Question 1 (10%)
Let A, B, and C be propositional wffs. Write a wff whose meaning is “if A then B else C.”

Question 2 (15%)
Use truth tables to verify the following equivalences:
(2.a) \((P \rightarrow Q) \equiv (\neg P \lor Q)\)
(2.b) \((\neg (P \land Q) \equiv (\neg P \lor \neg Q)\)
(2.c) \(A \lor (A \land B) \equiv A\)

Question 3 (10%)
Show that \(\rightarrow\) is not associative. That is, \((A \rightarrow B) \rightarrow C\) is not equivalent to \(A \rightarrow (B \rightarrow C)\).

Question 4 (15%)
Use Quine’s method to show each wff below is a contingency.
(4.d) \((A \rightarrow B) \land (B \rightarrow \neg A) \rightarrow A\)
(4.e) \((A \rightarrow B) \land (B \rightarrow C) \rightarrow (C \rightarrow A)\)
(4.f) \((A \lor B) \rightarrow (C \lor A) \land (\neg C \lor B)\)

Question 5 (10%)
Is the following wff a tautology? Why?
\(A \land (A \rightarrow B) \rightarrow B\)

Question 6 (15%)
Transform each of the following wff into a DNF. SHOW YOUR WORK.
(6.g) \(Q \land \neg P \rightarrow P\)
(6.h) \((P \lor Q) \land R\)
(6.i) \((A \lor B) \rightarrow (C \rightarrow D)\)

Question 7 (10%)
Transform each of the following wff into a full DNF. SHOW YOUR WORK.
(7.j) \(P \rightarrow Q \land R\)
(7.k) \((A \lor B) \land (A \lor C)\)

Question 8 (5%)
Transform each of the following wff into a full CNF. SHOW YOUR WORK.
(8.l) \(P \rightarrow Q \land R\)

Question 9 (10%)
Show that \(\{ \text{NAND} \}\) is a complete set of connectives.