2.9.5 Definition (Reasonable CDCL Strategy)

A CDCL strategy is *reasonable* if the rules Conflict and Propagate are always preferred over all other rules.
2.9.6 Proposition (CDCL Basic Properties)

Consider CDCL run deriving \((M; N; U; k; C)\) by any strategy but without Restart and Forget. Then the following properties hold:

1. \(M\) is consistent.
2. All learned clauses are entailed by \(N\).
3. If \(C \notin \{\top, \bot\}\) then \(M \models \neg C\).
4. If \(C = \top\) and \(M\) contains only propagated literals then for each valuation \(\mathcal{A}\) with \(\mathcal{A} \models N\) it holds that \(\mathcal{A} \models M\).
5. If \(C = \top\), \(M\) contains only propagated literals and \(M \models \neg D\) for some \(D \in (N \cup U)\) then \(N\) is unsatisfiable.
6. If \(C = \bot\) then CDCL terminates and \(N\) is unsatisfiable.
7. \(k\) is the maximal level of a literal in \(M\).
8. Each infinite derivation contains an infinite number of Backtrack applications.
2.9.7 Lemma (CDCL Redundancy)

Consider a CDCL derivation by a reasonable strategy. Then CDCL never learns a clause contained in $N \cup U$. 
2.9.9 Lemma (CDCL Soundness)

In a reasonable CDCL derivation, CDCL can only terminate in two different types of final states: \((M; N; U; k; \top)\) where \(M \models N\) and \((M; N; U; k; \bot)\) where \(N\) is unsatisfiable.
2.9.10 Proposition (CDCL Soundness)

The rules of the CDCL algorithm are sound: (i) if CDCL terminates from \((\epsilon; N; \emptyset; 0; \top)\) in the state \((M; N; U; k; \top)\), then \(N\) is satisfiable, (ii) if CDCL terminates from \((\epsilon; N; \emptyset; 0; \top)\) in the state \((M; N; U; k; \bot)\), then \(N\) is unsatisfiable.
2.9.11 Proposition (CDCL Strong Completeness)

The CDCL rule set is complete: for any valuation $M$ with $M \models N$ there is a reasonable sequence of rule applications generating $(M'; N; U; k; \top)$ as a final state, where $M$ and $M'$ only differ in the order of literals.
2.9.12 Proposition (CDCL Termination)

Assume the algorithm CDCL with all rules except Restart and Forget is applied using a reasonable strategy. Then it terminates in a state $(M; N; U; k; D)$ with $D \in \{\top, \bot\}$. 