Problem 1: Timing
**Problem 2: Two-Way Partitioning: Fiduccia & Mattheyses**

If \( p(i) = \) no. of pins on cell \( i \):

- Bin-sort cells on \( g_i \)
- \( -p_{\text{max}} < g_i < p(i) \)

\[
\begin{array}{c}
p_{\text{max}} \\
\text{MAX_GAIN} \\
-\text{p}_{\text{max}}
\end{array}
\]

\[
\begin{array}{c}
\text{CELL} \\
1 \ 2 \ 3 \ 
\end{array}
\]

\[
\begin{array}{c}
\text{LOCHED CELLS}
\end{array}
\]

Time required to maintain each bucket array \( O(P) / \text{pass} \)

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**Problem 3: Placement**

**Initial Placement**

**Partition and Replace**

A. Kahng
Problem 4: Non-Manhattan Routing

Given:
- Cell placement
- 100K nets
- 8 layers
- Assign each net to a (primary) layer

Intel 65nm
- M1 105nm
- M2 105
- M3 110
- M4 140
- M5 165
- M6 240
- M7 360
- M8 540

Problem 5: Layer Assignment

Given:
- Cell placement
- 100K nets
- 8 layers
- Assign each net to a (primary) layer

Intel 65nm
- M1 105nm
- M2 105
- M3 110
- M4 140
- M5 165
- M6 240
- M7 360
- M8 540
Routing Objectives

Minimize path delay
- Timing driven → maintain timing constraints
- Minimize wire length
- Balance congestion

Minimize noise
- Noise driven → minimize cross-coupled capacitance

Minimize clock skew
- Balance clock trees
- Keep buses together

Problem 5a: When to do layer assignment?

Advantages/disadvantages for global routing
Advantages/disadvantages for detail routing
Problem 5b: Linear time algorithm?

- Identify routing resources to be used
- [Identify layers (and tracks) to be used]
- Assign particular nets to these resources
- Also used in floorplanning and placement

- Within global routing
  - Advantages/disadvantages to doing layer assignment before routing region assignment
  - Advantages/disadvantages to doing layer assignment after routing region assignment

Linear time algorithm

Before routing region assignment?
- Simply take Euclidean distance of each net
- Bin nets according to distance – longer nets higher layers
- Improvement?
- Use Rectilinear Steiner Trees

After routing region assignment?
- Simply take length of RST of each net
- Bin nets according to distance – longer nets higher layers