(1) (5 points) Decide if the following are statements. If yes then state if it is True or False.
   (a) If it’s raining then it’s raining
   (b) If \( 1 = 0 \) then \( 3=4 \)
   (c) \( s \land \neg s \) is a tautology.

(2) (5 points) Express each statement in the form "If \( p \), then \( q \)" :
   (a) You get a good grade only if you study
   (b) It is necessary to have a valid password to log on to the server

(3) (5 points)
   (a) How many rows in the truth table one has to have if a statement has \( k \) different propositions?
   (b) Write down the truth table for the statement \((q \lor r) \iff (r \land q)\).

(4) (5 points) Using the laws of logic, decide whether or not the following pair is logically equivalent.
   \((p \land \neg(q \land \neg r)) \lor (p \land q)\) and \(r\)

(5) (10 points) Decide whether the following argument is valid. If it is valid argument, give a formal proof (i.e. justify which rules need to be applied to premises). If the argument is invalid, show that it is invalid by finding an appropriate assignment of truth values to the propositions.
   \( p \rightarrow (q \rightarrow r), p \lor s, t \rightarrow q, \neg s \). Prove: \( \neg r \rightarrow \neg t \).

(6) (5 points) Express the statements using quantifiers. Form the negation of the statement.
   (a) Either \( x = 0 \) or \( y = 0 \).
   (b) There exists a real number \( r \) such that \( r^2 < 2 \).

(7) (5 points) Find a proposition \( \Phi \) with the truth table

\[
\begin{array}{c|c|c}
 p & q & \Phi \\
\hline
 T & T & T \\
 T & F & F \\
 F & T & T \\
 F & F & F \\
\end{array}
\]