國 立 臺 北 科 技 大 學

九十九學年第二學期電機系博士班資格考試

積體電路實體設計演算法 試題

注意事項：

1. 本試題共【4】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在試卷答案欄內，否則不予計分。
4. 考試時間：二小時。

1. Design CMOS logic gates for the function $F = (A+B)(C+D)$. (10%)

2. Answer the following questions.

   (a) What is half-perimeter wire-length (*HPWL*)? Is *HPWL* method suitable to decide the routing path? Explain your answer. (10%)

   (b) In SA algorithm, a formula based on temperature and cost is used to determine the probability of hill climbing at different temperatures. Write the formula and explain how it works. (10%)

   (c) Maze routing algorithm uses two phases to derive shortest path between Source (*S*) and Target (*T*) points. What are these two phases? Is it possible to derive a detour path using Maze router if the paths between *S* and *T* are entirely blocked? (10%)

   (d) Dynamic programming uses "memoization" approach to speed up its calculation. What is "memorization" approach? (5%)

   (e) What is the Manhattan distance between $S(3,3)$ and $T(7, 8)$? (5%)

   (f) Given 3 points, $A(3, 2)$, $B(5, 4)$, $C(1, 6)$, draw a Steiner tree and mark the Steiner point of that tree. (5%)

   (g) Given the following graph, what is the result of relax? (5%)
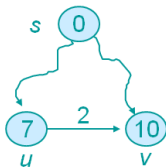
3. Given the following Polish expression $E = 12H3V45HVV6$,

   (a) Does the above expression satisfy the balloting property? (5%)

   (b) If we change the expression into $E = 123456VVVVV$, is it a normalized expression for Wong-Liu algorithm? (5%)

   (c) Is $E = 12V3V45V6VH$ a normalized Polish expression? If not, explain your answer; otherwise, convert it into a floorplan, and draw the floorplan, suppose the size of each block is $2*2$. (10%)

4. (a) A typical formula for calculating a floorplan is as shown below, what does A, λ, and W mean, respectively? (5%)

   $$Cost = A + \lambda W$$

   (b) Yet, another frequently used formula is as shown below. How to obtain A_{norm} and W_{norm}? (10%)

   $$Cost = \alpha A/A_{norm} + (1-\alpha) W/W_{norm}$$

   (c) Explain why the formula in question (b) is better than that in question (a). (5%)