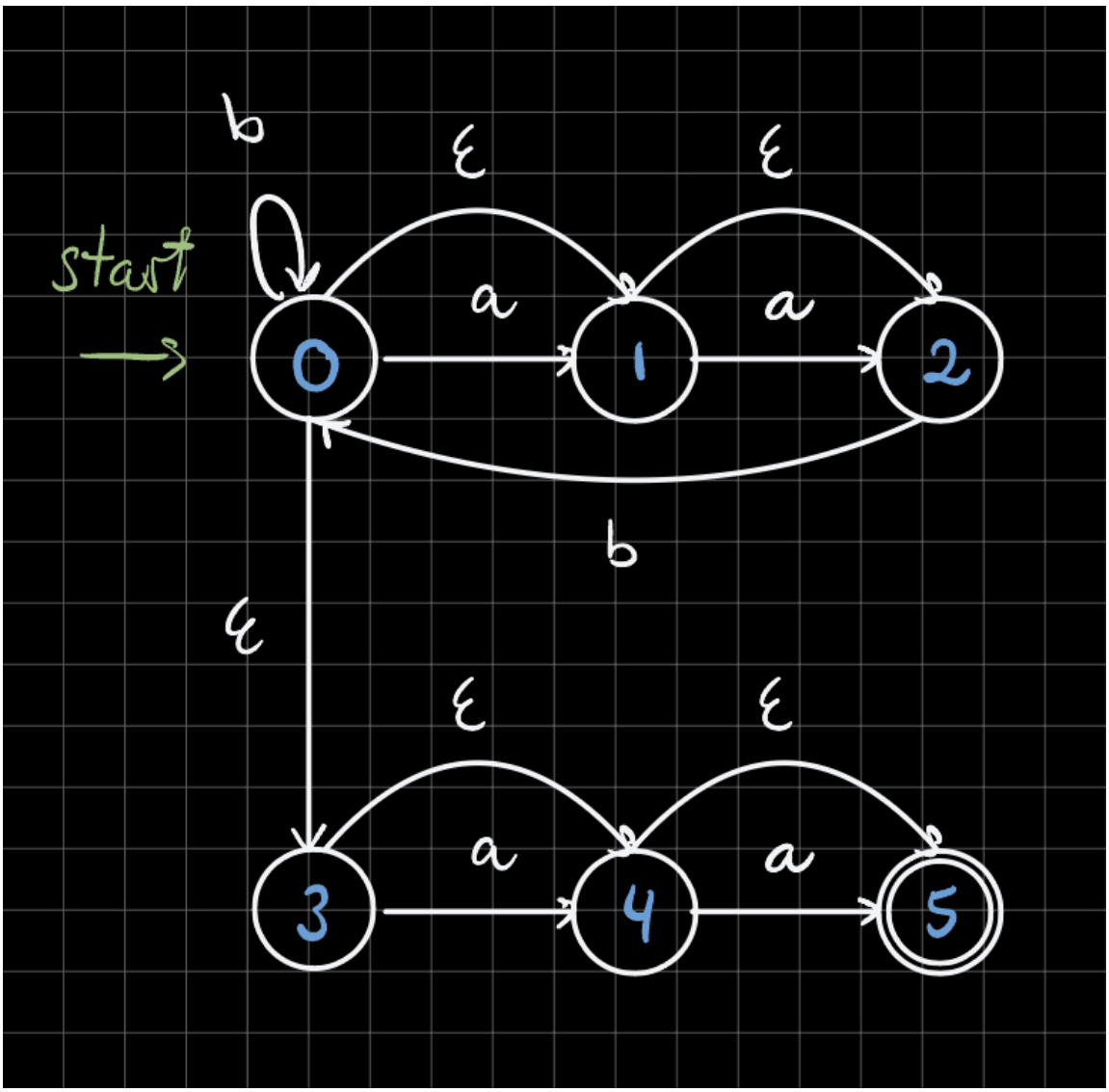
1.1

Given the language `L` with all strings over the alphabet `{a, b}`, with no more than 2 consecutive `a`'s in a row.

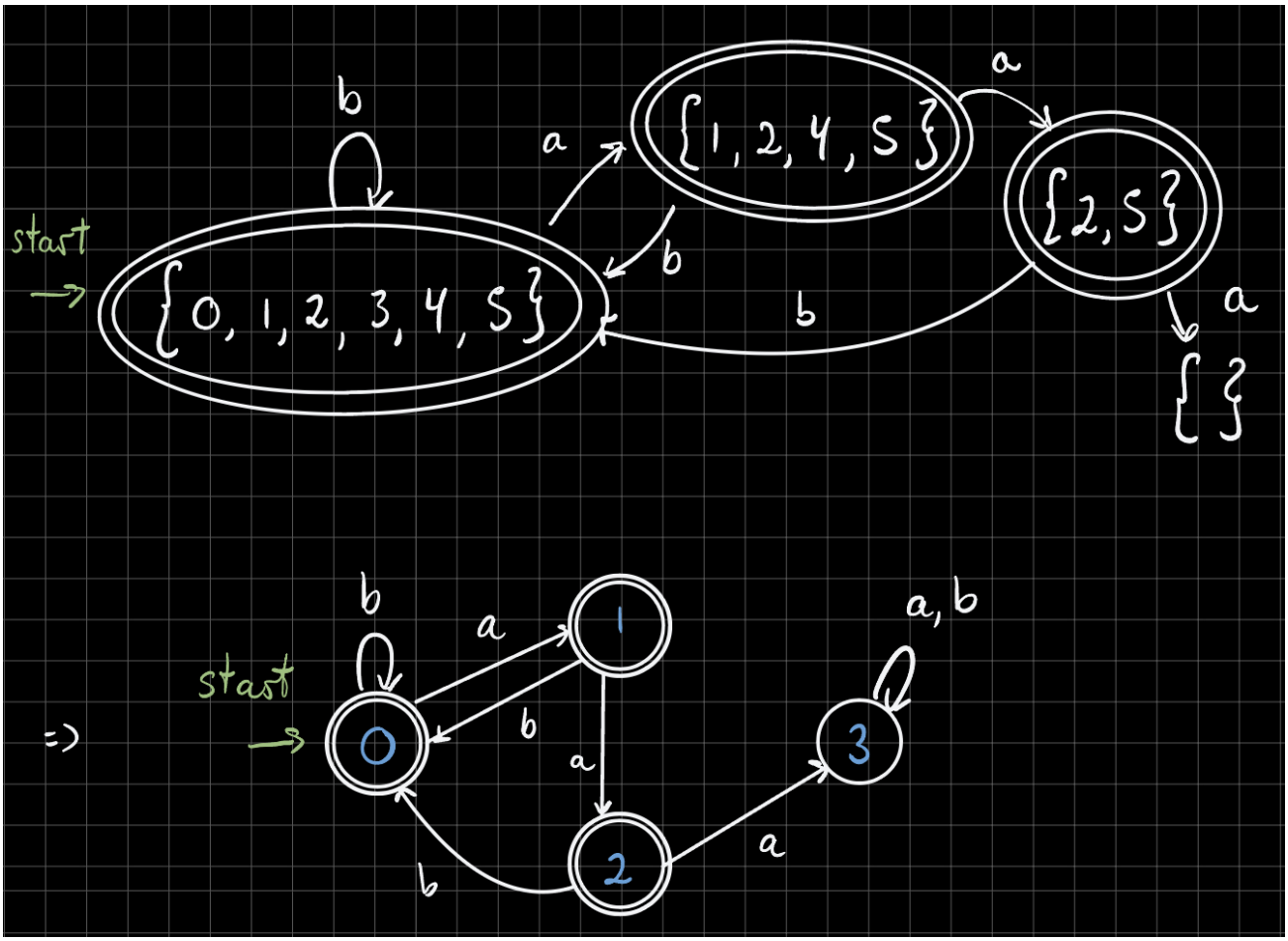
Below follows a regular expression that matches the string:

```
(b*(a?a?)b+)*a?a?
```

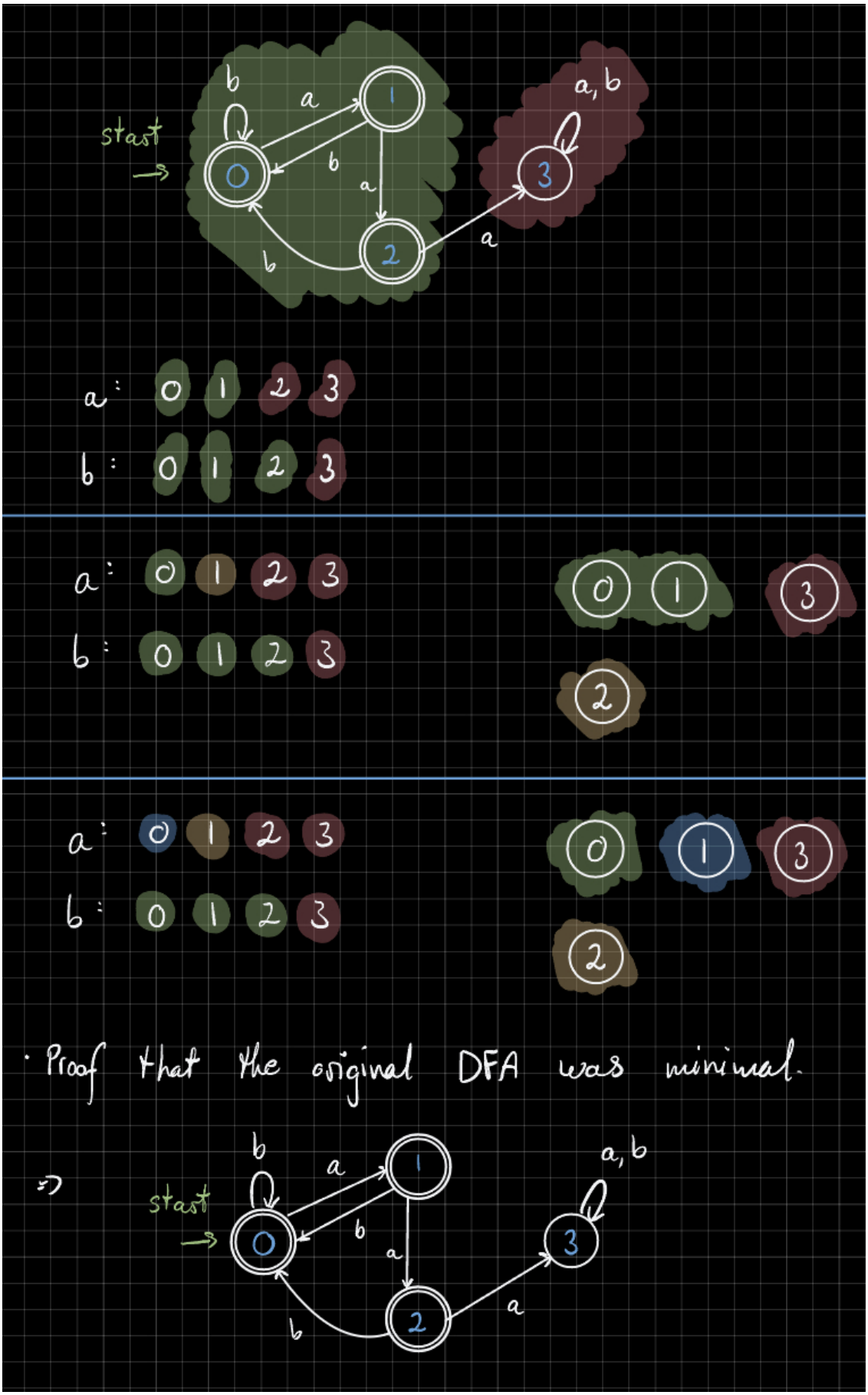
1.2



1.3



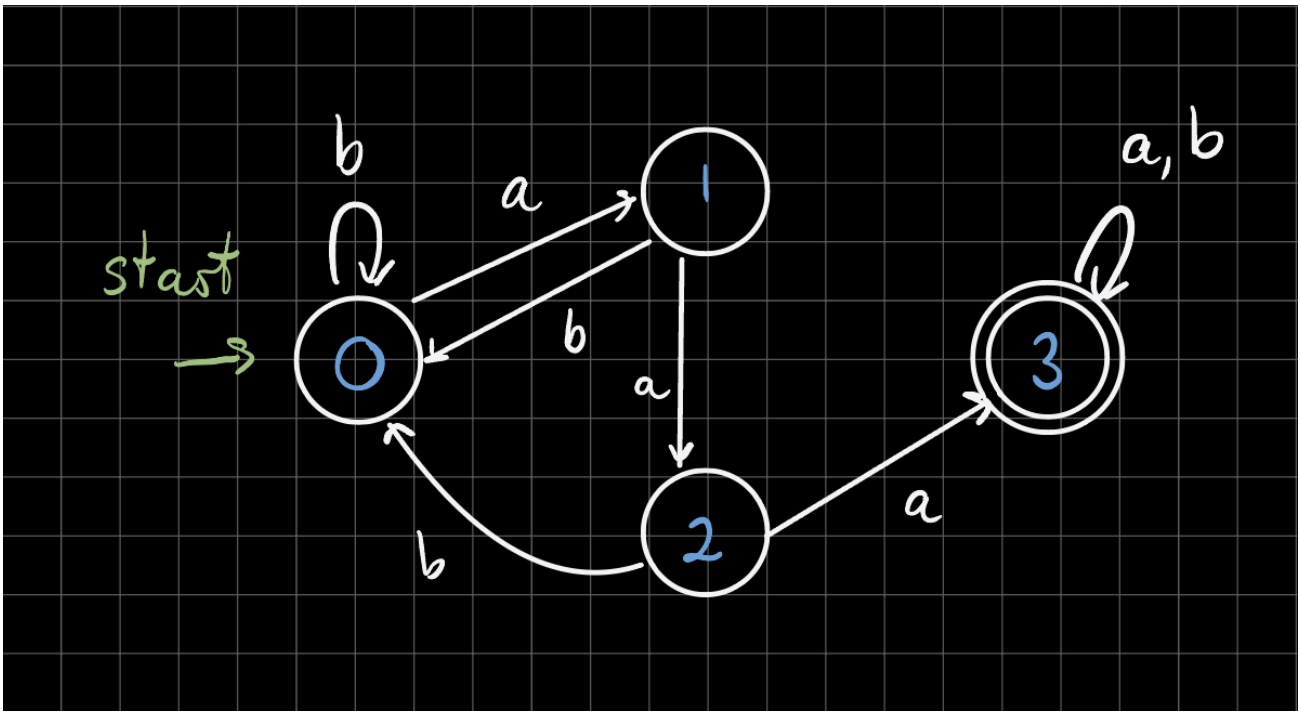
1.4



1.5

How would you go about creating a DFA matching $L*$, given that we already have a DFA matching L?.

To create a DFA matching the complement $L*$, given that we already have a DFA matching L, we can simply invert the DFA.



Produce a regular expression that matches `L*`.

The regular expression that matches `L*` is:

```
((b*a)+a)+a(a|b)*
```

To find this regular expression, we backtrack through the DFA that matches `L*`:

- `(a|b)*` matches the empty string, or any number of `a`'s or `b`'s. This corresponds to state 3.
- The `a` before `(a|b)*` corresponds to the edge between state 2 and state 3.
- The group `((b*a)+a)+` corresponds to the flow from state 0 to state 1 to state 2.

This regular expression was tested against the provided tests, and marked every test as red. This is the expected behavior, since the regular expression matches `L*`, which is the complement of `L`.

Between DFAs and regexes, which was the easiest to invert to the "opposite" language?

The DFA was the easiest to invert to the "opposite" language, since it is a simple matter of inverting the accepting and non-accepting states.

2 - DFA for a small language

2.1

The following regular expression matches exactly one statement on the provided format:

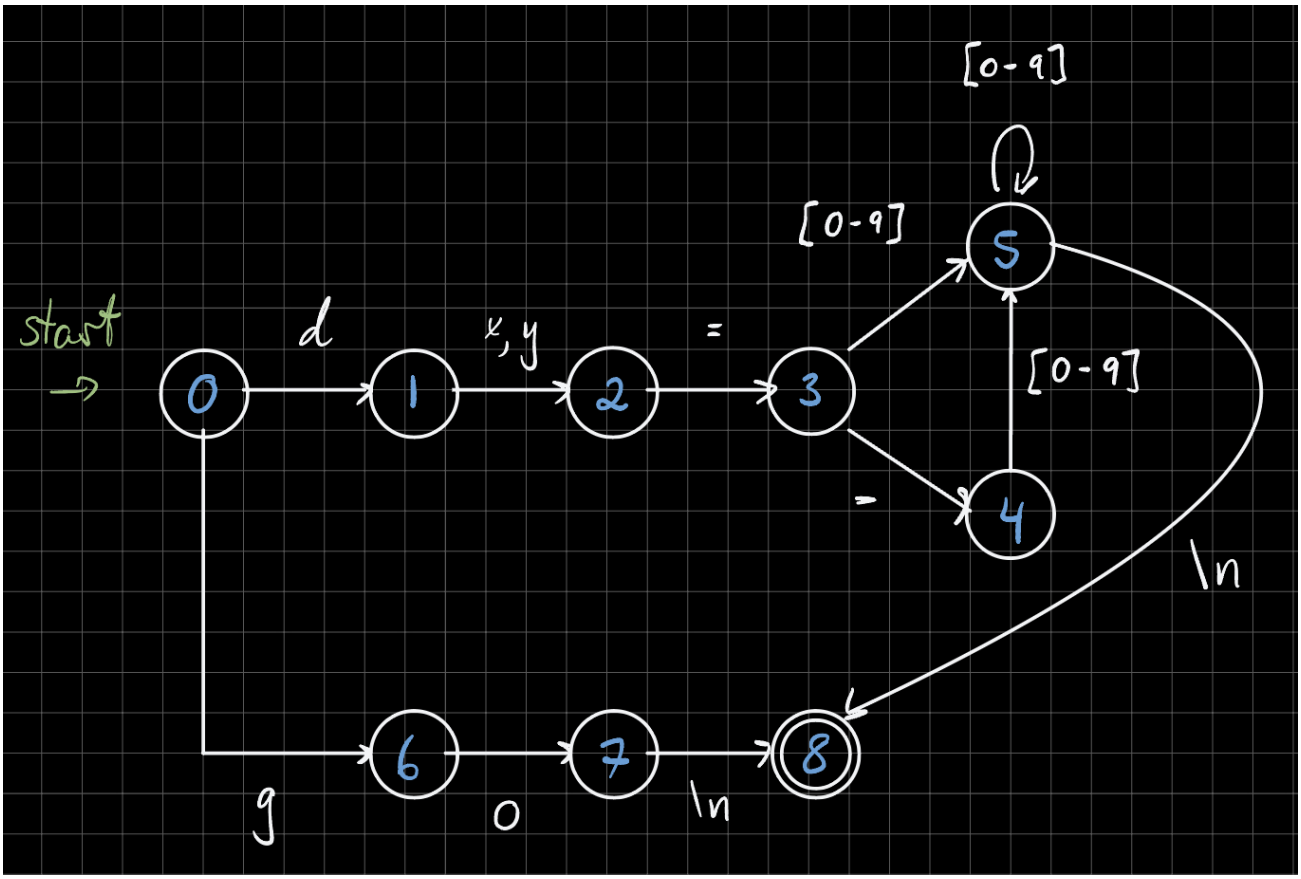
```
((d(x|y)\=\-?([0-9]+))|(go))\n
```

Breaking the regular expression down, we have:

- `(d(x|y)\=\-?([0-9]+))` is the left group. It starts by matching `d`, followed by either `x` or `y`, followed by `=`, followed by an optional `-`, followed by one or more digits.
- `(go)` is the right group. It matches the string `go`.
- `|` is the union operator. It matches either the left group, or the right group.
- `\n` matches the newline character.

Note that special characters like `\` and `-` must be escaped in the regular expression.

2.2



2.3

Please see the attached implementation details. Run the application using:

```
# Compile and generate the executable
make

# Generate the spiral and the PDF
cat spiral.txt | ./scanner | ps2pdf - spiral.pdf

# Open the PDF
open spiral.pdf
```

Note that the erroneous line in `spiral.txt` is line 5890, with the content `dx==-3` (double `=`).