notation is used for $p_1 \vee p_2 \vee \dots \vee p_n$

(1) $\bigvee_{j=1}^{n} p_j$

(2) $\bigwedge_{j=1}^{n} p_j$ is used for $p_1 \wedge p_2 \wedge \dots \wedge p_n$

```
int res = 0;          → when OR |
for(int j = 1; j<=n; j++){
   res |= p[j];
}
int res = 1;          → when and ∧
for(int j = 1; j<=n; j++){
  res &= p[j];
}
```

Sudoku puzzle as satisfiab. → code

1.1

13 (a) $\neg p$

(b) $p \wedge \neg q$, but is $\wedge$

(c) $p \to q$ "if you speed you get a ticket", "prep if" implication

(d) $\neg p \to \neg q$

(e) same as c $p \to q$

(f) $q \wedge \neg p$

(g) $q \to p$, whenever is "if"

33 (a) $\underbrace{\overset{1}{(p \vee q)} \to \overset{2}{(p \oplus q)}}_{3}$

p	q	$p \vee q$ (or)	$p \oplus q$	$(p \vee q) \rightarrow (p \oplus q)$	$p \wedge q$	$(p \oplus q) \rightarrow (p \wedge q)$
T	T	T	F	F ?	T	F ?
T	F	T	T	T	F	T
F	T	T	T	T	F	T
F	F	F	F	T	F	F

(B) $(p \oplus q) \rightarrow (p \wedge q)$

(c) $(p \vee q) \oplus (p \wedge q)$

F (opposite of T)
T (opposite of F)
T
F (opposite of T)

(d) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow q)$

p	q	$\neg p$	$p \leftrightarrow q$?	$\neg p \leftrightarrow q$?	$(p \leftrightarrow q) \oplus (\neg p \leftrightarrow q)$
T	T	F	T	F	T
T	F	F	F	T	T
F	T	T	F	T	T
F	F	T	T	F	T

* ask Aznet

(e) $(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$

p	q	r	$p \leftrightarrow q$	$\neg p$	$\neg r$	$\neg p \leftrightarrow \neg r$	$(p \leftrightarrow q) \oplus (\neg p \leftrightarrow \neg r)$
T	T	T		F	F	T	F
T	T	F		F	T	F	T
T	F	T		F	F	T	T
T	F	F		F	T	F	F
F	T	T		T	F	F	F
F	T	F		T	T	T	T
F	F	T		T	F	F	T
F	F	F		T	T	T	F

$(p \oplus q) \to (p \oplus \neg q)$

(f)

p	q	$\neg q$	$p \oplus q$	$p \oplus \neg q$	$(p \oplus q) \to (p \oplus \neg q)$
T	T	F	F	T	T
T	F	T	T	F	F
F	T	F	T	F	F
F	F	T	F	T	T

35. (a) $p \to \neg q$ (b) $\neg p \leftrightarrow q$

p	q	$\neg q$	$p \to \neg q$	$\neg p$	$\neg p \leftrightarrow q$
T	T	F	F	F	F
T	F	T	T	F	T
F	T	F	T	T	T
F	F	T	T	T	F

(c) $(p \to q) \vee (\neg p \to q)$ (d) $(p \to q) \wedge (\neg p \to q)$

p	q	$p \to q$	$\neg p$	$\neg p \to q$	$(p \to q) \vee (\neg p \to q)$	$(p \to q) \wedge (\neg p \to q)$
T	T	T	F	T	T	T
T	F	F	F	T	T	F
F	T	T	T	T	T	T
F	F	T	T	F	T	F

(e) $(p \leftrightarrow q) \vee (\neg p \leftrightarrow q)$ (f) $(\neg p \leftrightarrow \neg q) \leftrightarrow (p \leftrightarrow q)$

p	q	$p \leftrightarrow q$	$\neg p \leftrightarrow q$	$(p \leftrightarrow q) \vee (\neg p \leftrightarrow q)$	$(\neg p \leftrightarrow \neg q)$	$(\neg p \leftrightarrow \neg q) \leftrightarrow (p \leftrightarrow q)$
T	T	T	F	T	T	T
T	F	F	T	F	F	T
F	T	F	T	F	F	T
F	F	T	F	T	T	T

(41) why $(p \vee q \vee R) \wedge (\neg p \vee \neg q \vee \neg R) \Rightarrow$ True when at least one is T and at least one is F, but is F when all var's have same truth table?

$(p \vee q \vee R) \Rightarrow T$ if any of $p, q, R = T$ +

$(\neg p \vee \neg q \vee \neg R) \Rightarrow F$ if any of $p, q, R = F$ +

Both ~~statements~~ clauses are T, $\Rightarrow$ entire statement

is T, if only there's at least one T and one F among truth values.