Definition: Unate covering

Given a matrix for which all entries are 0 or 1, find the minimum cardinality subset of columns such that, for every row, at least one column in the subset contains a 1.

I’ll give an example

Prime implicant selection

Prime implicants
Use these to...

On-set minterms
...cover these

Eliminate rows covered by essential columns
Eliminate rows dominated by other rows
Eliminate columns dominated by other columns

Eliminate rows covered by essential columns

Eliminate rows dominated by other rows
Eliminate columns dominated by other columns

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>J</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>K</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Backtracking

- Will proceed to complete solution unless cyclic
- If cyclic, backtrack
  - Try all possible options to completion
- Advanced topic: Can use a number of tricks to simplify this

Use bound to constrain search space

- Eliminate rows covered by essential columns
- Eliminate rows dominated by other rows
- Eliminate columns dominated by other columns
- Speed improved, still $\in \mathcal{NP}$-complete
  - Too slow to solve for large problem instances

Loose end – Don’t cares

- What should be done about Xs in QM?
- Should they be included in the initial minterms?
- Should they be required in the Unate Covering problem?

Another example

$$f(a, b, c) = \sum(1, 2, 6) + d(3)$$

Summary

- Review
- Prime implicant selection in Quine-McCluskey
- Encoders and decoders
- Review: Transmission gates
- Multiplexers and demultiplexers

Reading assignment

- Rest of Section 4.6

Computer geek culture reference

- Complexity classes