Problem 1. (5pts)
Given is a piece of Sudoku puzzle.

(a) What conclusion can we make about the cells with ○? Proof your observation.
(b) Create a general rule and prove it. Then expand the rule and prove the extensions. Do it in several stages. Follow the example we did in class.

Problem 2. (5pts)
Recall the truth table for NOR logical operation.
Using only NOR gate create a logical gate for \( P \Rightarrow Q \).

**Group B**

**Problem 1. (5pts).**

Analyze the Sudoku puzzle below.

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<table>
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<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
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<td></td>
</tr>
<tr>
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<td>1</td>
<td>67</td>
</tr>
<tr>
<td>27</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
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<tr>
<td>9</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>
```

(a) What conclusion can we make about the cells with \( \circ \)?

Proof your observation.
(b) Create a general rule and prove it. Then expand the rule and prove the extensions. Do it in several stages. Follow the example we have discussed in class.

Create a general rule and prove it. Then expand the rule and prove it.

**Problem 2. (5pts).**

Using the truth tables prove the logical identity

\[(P \Rightarrow Q)^\sim = Q^\sim \Rightarrow P^\sim\]

**Group C**  
**Problem 1. (5pts).**

In the class we discussed the following Sudoku puzzle situation.

Daniel F. claimed that 1 is set to C22.
Here is his proof.

Since 7 in C54 ⇒ 5 in C58 ⇒ 2 in C28⇒ 1 in C22
(This type of proof is called a direct proof.)

There was another proof which is probably more suitable to the Sudoku puzzles.
We ask ourselves whether 1 or 2 is set to C22.
If 2 in C22⇒5 in C28⇒7 in C58⇒⇒.
Hence 1 is set to C22.
This proof is called a proof by contradiction.
Create a general rule and prove it. Then expand the rule and prove it.

Problem 2.(5pts).

Prove the logical identities below:
(a) $(P\land Q)^\sim = P^\sim \lor Q^\sim$
(b) $(P\lor Q)^\sim = P^\sim \land Q^\sim$