Simplest logic : Propositional / zero-order Logic (4)

- Logical system has
  - language to represent knowledge / facts / axioms
  - rules to do deduction.
- Different logics differ in
  - expressiveness of lang. to represent knowledge
  - types of rules of inference allowed.
- Simplest logic is Propositional Logic
  - Application : Digital circuits
- Each proposition is a Boolean-valued assertion: [5 > 3], [fish fly]
- <u>Propositional logic Language</u>:

  1) Constants : TRUE & FALSE

  2) Finite set of Boolean variables : $p, q, r, \ldots$

  3) p, q propositions, then $\neg p$, $p \wedge q$, $p \vee q$ propositions.

  ($\neg$, $\wedge$, $\vee$: Boolean connectives)

- <u>Example</u>: $\mathrm{TRUE} \wedge (p \vee q) \wedge (\neg r)$
- <u>State</u> : value each proposition can take ; n propositions variables $\Rightarrow 2^n$ states

$(\neg p = \mathrm{TRUE}) \equiv (p = \mathrm{FALSE})$.

$(p \wedge q = \mathrm{TRUE}) \equiv [(p = \mathrm{TRUE})$ and $(q = \mathrm{TRUE})]$

$(p \vee q = \mathrm{TRUE}) \equiv [(p = \mathrm{TRUE})$ or $(q = \mathrm{TRUE})]$

- Truth table can be used to define meaning of propositional formulae

p	$\neg p$
T	F
F	T

$\neg p$

$p \backslash q$	T	F
T	T	F
F	F	F

$p \wedge q$

$p \backslash q$	T	F
T	T	T
F	T	F

$p \vee q$