

## Truth table to compound proposition

Given a truth table, how do we find an expression using the input variables and logical operators that has the output values specified in this table?

*Application:* design a circuit given a desired input-output relationship.

| Input |     | Output      |             |
|-------|-----|-------------|-------------|
| $p$   | $q$ | $mystery_1$ | $mystery_2$ |
| $T$   | $T$ | $T$         | $F$         |
| $T$   | $F$ | $T$         | $F$         |
| $F$   | $T$ | $F$         | $F$         |
| $F$   | $F$ | $T$         | $T$         |

Expressions that have output  $mystery_1$  are

Expressions that have output  $mystery_2$  are

*Idea:* To develop an algorithm for translating truth tables to expressions, define a convenient **normal form** for expressions.

## Dnf cnf definition

**Definition** An expression built of variables and logical operators is in **disjunctive normal form** (DNF) means that it is an OR of ANDs of variables and their negations.

**Definition** An expression built of variables and logical operators is in **conjunctive normal form** (CNF) means that it is an AND of ORs of variables and their negations.