Instructions

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

1. Refer to p.5 to p.9, unit 4, why is filler cell insertion alone no longer sufficient to fix all MinIA constraint violations in modern technology nodes? Please provide two example scenarios and explain why filler cell insertion cannot resolve the violations in each case. (20 points, 10 points each)

2. Refer to p.27 to p.38, unit 4.
    a. If there are K cells in a row, then how many nodes and edges are in the graph model when both adjacent cell swapping and cell flipping can be applied? (5 points)
    b. When solving the DDA minimization problem as the shortest path problem considering both adjacent cell swapping and cell flipping, how would you modify the edge cost to minimize α * #cell flipping + β * #cell swapping (α, β ∈ Z^+ and) while ensuring that the total number of the DDA between adjacent cells is still minimized? (15 points)

3. Refer to p.6, unit 5.
    a. What features are extracted from layout patterns to support machine learning based hotspot detection in [Yu+DAC13]? For each feature, briefly describe its definition and explain why it may help detect hotspots. (10 points)
    b. Suggest and briefly describe one additional feature not mentioned in the paper and explain why this feature might be useful for identifying hotspots. (5 points)

4. Refer to p.22, unit 6, a serial edge simplification rule is used to eliminate a degree-2 node in the flipping graph. The updated gain between nodes i and k is defined as $gain_{i,k} = max(gain_{i,j}, gain_{j,k}) - max(gain_{i,j} + gain_{j,k}, 0)$ where j is the degree-2 node connected to i and k. Derive this equation and explain the reasoning behind each term. (15 points)

5. Refer to p.28, unit 6, briefly describe how [Kahng+ ICCAD08] address the DPL decomposition problem (10 points), and why GREMA outperforms [Kahng+ ICCAD08] in terms of solution quality (10 points) and runtime (10 points).