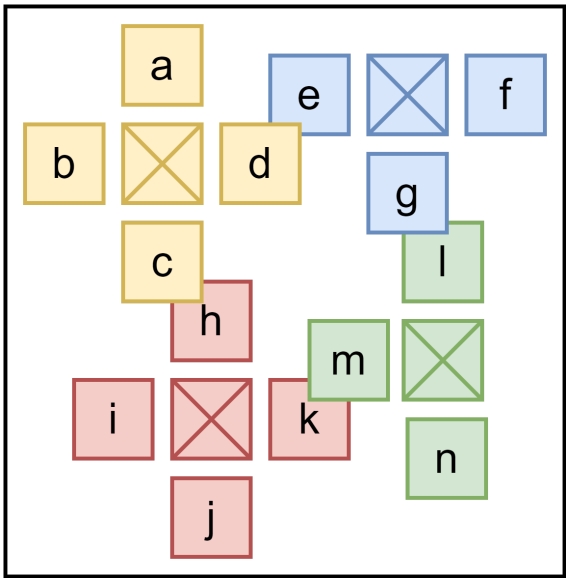
Instructions

- Ensure your handwriting is legible, or use a typed document if preferred.
- Staple all pages together before submission.

1. Explain how process limitations, such as lithography printability issues and process variation, impact chip manufacturing. How does Optical Proximity Correction (OPC) help address these challenges? (10 points)

2. Refer to p.6 ~ p.30, unit 1. In the MANA algorithm, different partial paths can reach the same grid point with varying lengths. The first pruning strategy ensures that the difference between the min length of one partial path and the max length of another one remains within a specific bound ***d***. Assume that the minimum required wire length is ***L***.
    a. What is the value of d? (5 points)
    b. Provide a clear explanation of why this bound holds. (15 points)

3. Refer to p.8 ~ p.14, unit 2, answer the following questions.
    a. Draw the conflict graph of the given design. (5 points)



    b. List the vertex degrees and feasible numbers of all the vertices. (10 points)
    e.g.

Vertex	Degree	Feasible number
a	…	…
b	…	…
…	…	…

c. List the vertices in the maximal independent set solution and draw the updated conflict graph after the first iteration of H2K. Assume the subgraph size k = 4, and assign higher priority to a vertex based on (1) a smaller degree, then (2) a smaller feasible number. If both (1) and (2) are the same, break ties with vertex names in alphabetical order (a, b, c, …).(15 points)

d. Propose a heuristic in addition to degree and feasible numbers that could be used to improve the subgraph extraction process in H2K. Explain how the proposed heuristic would be computed and incorporated into the priority queue of H2K. (15 points)

4. Refer to p.14 ~ p.18, unit 3, answer the following questions.
   a. How does Iterated Monte-Carlo (IMC) optimize the number of inserted fills? (5 points)

   b. Compare Iterated Monte-Carlo (IMC) and Monte-Carlo (MC) by discussing the trade-offs in the following aspects. For each aspect, briefly explain why IMC behaves differently from MC.
      i. Computational time (10 points)
      ii. Density variation control (10 points)