Just write "TRUE" or "FALSE".

(10) 1(a) For any languages A and B, we always have \((B\cdot A)' = (B'\cdot A')\).

(b) If a regular expression \(E\) contains \(\lambda\), then \(L(E) \neq \emptyset\).

(c) If a CFG, \(G \neq \emptyset\) has no useless productions then \(L(G) \neq \emptyset\).

(d) Any ambiguous CFG is equivalent to an unambiguous CFG.

(e) If a DFA \(M\) has no inaccessible states and \(M\) has at least one accepting state, then \(L(M) \neq \emptyset\).

Just write down the correct answer.

(18) 2(a) Find a regular expression \(E\) for the set of all strings in \(\{a,b\}^*\) which contains at least three b's.

Ans: \(E = \)

(b) If \(G = \{S \rightarrow bSAa, S \rightarrow \lambda, A \rightarrow a, A \rightarrow \lambda\}\), then

\(L(G) = \)

(c) If \(M\) is the NFA below, then

\[ \begin{array}{c}
  \text{A} \\
  \text{B} \\
  a \\
  b \\
 \end{array} \]

\[ L(M) = \]

(d) Find a RLG \(G\) for \(a^*b^*c^*d^*\).

Ans: \(G = \)

(e) Find a DFA \(M\) with \(L(M) = Q^* + (1^*Q)\)

Ans: \(M = \)

Use the back of this paper for question #3.

(12) 3(a) A regular expression over \(\{0,1\}\) is a string on which alphabet?

(b) Define what is a leftmost derivation of a string from a CFG \(G\).

(c) Define when two states of a DFA \(M\) are indistinguishable.

(d) Define what is the extended transition function of an NFA \(M\).
1. (a) FALSE. Take $A = \{a\}$ and $B = \{b\}$
(b) FALSE. Consider $0, 1, \emptyset$
(c) TRUE
(e) TRUE
(d) FALSE. If this was true inherently ambiguous CFLs would exist.

2. (a) $E = (a+b)^* \cdot b \cdot (a+b)^* \cdot b \cdot (a+b)^* \cdot b \cdot (a+b)^*$
(b) $L(G) = \{b^na^k : n \geq 0, 0 \leq k \leq 2n\}$
(c) $L(M) = (ba)^* + b \cdot (a + cb)^*$
(d) $S \rightarrow aS | bA | cB, \quad A \rightarrow bA | cB, \quad B \rightarrow b$

(e) 

3(a) A regular expression over $\{0, 1\}$ is a string on the alphabet $\{0, 1, \lambda, \emptyset, +, *, (, )\}$.
(b) A leftmost derivation of a string from $G$ is a derivation from $G$ in which the leftmost variable is being replaced at each step of the derivation.
(c) Two states $p$ and $q$ of a DFA $M$ are said to be indistinguishable if for each $w \in \Sigma^*$, $S^*(p, w) \in A$ if and only if $S^*(q, w) \in A$.
[Here $\Sigma$ = input alphabet of $M$ and $A$ = set of accepting states in $M$]
(d) The extended transition function of an NFA $M$ is the function $\Delta^* : Q \times \Sigma^* \rightarrow P(Q)$ defined by
$$\Delta^*(p, w) = \{q \in Q : \rho \text{ can lead you from } p \text{ to } q\}$$