5 Logic and Proof (LCP)

(a) Proof methods for propositional logic include the sequent calculus, DPLL and BDDs. Describe briefly each of these methods. State, with reasons, which method is to be preferred for a problem that makes heavy use of the $\leftrightarrow$ and $\oplus$ symbols. (Note that $\oplus$ denotes exclusive or.) [7 marks]

(b) Describe briefly the procedure for constructing a BDD, illustrating your answer using the formula $((P \lor Q) \land R) \lor (P \rightarrow (Q \land R))$. [7 marks]

(c) Consider the following set of $n + 1$ propositional formulas, where $n \geq 0$:

\begin{align*}
P_i \leftrightarrow P_{i+1} \quad \text{(for } i = 1, \ldots, n) \\
P_1 \oplus P_{n+1}
\end{align*}

Describe a possible execution of the DPLL procedure to determine whether this set is satisfiable or not. [6 marks]