

所 別：管理技術研究所
學程別：資訊管理學程

組別：甲組

科目：計算機數學

1. (8%) Find the number of nonnegative integer solutions to

$$x_1 + x_2 + \cdots + x_6 < 10.$$

2. (8%) Solve the following recurrence relation:

$$a_{n+1} - 5a_n = 0, n \geq 0$$

$$a_0 = 3$$

3. (6%) Prove that $C_0^n - C_1^n + C_2^n - \cdots + (-1)^n C_n^n = 0$.

4. (8%) Consider the following program segment:

```
counter := 0;  
for i := 1 to 18 do  
  for j := 1 to i do  
    for k := 1 to j do  
      counter := counter + 1;
```

What is the value of *counter* after the loop has executed?

5. The propositional connective *neither-nor*, $\downarrow$, is defined as follows:

p	q	$p \downarrow q$
T	T	F
T	F	F
F	T	F
F	F	T

In other words, $p \downarrow q$ is true only if both p and q are false.

- (a) (5%) Show that $\sim p \equiv p \downarrow p$.

- (b) (5%) How can we define $p \wedge q$ using $\downarrow$ only? (I.e., no other logical connectives are allowed.)

6. (a) (5%) If $G = (V, E)$ is a connected graph with $|E| = 17$ and $\deg(v) \geq 3$ for all $v \in V$, where $\deg(v)$ is the degree of vertex v , what is the maximum value for $|V|$?

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科目：計算機概論

5. IPv6, the next generation Internet Protocol is recently proposed to ultimately replace the current IPv4. Compared to IPv4, IPv6 has the following differences:

- (1) IP address has changed from 32 bits to 128 bits.
- (2) IPv6 header has 8 fields instead of 12 in IPv4.
- (3) A 4 bits priority field and 24 bits flow label field are added in IPv6 header.

With respect to the applications and situations in the current Internet, please explain why the above three modifications are suitable and necessary. (9%)

6. List three functions of an operating system (OS). (12%)

7. List the three most common network topologies. Which topologies need collision-avoidance schemes? (12%)

8. Design an algorithm that, when given an arrangement of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, rearrange the digits so that the new arrangement represents the next larger value that can be represented by these digits (or report that no such arrangement exists if no rearrangement produces a larger value.) For example, 5647382901 would produce 5647382910. (16%)