PHL245 Modern Symbolic Logic

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1 Truth Tables

1.1 Summary

First we remark that we are here talking about binary operators, so they will have and only have two operands. We have the following to consider:

- **Logical OR** ($\vee$) is true when either one of the operands is true. It evaluates to false otherwise.
- **Logical AND** ($\wedge$) is true when both of the operands are true and false otherwise.
- **Implication** ($\implies$) is true in two cases. The first case is when the first operand is false and second case is when both operands are true.
- **Double implication, Iff** ($\iff$) is true when either both operands are true or when both operands are false.
- **Negation** ($\neg$[1]) is true when the operand is false and false otherwise.

1.2 Full truth tables

Example: [2] evaluate $(P \wedge \neg Q) \vee R$. $\neg R \vee Q$. $\therefore \neg P \implies Q$. Notice that this is equivalent to evaluating

$$(((P \wedge \neg Q) \vee R) \wedge (\neg R \vee Q)) \implies \neg P \implies Q$$

and by staring at it we see this statement is valid and only valid when $(P, Q, R) \in \{(T, T, T), (T, F, F), (F, T, T)\}$, which has a non-null set of solution. Hence the statement is consistent.

[1] Or in this course, we may see $\sim$

[2] This example was adapted from Scharer 4.4 EG3.