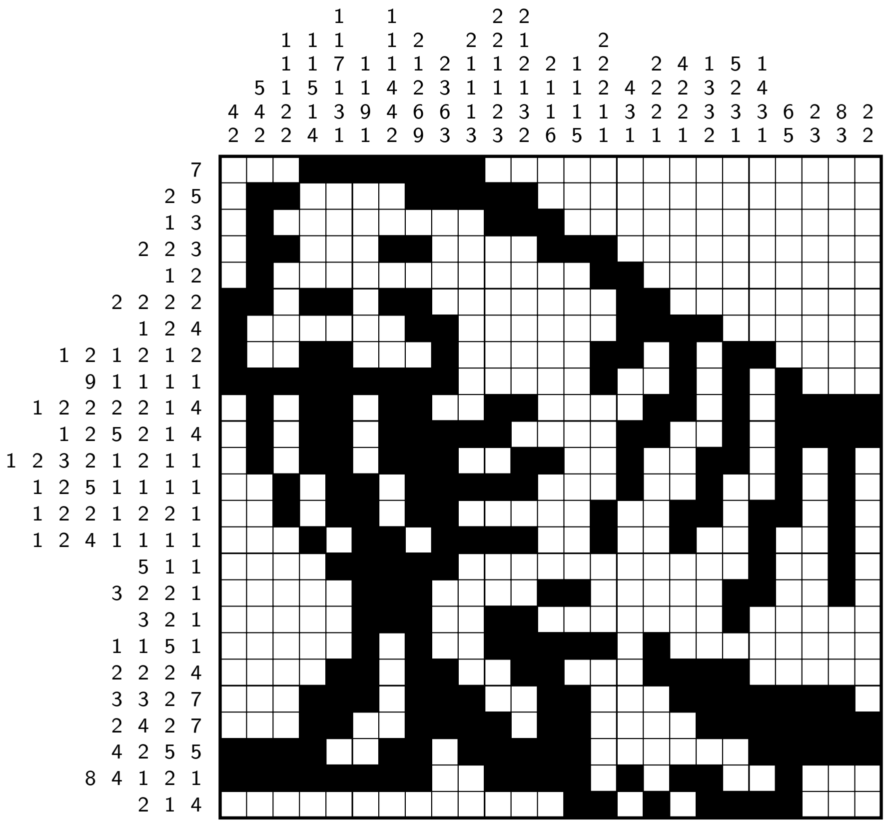
## Selected Solutions for March 5

2

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 | 1 | 7 | 6 | 9 | 4 | 2 | 3 | 8 |
| 4 | 9 | 2 | 3 | 5 | 8 | 7 | 6 | 1 |
| 8 | 3 | 6 | 2 | 1 | 7 | 5 | 4 | 9 |
| 7 | 6 | 5 | 1 | 4 | 2 | 8 | 9 | 3 |
| 2 | 4 | 9 | 7 | 8 | 3 | 1 | 5 | 6 |
| 1 | 8 | 3 | 9 | 6 | 5 | 4 | 2 | 7 |
| 6 | 2 | 8 | 4 | 7 | 9 | 3 | 1 | 5 |
| 9 | 7 | 4 | 5 | 3 | 1 | 6 | 8 | 2 |
| 3 | 5 | 1 | 8 | 2 | 6 | 9 | 7 | 4 |

This puzzle was found on https://www.sudokowiki.org/.

3




This puzzle was created by user Lalopop, according to

https://www.nonograms.org/nonograms/i/34149

## Selected Solutions for March 12

3 (a) Using the procedure from slide 45 we obtain

$$
\begin{aligned}
p \vee \neg(p \vee \neg q) \to \neg p \to q \quad & \xrightarrow{①} \quad \neg(p \vee \neg(p \vee \neg q)) \vee (\neg p \to q)) \\
& \xrightarrow{①} \quad \neg(p \vee \neg(p \vee \neg q)) \vee (\neg\neg p \vee q) \\
& \xrightarrow{②} \quad (\neg p \wedge \neg\neg(p \vee \neg q)) \vee (\neg\neg p \vee q) \\
& \xrightarrow{②} \quad (\neg p \wedge (p \vee \neg q)) \vee (\neg\neg p \vee q) \\
& \xrightarrow{②} \quad (\neg p \wedge (p \vee \neg q)) \vee (p \vee q) \\
& \xrightarrow{③} \quad (\neg p \vee (p \vee q)) \wedge ((p \vee \neg q) \vee (p \vee q))
\end{aligned}
$$

(b) Using the procedure from slide 45 we obtain

$$
\begin{aligned}
\neg(p \to (\neg(q \to (r \vee \neg p)))) \quad & \xrightarrow{①} \quad \neg(\neg p \vee (\neg(q \to (r \vee \neg p)))) \\
& \xrightarrow{①} \quad \neg(\neg p \vee (\neg(\neg q \vee (r \vee \neg p)))) \\
& \xrightarrow{②} \quad \neg\neg p \wedge \neg\neg(\neg q \vee (r \vee \neg p)) \\
& \xrightarrow{②} \quad p \wedge \neg\neg(\neg q \vee (r \vee \neg p)) \\
& \xrightarrow{②} \quad p \wedge (\neg q \vee (r \vee \neg p))
\end{aligned}
$$

4 (a) For each row whose last entry is T, we form the conjunction of the literals corresponding to the atoms. Here "corresponding" means that atom $p$ is turned into $\neg p$ when $p$ is assigned F, and stays $p$ if $p$ is assigned T. Then we form the disjunction of all conjunctions. If there are no rows ending in T we return the DNF $\bot$. If there are no atoms, we return $\top$ if the formula evaluates to T and $\bot$ if it evaluates to F.

Applying the above procedure to the truth tables computed in the solution of Exercise 1(b) yields

$$(p \wedge q) \vee (p \wedge \neg q) \vee (\neg p \wedge q) \vee (\neg p \wedge \neg q)$$

for $\varphi$ and

$$(p \wedge q \wedge r) \vee (p \wedge \neg q \wedge r) \vee (p \wedge \neg q \wedge \neg r)$$

for $\psi$.

(b) A DNF $\varphi$ is satisfiable if there is a conjunction such that there is a truth assignment that satisfies all literals in the conjunction. This can be checked in linear time.