Exam on DFAs and CFGs - April 29th, 2020

Exercise 1

Minimum DFA for $\{w \in \{0,1\}^* \mid \texttt{value}_2(w) \in \dot{3} \wedge |w|_{00} = 0\}$

Solution:

```
    0   1
q0  q0b q1  +
pou pou pou
q0b pou q1  +
q1  q2  q0
q1b pou q0
q2  pou q2b
q2b q1b q2b
```

Exercise 2

Minimum DFA for $\{w \in \{a,b\}^* \mid |w|_{baa} = 2\}$

Solution:

```
    a   b
q0  q0  b
b   ba  b
ba  baa b
baa baa b2
b2  ba2 b2
ba2 f   b2
f   f   bp  +
bp  bap bp  +
bap pou bp  +
pou pou pou
```

Exercise 3

Solution:

```
    0   1
q0  q0b q1
q0b q0  q1b
q1  q2  q0
q1b q2b q0b
q2  q1  q2b +
q2b q1b q2
```

Exercise 4

Solution:

```
S -> X | Y
X -> aXb | B
Y -> aYb | aA
B -> bB |
A -> aA | a
```

Exercise 5

Non-ambiguous CFG for $\{xcy \mid x, y \in \{a, b\}^* \wedge |x|_{aa} = |y|_b\}$

Solution:

```
S -> aX | bS | cZ
X -> aXY | bS | cZ
Y -> Ya | b
Z -> aZ |
```

Exercise 6

Solution:

```
S -> X | XbP
X -> aXa | aYb
y -> aYbA |
A -> aA |
P -> aP | bP |
```