National Yang Ming Chiao Tung University
電子研究所 / 前瞻半導體研究所
Physical Design Autmation, Fall 2023

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# Midterm

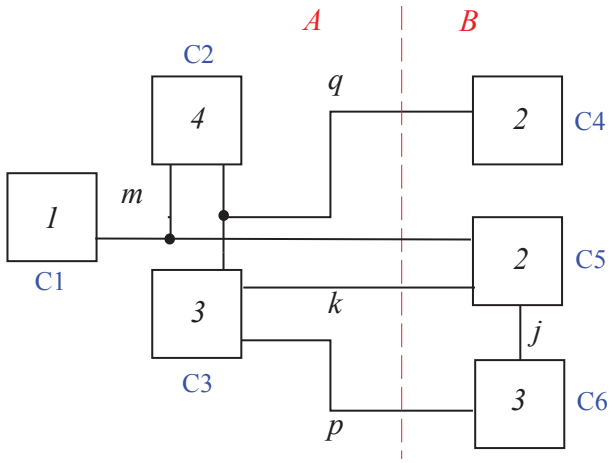
1. (10%) The time complexity of an algorithm is independent of the implementation. For example, the data structure you choose does not effect the run time. True/False? Please explain.

2. (10%) Your friend, John, claims that he invents a very smart algorithm to solve the traveling salesman problem (TSP) within polynomial time. When you ask him to solve the Hamiltonion Circuit (HC) problem using that algorithm, however, he cannot solve it within polynomial time. Do you believe John's algorithm and what he says? Why?

3. (10%) Why/how can the simulated annealing based algorithm (SA) escape from a local optimum? Can it always guarantee a global optimum solution?

4. (10%) Nodes $a$ and $b$ are in distinct partitions. Assume that the respective internal and external costs of node $a$ are 6 and 3, and the respective internal and external costs of node $b$ are 2 and 4. Then, can we swap nodes $a$ and $b$ to reduce the cut cost?

5. (15%) Apply the Fiduccia-Matheyses heuristic to the circuit below to find a balanced bipartition. (The balanced criterion is the same as that defined in the lecture notes.) Show all steps that lead to your answer. Let the desire balance factor be 0.3 and the sizes of cells as follows: $s(C1) = 1, s(C2) = 4, s(C3) = 3, s(C4) = 2, s(C5) = 2$, and $s(C6) = 3$. The initial partition is $A = \{C1, C2, C3\}$ and $B = \{C4, C5, C6\}$.



6. (25%) Given the following Polish expression, $E = 12H34VH$.

   (a) Give a slicing tree corresponding to the expression $E$.

   (b) Assume the modules, 1, 2, 3, and 4, have the sizes and shapes indicated in the following table. If all modules are rigid and have free orientations, what will be the size of the smallest bounding rectangle corresponding to the Polish expression $E$? Show all steps that lead to your answer.

| Module ID | Width | Height |
|---|---|---|
| 1 | 3 | 3 |
| 2 | 1 | 3 |
| 3 | 2 | 4 |
| 4 | 2 | 2 |

   (c) Give a B*-tree for the floorplan derived in (b).

   (d) Give the Sequence Pair for the floorplan derived in (b).

   (e) Give the TCG the floorplan derived in (b).

7. (20%) Consider five modules, a, b, c, d, and e and their dimensions below,

| Module ID | Width | Height |
|---|---|---|
| a | 2 | 3 |
| b | 3 | 3 |
| c | 4 | 2 |
| d | 3 | 2 |
| e | 2 | 6 |

   (a) Show the packing procedure for the sequence pair (abcde, dbaec), and give the area cost.

   (b) Show the packing procedure for the B*-tree below, and give the area cost.