Question 1 (10%)
Write down the parenthesized version of each of the following expressions.
(1.a) \( P \lor \neg Q \land R \rightarrow P \lor R \rightarrow \neg Q \)
(1.b) \( A \rightarrow B \lor \neg C \land D \land E \rightarrow F \)

Question 2 (25%)
For each of the expressions below, state whether it is a wff or not.
(2.c) \( A \rightarrow B \lor \neg C \land D \land E \rightarrow F \)
(2.d) \( \neg P \land Q \)
(2.e) \( (A \rightarrow B) \lor \neg(C \land D \land E) \rightarrow F \land (G \rightarrow \neg H) \)
(2.f) \( (A \rightarrow B) \lor \neg(C \land D \land E) \rightarrow F \land (G \land \neg H) \)
(2.g) \( A \land (B \lor \neg(C \land D \land E)) \rightarrow F \land (G \land \neg H) \)

Question 3 (40%)
Draw the syntax tree for each of the following expressions.
(3.h) \( (P \lor \neg Q) \land (\neg P \lor Q) \)
(3.i) \( (P \land \neg Q) \lor (\neg P \land Q) \)
(3.j) \( P \lor (\neg Q \land R \rightarrow P) \lor (R \rightarrow \neg Q) \)
(3.k) \( (A \rightarrow B) \lor \neg(C \land D) \land (E \rightarrow F) \)

Question 4 (25%)
Write down how the expression \( (A \rightarrow B) \lor \neg(C \land D) \land (E \rightarrow F) \) can be obtained using the definition of wffs (use the example below):

Example: The expression \( (A \land \neg B) \lor (C \rightarrow D) \) can be obtained as follows:
1. \( A \) is a wff (propositional variable)
2. \( B \) is a wff (propositional variable)
3. \( \neg B \) is a wff (obtained by applying \( \neg \) to 2)
4. \( A \land \neg B \) is a wff (obtained by applying \( \land \) to 1 and 3)
5. \( (A \land \neg B) \) is a wff (obtained by applying parentheses to 4)
6. \( C \) is a wff (propositional variable)
7. \( D \) is a wff (propositional variable)
8. \( C \rightarrow D \) is a wff (obtained by applying \( \rightarrow \) to 6 and 7)
9. \( (C \rightarrow D) \) is a wff (obtained by applying parentheses to 8)
10. \( (A \land \neg B) \lor (C \rightarrow D) \) is a wff (obtained by applying \( \lor \) to 5 and 9)