HW3: formal languages

LING83800

1. Let:

$$A = \{a, b, c, 2, 3, 4\}$$
$$B = \{a, b\}$$
$$C = \{c, 2\}$$
$$D = \{b, c\}$$
$$E = \{a, b, \{c\}\}$$
$$F = \varnothing$$
$$G = \{\{a, b\}, \{c, 2\}\}$$

Then indicate whether the following statements are true or false:

(a) $c \in A$

(b) $c \in F$

(c) $c \in E$

(d) $\{c\} \in E$

(e) $\{c\} \in C$

(f) $B \subseteq A$

(g) $A \subseteq C$

(h) $D \subseteq E$

(i) $F \subseteq A$

(j) $E \subseteq F$

(k) $B \in G$

(l) $B \subseteq G$

(m) $C \in G$

(n) $G \subseteq A$

2. Let:

$$A = \{\texttt{a}, \texttt{bc}, \texttt{def}\}$$
$$B = \{\texttt{gh}, \texttt{ij}\}$$
$$C = \{\texttt{klm}\}$$

Then list all strings in the following (finite) languages:

(a) AB

(b) CAB

(c) $A \cup B$

(d) $AB \cup C$

(e) $C^R \cup A$

(f) $AC^?$

(g) $B^? B^?$

(h) BB^R

3. The regular language $G = \{\texttt{ab}, \texttt{bb}\}$ can be derived by union and concatenation.

$$G = (\{\texttt{a}\} \cup \{\texttt{b}\})\{\texttt{b}\}$$

Using union and concatenation, write a similar algebraic derivation for each of the following regular languages. Try to write your derivation as compactly as possible.

(a) $\{\texttt{ca}, \texttt{aa}\}$

(b) $\{\texttt{aaac}, \texttt{aacc}, \texttt{abac}, \texttt{abcc}\}$

(c) $\{\texttt{fatigable}, \texttt{infatigable}, \texttt{defatigable}, \texttt{indefatigable}\}$

(d) $\{\texttt{ardor}, \texttt{ardour}, \texttt{glamor}, \texttt{glamour}, \texttt{labor}, \texttt{labour}, \texttt{neighbor}, \texttt{neighbour}\}$

4. **Stretch goal** (optional): Attempt to write each of the regular language from the previous question using the most compact regular expression possible.