

考 試 科 目	計算機概論 41612	系 別	資訊管理學系/資管組	考 試 時 間	2 月 28 日(六) 第一節
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一、[共 20%]: 某生使用電腦時日長久後發現硬碟存取速度越來越慢，特別在存取異動頻繁的大檔案時更加明顯，經維修人員建議使用磁碟重組工具(Disk Defragmenter)後效能有所改善，請問：

1. 在本題案例中您認為造成效能低落的主要原因是什麼? [5%]
2. 磁碟重組工具為何能改善效能，其運作原理為何? [5%]
3. 該生友人提議將硬碟替換為固態硬碟(solid-state drive)可以一舉解決此效能問題，請比較固態硬碟與傳統硬碟差異並評論此說法是否正確。[10%]

二、[共 20%]: 請寫出下列五個網路服務或通訊協定之英文全名[各 1%]並解釋其用途[各 2%]與該服務連線之公認埠號(well-known port number)。[各 1%]

- a. DNS
- b. HTTPS
- c. FTP
- d. SMTP
- e. DHCP

三、[共 20%]: 下列三者為計算結果相同的數學運算式：

- a.  $6 + 5 - 3 + 7 * 8 / 2$
- b.  $7 * 5 + 8 / (4 - 2)^3$
- c.  $(6 / -3 + 7) * 8 - 4$

1. 請分別依數學運算法則繪製出上面三個運算式的二元運算樹(binary expression tree)。[各 3%]
2. 請以虛擬碼(pseudo code)針對上述之二元運算樹設計前序走訪(pre-order traversal)演算法。[5%]
3. 請寫出上列三個運算式的前序表示法(prefix notation)。[各 2%]

四、[共 20%]: 某生為了系統登入需要寫了一段程式，功能是判斷使用者姓名(放入 strName)與密碼(放入 strPWD)無誤後即可登入，其片段如下：

```
//從登入頁面取得使用者姓名(置於 strName)，與密碼(置於 strPWD)後組成 SQL 指令字串
string strSQL = "SELECT * FROM Users where Username =" + strName +
    "' and Pass =" + strPWD + "' -- 若帳密不符則回傳 0 筆資料";
//使用先前建立之資料庫連線 cnx 以建立 SQL 命令，執行後取得回傳資料筆數放入 iRecs
SqlCommand cmd = new SqlCommand(strSQL, cnx);
int iRecs = (int) cmd.ExecuteScalar();
//判斷回傳筆數若大於零則登入成功，否則登入失敗
if (iRecs > 0) { //成功進入系統... (程式略) }
else { //失敗顯示錯誤訊息並導回登入頁... (程式略) }
```

考 試 科 目	計 算 機 概 論 41612	系 別	資 訊 管 理 學 系 / 資 管 組	考 試 時 間	2 月 28 日 (六) 第一節
---------	--------------------	-----	---------------------	---------	------------------

該程式上線後，發現有不正常登入情形，經鑑識後發現該系統遭 SQL Injection 攻擊。請回答下列問題：

1. 何謂 SQL Injection? [5%]
2. 運用 SQL Injection 攻擊除了造成上例未授權之登入外，還可能造成其他何種資安威脅(至少寫出兩項)? [5%]
3. 如果您現在身分是滲透測試者，您會在登入頁面分別針對 strName 與 strPWD 對應欄位輸入怎麼樣的字串來測試並確認該程式的 SQL Injection 問題?[5%]
4. 請提出改善建議給該生修正程式。[5%]

五、[共 20%]: 今欲建立全國學生歷年數學科成績平均，要求全國各地學校交付所有學生歷年的數學成績表，內容須包含學生個人身分 ID(假設個人身分 ID 已模糊化為 5 碼)與成績，資料檔案可用下列三種格式交付：

csv 檔：

```
ID, Score
A1001, 89
A1002, 76
A1003, 91
...
```

xml 檔：

```
<?xml version="1.0" encoding="UTF-8" ?>
<MathScores>
  <S0>
    <ID>A1001</ID>
    <Score>96</Score>
  </S0>
  <S1>
    <ID>A1002</ID>
    <Score>68</Score>
  </S1>
  <S2>
    <ID>A1003</ID>
    <Score>85</Score>
  </S2>
  ...
</MathScores>
```

考 試 科 目	計 算 機 概 論 41612	系 別	資 訊 管 理 學 系 / 資 管 組	考 試 時 間	2 月 28 日(六) 第一節
---------	--------------------	-----	---------------------	---------	-----------------

json 檔：

```
[
  {"ID": "A1001", "Score": 82},
  {"ID": "A1002", "Score": 94},
  {"ID": "A1003", "Score": 79},
  ...
]
```

由於資料量非常龐大，經專家建議採用 MapReduce 編程模型(programming model)來計算某學生歷年數學成績平均值。請問：

- 1.何謂 MapReduce? [5%]
- 2.MapReduce 編程模型有哪些特性? [5%]
- 3.請繪製出 MapReduce 運作流程圖，以本題提供的三份資料範例解釋如何計算每個學生的歷年數學成績平均值。[10%]



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 x1613	所 別	資訊管理學系/資管組	考 試 時 間	2 月 28 日(六) 第三節
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I. True/False (15%): Write True or False to answer each question. Note: T, t, F, f are not acceptable answers.

1. Although open data is provided by the government, firms still need to pay for copyright if they build applications based on the data for profit.
2. A firm requiring a lot of data storage can benefit from cloud computing
3. When browsing a database, 30 courses listed in the Courses File means there are 30 entities
4. In an IT consultant firm, ex. IBM and Gartner, the most important asset of the firm is consultants' experiences and knowledge. In order to fully utilize the valuable asset, enterprise information portal is a possible solution.
5. Most servers run at just 15-20 percent of capacity. Virtualization can boost server utilization rates by enabling a physical server to run several instances of operating systems. In other words, a physical server appears to users as multiple logical resources.

II. Multiple Choice (15%): Write the Capital letter ONLY that represents the best answer to the questions below.

1. What is the most common reason for failure of large IT projects? Choose the best answer
  - A. user resistance and rigid organizational structures and processes
  - B. user requirements and expected service levels are not specified clearly
  - C. poor project management
2. NCCU is assigned with a class B IP address: 140.119. The school then gives different network segments to different departments. For example, 140.119.1.x/24 is assigned to the finance department and 140.119.2.x/24 is assigned to the accounting department. The TA in the finance department sends an email to the TA in the accounting department. We use a router to connect the two network segments. According to the TCP/IP model, which two layers are related to the tasks performed at the router?
  - A. Application and Internet
  - B. Application and Transport
  - C. Internet and Network Interface
  - D. Transport and Network Interface
3. What is the key idea of Big Data?
  - A. massive amounts of data
  - B. unstructured data not suitable for relational database
  - C. business intelligence



考試科目	管理資訊系統 41613	所別	資訊管理學系/資管組	考試時間	2月28日(六)第三節
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4. O2O is an emerging trend of e-commerce. 17Life.com is one service provider built on the new trend, which recommends stores and sells discounted vouchers online. Customers then use the vouchers to shop in stores, e.g. restaurants. Which of the following key features of e-commerce best explained the motivation that physical stores participate in the O2O channel like 17Life.com?

- A. provide access to customers
- B. discover more about customers
- C. reduce information asymmetry

5. Kraft Foods is a renowned food manufacturer. The company applies SAP ERP to keep track of production, inventory and sales. In 2012, the firm introduced SAP BusinessObjects Explorer to better capture trends and patterns from historical data. What is/are underlying technology(ies) of the description above? ? Choose the best answer

- A. database and data warehouse
- B. business intelligence
- C. enterprise application

### III. Essay Questions (70%)

1. Enterprise applications refer to information systems executing business processes across functional areas & all levels of management, such as ERP, SCM and KMS. The following questions are related the role and the usage of enterprise applications.-30%

(a) IDC Manufacturing Insights recently conducted a worldwide survey over 460 manufacturing enterprises. One key finding of the survey is related to the role of ERP. For most manufacturers, ERP is the essential system to run their business and our respondents indicate an inability to operate without an ERP system in place. However, when it comes to how ERP contributes to delivering a superior customer experience, firms with 100 – 1000 employees indicate that their ERP have limited, little or no contribution towards the delivery of a good customer experience. The opposite holds true for larger companies with more than 5000 employees. Those firms indicate that their ERP is a vital platform for delivering a good customer experience as it connects the back and front office operations. Can you provide the rationale to explain the different opinions between two types of firms?-12%

(b) According to the survey about firms' concerns on enterprise applications like ERP (Forrest Research, 2009), high cost of ownership, including installations of on-premises packaged software and following maintenance costs, top the list of concerns. Cloud computing is one possible solution on this issue especially for small and medium firms. Working as an IT consultant, you are invited to provide at least one alternative (other than cloud computing) for small and medium firms. Please supply with a brief description of the option and the comparison with enterprise applications. An answer without a short explanation will be given zero point.-12%

(c) When the IT department suggests investing in enterprise applications, what is the key step that IT department should apply to convince top executives?-6%

考試科目	管理資訊系統 41613	所別	資訊管理學系/資管組	考試時間	2月28日(六)第三節
------	-----------------	----	------------	------	-------------

2. In the job-searching market, customer base is critical to a firm operating a matching platform. However, customers can easily use the Internet to find various products (that is, job opening) that fits their preferences. For example, 104.com and 1111.com are major platforms providing multiple search criteria to help customers find job openings. One way to enter a market is to analyze the business environment of the market. According to the above description, can you explain how 66K 工作網 enter the job-searching market using Porter's competitive force model, and how 66K 工作網 implement the competitive strategies using information systems?-12%

Competitive force	➔	Competitive strategy
Competitors		Low cost leadership
Customer influence		Product differentiation
Supplier influence		Focus on market niche
Substitute of products		Strengthening customer intimacy
Market entrants		Strengthening supplier intimacy

3. You have acquired approval from the strategic planning group for the proposal you turned in. You are now going into planning stage:-15%

Task	Description	Immediate Predecessors	Duration (wks)	Minimum Required Time	Unit cost to shorten a week
A	Project preparation	--	2	1	8K
B	Requirement collection	A	5	4	10K
C	User interface review	A	4	3	9K
D	Specification for requirement	B, C	4	2	11K
E	Specification for data model	C	3	1	9K
F	System development	D, E	10	8	12K
G	Testing	F	4	3	10K

(a) The above are required activities and activity duration of the project. The manager would like to use PERT chart to visualize and monitor the project schedule. He also wants to know the critical path so that he can adjust schedule if necessary. What is the slack of C? What is the critical path (show your calculation)?-8%

(b) End users may be reluctant to spend time communicating their true requirements with the IT team. Consequently, when reviewing user interface with end users (activity C), IT team is likely to spend additional time finding out true requirements of end users. The impact of the risk will cause additional 3 weeks for project completion. What is the action plan would you put in the document to ensure the project finished on time when the activity C was delayed? Please provide the rationale and the answer.-7%

備

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考 試 科 目	管理資訊系統 41613	所 別	資訊管理學系/資管組	考 試 時 間	2 月 28 日(六) 第三節
---------	-----------------	-----	------------	---------	-----------------

4. According to an article on iThome, Trend Micro (趨勢科技) provides the web reputation service to help subscribers (individuals & firms) filter webpages and prevent them from virus infection. Trend Micro monitors 163 billion websites, and on average, re-check and analyze 47 million webpages per day. Trend Micro faces two problems: (1) massive amounts of data are required to processes per day; (2) research teams which have different expertise are distributed in U.S., Japan and Taiwan. When experts in different locations are required, Trend Micro has to transmit data for analysis across countries. The transmission is expensive and time-consuming. Trend Micro adopts cloud computing to address the two issues. Please explain the underlying technology that Trend Micro employs to implement cloud computing, and how the technology address the two problems mentioned above.-13%



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考 試 科 目	計算機概論 xlb>2	所 別	資管系碩士班科技組	考 試 時 間	2 月 28 日 第 1 節 (六)
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1. 請說明 JavaScript 中物件 (object) 的結構。(10%)
2. 試比較 JavaScript 的物件與 Java 的物件的異同。(20%)
3. 以下是非同步呼叫 (AJAX, Asynchronous JavaScript and XML) 的一個範例 (此範例出自 W3School，但經過簡化)。

```

<!DOCTYPE html><html><head><script>
var xmlhttp=new XMLHttpRequest();
function loadXMLDoc(url,cfunc){
    xmlhttp.onreadystatechange=cfunc;
    xmlhttp.open("GET",url,true);
    xmlhttp.send();
}
function myFunction(){
    loadXMLDoc("ajax_info.txt",function() {
        document.getElementById("myDiv").innerHTML=xmlhttp.responseText;
    });
}</script></head>
<body>
    <div id="myDiv"><h2>Let AJAX change this text</h2></div>
    <button type="button" onclick="myFunction()">Change Content</button>
</body></html>

```

請依據此範例回答下列問題：

- a. 在非同步呼叫中必須設定一回呼函數 (callback function)，請指出上例中的回呼函數是哪一個？(10%)
  - b. JavaScript 是一個 functional programming language (FPL)。FPL 的特色之一是可以將函數視為資料。請說明上例中，如何將函數視為資料來處理？(10%)
  - c. Web Application 被視為是「事件驅動 (event driven)」。設定事件驅動時，會有一個事件加上一個負責處理事件的事件處理器 (event handler)。請指出上例中：
    - (a) 哪幾行指令是設定事件驅動？(10%)
    - (b) 分別是甚麼事件？(5%)
    - (c) 各別的事件處理器是甚麼？(5%)
4. 何謂 design pattern？(10%)
  5. 試舉一個你所熟悉的 design pattern 繪圖說明其意義。(20%)

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考試科目	資料結構	所別	資管系 / 行政組	考試時間	2月28日(六)第3節
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I. Find the longest common subsequence (LCS) of two strings.

Consider the two strings:

X = AABBSCHAAA

Y = ABCSCA

The longest common subsequence of X and Y is ABSCA.

Use different ideas to define the algorithms with the following Pseudo code.

**Algorithm:** LCS(X, Y)

**Input:** two strings X and Y

**Output:** the longest common subsequence of X and Y

1. (20%) Define a brute-force algorithm with the above Pseudo code and analyze its time complexity
2. (20%) Define a greedy algorithm with the above Pseudo code. Find a counter example that the algorithm fails.
3. (20%) Define a dynamic-programming algorithm with the above Pseudo code. Show the recurrence equation on LCS.

II. Evaluate an arithmetic expression with tree data structure.

1. (20%) Represent the expression  $8 * 2 + 3 * 6 - 7 < 4 * (4 - 8 + 5) + 9$  using a binary tree. (An internal node stores an operator, e.g., \*, +, and an external node stores a value, e.g., 3, 5.)
2. (20%) Define a recursive algorithm to evaluate a binary-tree expression as below.

**Algorithm:** evaluateExpression(T, v)

**Input:** A binary tree T and a node v in T

**Output:** the value of v

備

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