考試科目	計算機概論	系所別	資訊管理學系/資管組	考試時間	2 月 18 日(一) 第 一 節

I. Multiple Choice (45%, 3 points for each)

1. Compared to a file-server system, which of the following is *Not* true of using a client-server system:
   a) higher system security
   b) higher system scalability
   c) higher network traffic
   d) higher network transparency

2. A(n) _____ cookie lasts only until the browser is closed.
   a) local
   b) global
   c) adaptive
   d) session

3. Arrays must be indexed with _____ data type.
   a) either an integer or a string
   b) either a float and a double
   c) either a string or a float
   d) either a boolean or a double

4. The _____ file structure is associated with the problem of clustering.
   a) sequential
   b) indexed
   c) hash
   d) fetch

5. In a relational detabase, each table column represents a different _____.
   a) data attribute
   b) key value
   c) session type
   d) record set

6. Interpret the result of the following SQL query:

```
SELECT * FROM Products
WHERE ProdcutName LIKE '_a%'
```

   a) selects from the table Products, find any values that starts with "a"
   b) selects from the table Products, find any values that consist with "a" and at least 3 characters in length
   c) selects from the table Products, find any values that have "a" in the second position
   d) selects from the table Products, find any values that ends with "a"

考試科目	計算機概論	系所別	資訊管理學系/資管組	考試時間	2 月 18 日(一) 第 一 節

7. Which type of webpages will automatically adjust the content (resize, hide, shrink, or enlarge) to display appropriately relative to the size of the device screen?
   a) adaptive
   b) constructive
   c) sensitive
   d) responsive

8. Which of the following is Not true of using XML?
   a) It generates both machine and human readable data formats
   b) It is faster to parse than any other data formats
   c) It can create customized markup for any type of information
   d) It can support various types of data formats

9. With a(n) _____ user interface, users interact with the software through ordinary, intuitive behavior such as touch, gesture, and voice.
   a) adopted
   b) conditional
   c) natural
   d) hybrid

10. Which of the following best describe a cross-platform application?
   a) a program that coordinates data sharing among various devices
   b) a program that communicates between different devices and networks
   c) a program that runs the same way on various types of operating systems
   b) a program that incorporates various aspects of operating systems

11. Which of the following is NOT true about network communications
   a) WAPs enables PCs and devices to transfer data wirelessly among themselves
   b) WAPs have two types of antennas for optimizing signals
   c) TCP/IP defines how messages are routed from one point to the other
   d) TCP/IP groups data into a single packet for sending it over the Internet

12. Which of the following is not found in XML documents?
   a) root element
   b) variables
   c) data
   d) namespace

考試科目	計算機概論	系所別	資訊管理學系/資管組	考試時間	2 月 18 日(一) 第 一 節

13. Which of the following best describes paging?
    a) The technique of dividing data into disk sectors
    b) The process of converting data into information
    c) The technique of swapping items between memory and disk
    d) The process of transforming items into machine readable formats

14. When a system spends much of its time paging, it is said to be _____.
    a) matching
    b) virtualizing
    c) switching
    d) thrashing

15. When partitioning a hard drive:
    a) the hard drive will be divided into distinct drives
    c) the hard drive will be synchronized to the system settings
    c) the hard drive will be connected to other hard drives in the network
    d) the hard drive will be accessed among all the connected devices

考試科目	計算機概論	系所別	資訊管理學系/資管組	考試時間	2 月 18 日(一) 第 一 節

II. Answer the following questions (55%)

1. (15%, 5 points for each) Analyze the worst case time complexity for each of the conditions

(a)

```
int exam (int n, int m, int num) {
  if (n < 30)
    return num = n * m;
  else if (n < 90)
    return exam (n, m/2);
  else
    return exam (n/2, m);
}
```

(b)

```
void exam (int n, int m, int cnt) {
  for (int i = 0; i < n * m; i++) {
    for (int j = n; j > 0; j--)
      cnt++;
    for (int k = 0; k < i; k++)
      cnt++;
  }
}
```

(c)

```
int exam (int n, int m, int cnt) {
  for (int i = n * n; i > 0; i--) {
    for (int j = 0; j < n; j++)
      cnt++;
    for (int k = 0; k < i; k++)
      cnt++;
  }
 Return cnt;
}
```

考試科目	計算機概論	系所別	資訊管理學系/資管組	考試時間	2 月 18 日(一) 第 一 節

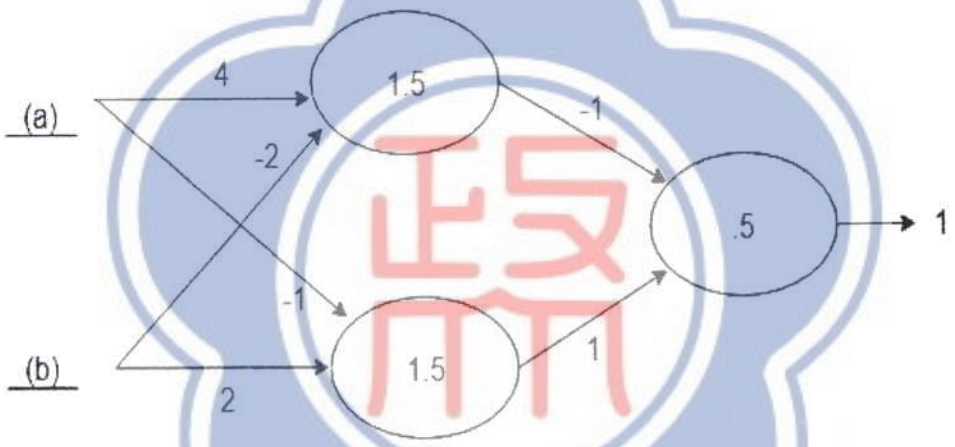
2. (8%, 4 points for each) Given an AVL tree:

(a) What is the minimum number of nodes in a balanced AVL tree of height 5? Include appropriate explanations to defend the answer.

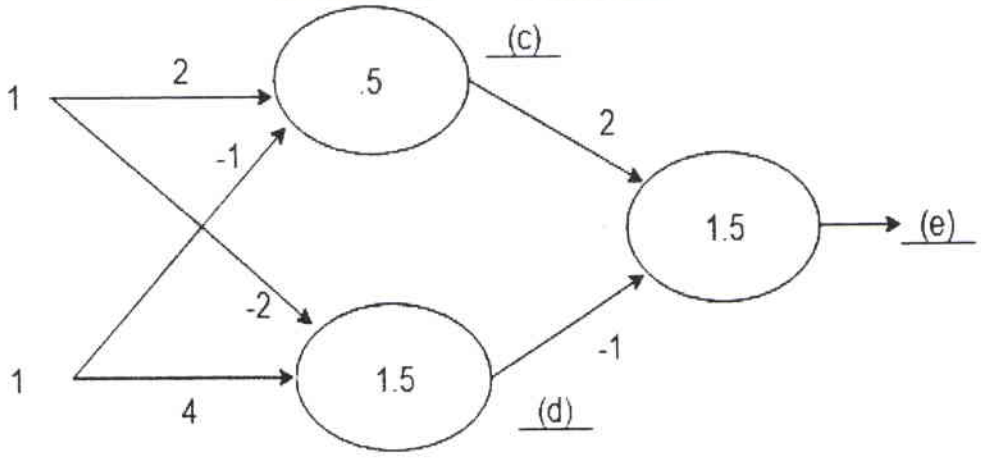
(b) What is the time complexity to print out all the odd values contained in the tree in descending order. Include appropriate explanations to defend the answer.

3. (20%, 4 points for each) Fill in the blanks in the artificial neural network below
(note: the upper input is 1 and the lower input is 0)

Fill in the blanks (a) and (b) with input values



Fill in the blanks (c), (d) and (e) with the output of each neuron



考試科目	計算機概論	系所別	資訊管理學系/資管組	考試時間	2 月 18 日(一) 第 一 節

4. (8%, 2 points for each) Based on the following Java code:

```
class Stacks implements StackTypes
{
    int Counter = 0;
      int CntStopper = 10;
    int[] StackNew = new int[10];
    public void push(int NewInputs)
    {
        if (Counter < CntStopper)
            StackNew[Counter++] = NewInputs;
    }
}
```

(a) after executing the following statement, what is the value of Counter associated with Stack:

```
StackTypes Stack;
```

(b) after executing the following statement, what is the value of Counter associated with Stack?

```
Stack.push(5);
```

(c) after executing the following statements, what is the value of StackNew [1] associated with Stack1?

```
StackTypes Stack1;
Stack1.push(100);
Stack1.push(130);
Stack1.push(170);
```

(d) after executing the following statements, what is the value of the variable Counter associated with Stack2?

```
StackTypes Stack2;
Stack2.push(6);
Stack2.push(7);
Stack2.push(8);
Stack2.push(9);
Stack2.push(0);
```

5. (4%) List the four conditions required for OS deadlock and give a brief description (no longer than two sentences) of each.

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

考試科目	管理資訊系統	系所別	資訊管理學系(資管組)	考試時間	2 月 18 日(一) 第 3 節

I. Multiple Choice (18%): Write the Capital letter ONLY that represents the best answer to the questions below.

1. The founder of 奧丁丁市集 built the startup because "他發現醬油、鮮奶、水果這些小農的產品還沒人賣過。" Why are these products slow to e-commerce?

A. Agriculture is the traditional industry so it is slow to e-commerce

B. Farmers do not know how to use computers and sell produces online

C. The nature of products is not suitable for selling online

Figure 1

2. The above figure is the network configuration of a computer. What would happen if DNS server is broken?

A. cannot receive emails

B. cannot browse websites

C. Both A & B are correct

3. According Figure 1, which of the following is correct?

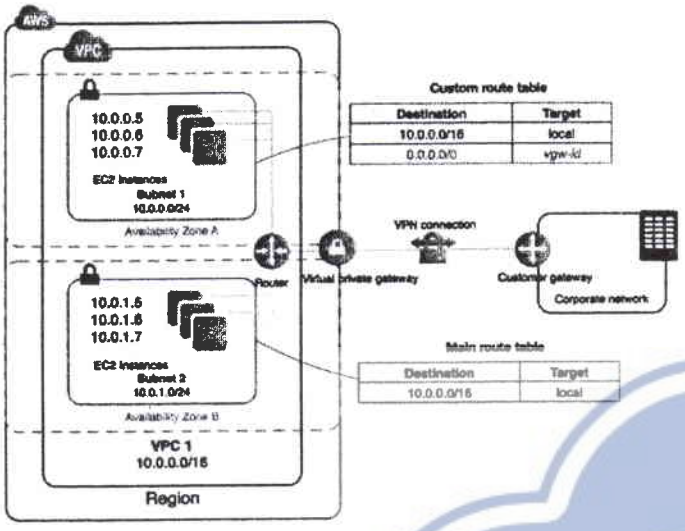
A. In a LAN, a switch only recognizes MAC address

B. Default gateway specifies the port linking to a router

C. Both A & B are correct

考試科目	管理資訊系統	系所別	資訊管理學系 / 資管組	考試時間	2 月 18 日(一) 第 3 節

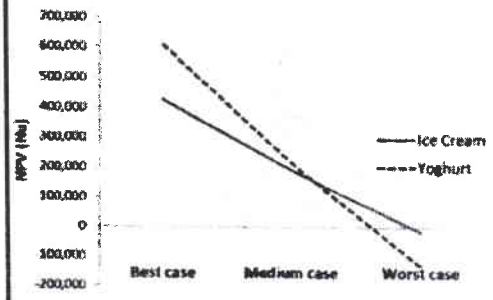
Figure 2



4. The above figure is originated from AWS. Which of the following statement is correct?
   A. AWS EC2 is classified as platform as a service
   B. VPN refers to an internet connection from the external to a corporate network
   C. Both A & B are incorrect

5. How do EC2 instances in the figure 2 address cyber-attacks?
   A. EC2 instances are located within AWS's network, which has better security protection than ordinary firms.
   B. EC2 instances are assigned with private IP address, isolated from the Internet.
   C. Both A & B are incorrect

6. How do we interpret the diagram below? Choose the best answer.
   A. NPV of Project I is lower so we should decline Project I
   B. Standard deviation of Project Y is higher so we should decline Project Y
   C. Standard deviation of Project I is lower indicating the risk of project I is lower.



NPV of Project Y(yoghurt): 369,761
NPV of Project I (ice cream): 224,761

考試科目	管理資訊系統	系所別	資訊管理學系 1資管組	考試時間	2 月 18 日(一) 第 3 節

II. Essay Questions (82%)

1. 雙 11 becomes the key activity for online platforms and stores. For example, momo announces that 13 million of people visit the site on 11/11/2018, and the number of orders is ten times of the daily average. If you were momo's IT manager,

(1) Please explain in details whether it would be an issue to the website. -6pts

(2) Momo adopts cloud computing to address the concern. Can you think of a situation where momo still shutdowns the website even after adopting cloud computing? -7pts

2. In 2017, E.SUN bank (玉山銀行) introduces a Chatbot application to supplement its online customer service. The Chatbot application aims to answer customers' questions on the three most consulted areas: mortgage, selection of credit cards, and currency exchange. Say you work in another financial institution.

(1) How would you propose a concise business memo to convince your manager the investment on Chatbot?-10%

(2) Chatbot has been gained traction in industries nowadays. What is the most critical component of a Chatbot application? -6%

(3) While E.SUN bank successfully adopted the Chatbot, can you provide a concise discussion on why another financial institution may fail the adoption? -7%

3. 蝦皮 is an e-commerce platform:

(1) Why are cross-side network effects critical to 蝦皮? -8pts

(2) What action did 蝦皮 take to achieve cross-side network effects? -8pts

(3) It is possible to have an application based on block chain to replace e-commerce platform like 蝦皮. What is the key feature of block chain to enable such a change? Is this new system better than the existing system like 蝦皮? -15pts

4. EU enforced the new regulation called GDPR this year.

(1) What is GDPR? Can you provide an example impacted/regulated by GDPR? -8pts

(2) Are firms in Taiwan impacted by GDPR? -7pts

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

國立政治大學 108 學年度 碩士暨碩士在職專班 招生考試試題

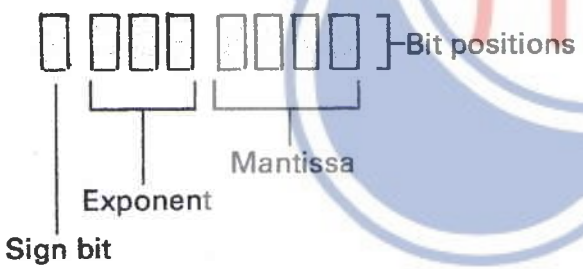
考試科目	計算機概論	系所別	資訊管理學系／科技組 (41622)	考試時間	2 月 18 日(一) 第一節

一、是非題（共 11 題，佔 22 分，答對每題 2 分，**請使用 Y 或 O 表示正確；N 或 X 表示錯誤**。）

1. 在 binary tree 之中，一個 node 最多只有兩個 child。
2. 在 stack 資料結構中，pop()函式總是會拿出 stack 最底層的 item。
3. $O(e^n) > O(n!)$
4. 對一個 linked list 進行 append()動作時，time complexity 為 O(n)。註：append()是將 item 放置在 list 的最後方。
5. SMTP (simple mail transfer protocol)在傳送信件時，收信方的 UA (user agent)需要在線上。
6. 最基本的 Dijkstra's shortest path algorithm 時間複雜度是 $O(|V|^2)$，|V|為 node 之個數。
7. 一個 64 位元的 CPU 最多可以定址 2^{64} 個記憶體位址，因此理論上可使用 2^{64} bit 的 RAM 空間。
8. 一般來說，一個 subnet 的邊界應該是 router，而一個 router 不應該將 destination IP 屬於 10.0.0.0/8 以及 192.168.0.0/16 的封包傳送到 Internet。
9. 字串"GGTTGACTA"與字串"TGTTACGG"的 minimum edit distance 是 4。
10. 在 relational database 中，foreign key 必為另一個 table 的 primary key。
11. 對於一個設計良好的 hash function 來說，若其輸出的雜湊值是介於 0 至 N-1 之間。在該區間內，其輸出值的分佈應為 normal distribution。

二、選擇題（共 6 題，佔 18 分，答對每 3 分，**請選出所有的正確選項**）

1. 若八位元之浮點數字設計如下，請問下列何者數字無法被表示？



(A) -15/2
(B) 31/32
(C) -15/4
(D) 7/32
(E) 以上數字均可被表示

2. 以下運算何者結果為 0？
(A) (11010011 AND 01101010) AND 10000100
(B) (10110101 OR 10101011) OR 01000000
(C) (10010101 XOR 10101010) XOR 00111111
(D) 00000011 >> 2
(E) NOT 1

考試科目	計算機概論	系所別	資訊管理學系／科技組 (41622)	考試時間	2 月 18 日(一) 第一節

3. 以下作業系統之描述，何者正確？
   (A) 作業系統的分頁大小 (page size) 越小，page fault ratio 越大。
   (B) 作業系統的分頁大小 (page size) 越小，I/O 時間越長。
   (C) 作業系統的分頁大小 (page size) 越小，記憶體破碎程度越大。
   (D) 當系統中 process 數量太過多時，CPU 會有一大部分的時間在做 page fault。
   (E) 一般來說，page fault 與 system call 會伴隨出現。
4. 下列作業系統 deadlock 與 starvation 的敘述何者正確？
   (A) Process 一定不可以搶奪其他 process 所持有的資源。
   (B) Deadlock 必定發生於某一 process 持有部分資源而又等待其他 process 所持有的資源。
   (C) Deadlock 會造成 CPU utilization 與 throughput 大幅降低。
   (D) 若有 preemptive 機制則可使 starvation 不發生。
   (E) 以上皆錯誤。
5. 以下網路技術之敘述何者正確？
   (A) CSMA/CD 機制可以避免 collision。
   (B) CSMA/CA 機制可以避免 collision。
   (C) Hidden Terminal Problem 只會出現在無線網路的環境。
   (D) RTS/CTS 可以完全避免碰撞問題。
   (E) CSMA/CA 機制需要 receiver 回傳 ACK，而 receiver 能優先獲得頻道通訊權是因為 access point 已保留 receiver 之 ACK 通訊時間。
6. 以下網際網路技術之敘述何者正確？
   (A) TCP sender 的 retransmission 機制可由 sender 端 timeout 觸發或由 receiver 端 timeout 觸發。
   (B) TCP sender 每成功接收一個 ACK 便會加大 congestion window (cwnd)。
   (C) TCP receiver 每成功接收一個 message 便會加大 receiving window (rwnd)。
   (D) TCP 處於 slow start 階段時，成長速度較慢，其 cwnd 為線性成長。
   (E) 以上皆錯誤。

三、問答題（共 7 大題，佔 60 分，每題配分標於題目後）

1. 請說明一個 192.168.100.0/24 的 subnet 應該如何切割為四個子 subnets？請列出四個子 subnets 之 network id、IP range 以及 netmask，請使用 CIDR (Classless Inter-Domain Routing) 之表示法。（8 分）

考試科目	計算機概論	系所別	資訊管理學系／科技組 (41622)	考試時間	2 月 18 日(一) 第一節

2. 請以下兩表說明關聯式資料庫的兩個重要概念：(a) inner join、(b) cross join。(8 分)

雇員表(Employee)

LastName	DepartmentID
Rafferty	31
Jones	33
Steinberg	33
Robinson	34
Jasper	NULL

部門表(Department)

DepartmentID	DepartmentName
31	銷售部
33	工程部
34	秘書
35	市場部

3. 試說明何謂「雜湊函數 (Hash Function)」？請舉出兩個雜湊函數應有的特點。(4 分)

4. 請寫出一份 pseudocode，其輸出內容為 1 至 100 的整數中，為偶數且不能被三整除，但可以被五整除的數字。(8 分)

5. 試完成以下的 Dec_to_Hex()函式，其函式之輸入是一個十進位整數 n，其輸出是一個起頭為"0x"的字串，該字串表示該 n 值的十六進位數值。例如：輸入為十進位之整數 100 時，其輸出為"0x64"。十六進位數字請使用"0123456789ABCDEF"，亦可自行定義函式。(8 分)

```
string Dec_to_Hex(int n) {
    string b = "0x";
    ...
    return b;
}
```

6. 給定一集合 S，該 S 包含 n 個整數。請撰寫一個 pseudocode 函式，該函式可以輸出該集合 S 的所有可能 subsets (也就是 S 的 power set)。集合物件可使用 empty()、add()等自定義函式；函式亦可使用 recursive 寫法。(12 分)

7. 給定一個 unsorted array，該 array 包含 n 個整數。試寫出一個 pseudocode function，可回傳該 unsorted array 中，最長連續項目的序列。例如：[100, 4, 2, 1, 3] 應輸出 [1, 2, 3, 4] 之序列。(12 分)

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。

考試科目	資料結構	系所別	資訊管理學系/科技組	考試時間	2 月 18 日(一) 第 3 節

I. Answer Yes(O)/No(X) for the following statements (40%):

1._____ : In a splay tree, splaying a node means moving the node to the leaf.
2._____ : Multiple entries can have the same key in a map but not in a dictionary.
3._____ : Using an unsorted list to implement a map, get(k) takes O(n) time to find the entry associated with key k.
4._____ : A hash function maps a key to an integer in a fixed interval, e.g., [0,N-1] for a hash table associated with an Array of size 2N.
5._____ : In a hash table, collision occurs when a key is mapped to different indices.
6._____ : Double hashing handles collisions by putting the colliding items in the next closest available table cell.
7._____ : A postorder traversal of a binary search tree visits the keys in increasing order.
8._____ : A preorder traversal of a binary search tree visits the keys in decreasing order.
9._____ : Removing a key takes O(n) time for a binary search tree that has n nodes with height h.
10._____ : An AVL tree is a binary search tree where for every internal node, the heights of its children are at the most one difference.
11._____ : Hashing is efficient when the load factor (the number of stored elements / the size of the Array) is close to 100%
12._____ : A skip list is a series of lists where each list is a subsequence of the previous one.
13._____ :In a skip list with n entries, the expected search, insertion and deletion time is O(n).
14._____ : Two edges in a graph are parallel if they have the same end vertices.
15._____ : Two vertices in a graph are adjacent if there exists an edge having these two vertices as its end vertices.
16._____ : The sum of the degrees of all vertices is equal to the number of edges in an undirected graph.
17._____ : The number of edges in a undirected graph is greater than n(n-1)/2 (n is the number of vertices in the graph).
18._____ : Checking whether two vertices are adjacent can be done in O(1) time in an edge-list graph.
19._____ : Removing a vertex in an adjacency-matrix graph takes O(1) time (n is the number of vertices in the graph).
20._____ : A spanning tree of a graph is a tree that covers all connected vertices in a graph.

考試科目	資料結構	系所別	資訊管理學系/科技組	考試時間	2 月 18 日(一) 第 3 節

II. Answer the following questions (60%):

1. Evaluate and represent an arithmetic expression:

1.1 (5%) Represent the expression 2+8*6/3-2>9/3*7-(2+3)*5 using a binary tree. (An internal node stores an operator, e.g., *, +, and an external node stores a value, e.g., 3, 5.)

1.2 (8%) Complete the following pseudo code to evaluate such kind of an expression.

Algorithm: evaluateExpression(T, v)
Input: A binary tree T and a node v in T
Output: the value of v

1.3 (7%) Complete the following pseudo code that prints a binary tree expression with correct parentheses, i.e., (((2+((8*6)/3))-2)>(((9/3)*7)-((2+3)*5))).

Algorithm: printExpression(T, v)
Input: A binary tree T and a node v in T

2. Heap Construction: Use an **array** to build a max-heap of {13, 2, 16, 21, 15, 79, 32, 24, 20, 14, 7, 82, 51, 43, 55, 59, 8, 1} (the value of the parent node is larger than the value of its child node).

2.1 (10%) Describe the bottom-up construction step-by-step and show how the values of an array updated. Hint: at each iteration, add half of new values to merge heaps

2.2 (10%) Apply remove() to the heap twice and show the result step by step.

3. Divide and Conquer: Find the average of elements in an integer array A (starting from index i up to index j (included)).

3.1 (10%) The first idea is using a loop and iteratively computing average. Complete the following pseudo code and analyze its time complexity.

Algorithm IterativeAverage(A, i, j):
Input: an array A and starting index i and end index j

考試科目	資料結構	系所別	資訊管理學系/科技組	考試時間	2月18日(一) 第3節

Output: The average of (j-i+1) integers in A (starting from index i up to index j (included))

3.2. (10%) Similar to mergesort, we can also apply divide and conquer to find the average of n elements. The idea is to divide n elements to two parts, recursively find the average of the first half of A and the other of the second half of A, and compute the average based on these two parts. This kind of algorithm is called binary recursion algorithm, since we use two recursive calls to solve the problem. Complete the pseudo code, write its time complexity in a recursive equation, and deduct its O time complexity.

Algorithm MergeAverage(A, i, j):
Input: an array A and starting index i and end index j
Output: The average of (j-i+1) integers in A (starting from index i up to index j (included))

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。