國立中山大學109學年度
碩士暨碩士專班招生考試試題

科目名稱：離散數學【電機系碩士班丙組】

—作答注意事項—

考試時間：100分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請衡酌作答。
- 答案卡請以2B鉛筆劃記，不可使用修正液（帶）塗改，未使用2B鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，其後果由考生自行負擔。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- **試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。**
- **試題採雙面列印，考生應注意試題頁數確實作答。**
- **違規者依本校招生考試試場規則及違規處理辦法處理。**

國立中山大學109學年度碩士暨碩士專班招生考試試題

科目名稱：離散數學【電機系碩士班丙組】　　題號：431011

※本科目依簡章規定「可以」使用計算機（廠牌、功能不拘）（問答申論題）　　

Problem 1. (20points) TRUE or FALSE: Decide whether or not the following statements are True(O) or False(X). You do **not** have to justify the answer. Each correct answer is 5 points, and each incorrect one is -3 points (until you get 0 points in problem 1). If you choose not to answer, you get 0 points for each.

1.1 True(O) or False(X): Assume that A and B are problems. If A is an NP one and B is in P, $A \cap B$ is not NP-complete.

1.2 True(O) or False(X): If A is in NP-complete and A can be solved in polynomial time less than B, B belongs to NP-complete.

1.3 True(O) or False(X): Solutions to the class of NP problems can be verified in polynomial time.

1.4 True(O) or False(X): A class of NP problems without known polynomial algorithms that can be reduced to one another is called NP-complete.

Problem 2. (15 points) Decide the complexity of the following computation. Please justify your answer. Otherwise, you get 0 points.

If N and M are positive integers, then the complexity $1^M + 2^M + \ldots + N^M = O(L)$. What is L in terms of N and M?

Problem 3. (35 points). Find and draw all the spanning trees of the following graphs. You have to list all the spanning trees to get full points for each subproblem. Otherwise, you get 0 points.

3.1 K3 (i.e., a complete graph with 3 vertices). **(5 points)**

3.2 K2,2 (i.e., a complete bipartite graph with 4 vertices). **(15 points)**

3.3 Find the total number of spanning trees of the graph. **(15 points)**

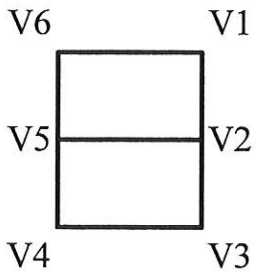

Fig. 1

Problem 4. (20 points). Use Dijkstra's algorithm to find the shortest path between V1 and V7. Please justify your answer. Otherwise, you get 0 points.

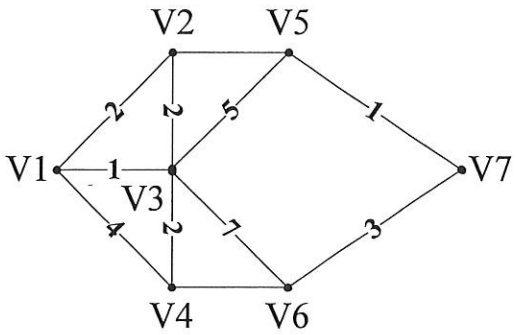

Fig. 2

Problem 5. (10 points). There are 12 students, and you are a coach. You want to divide the students into three specific groups, i.e.,G1, G2, and G3, so that each group contains four students. Please decide how many ways you can divide them. Please justify your answer.