

考試科目	計算機概論	系別	資訊管理學系/資管組 4161	考試時間	2月22日(六)第一節
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1. [15%]: 請根據網路通訊的 OSI 參考模型，於下列空格中依序填入各層名稱及至少一個該層之通訊協定(protocol)，若通訊協定使用英文縮寫請一併列出英文全名，寫法請參考第 5 層與第 6 層。

Layer 1: _____ (a-1) _____ Layer, protocol: _____ (a-2) _____

Layer 2: _____ (b-1) _____ Layer, protocol: _____ (b-2) _____

Layer 3: _____ (c-1) _____ Layer, protocol: _____ (c-2) _____

Layer 4: _____ (d-1) _____ Layer, protocol: _____ (d-2) _____

Layer 5: Session Layer, protocol: NetBIOS (Network Basic Input/Output System)

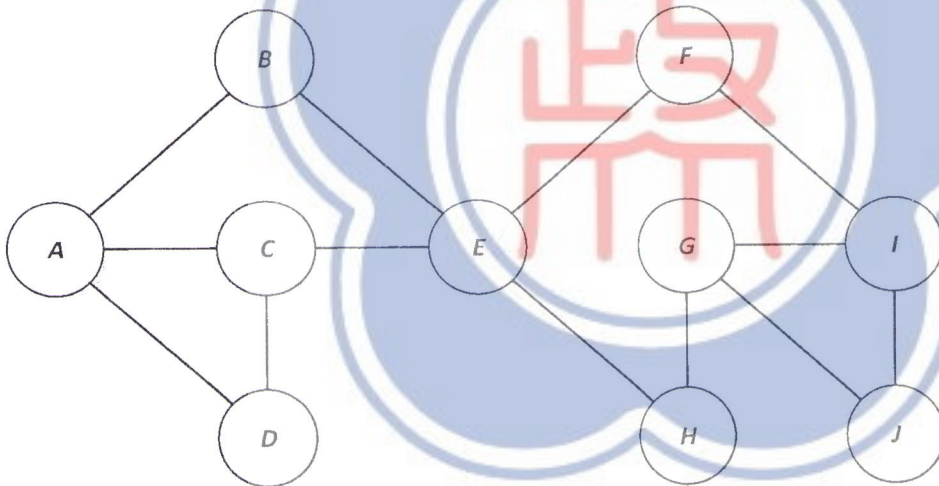
Layer 6: Presentation Layer, protocol: NDR(Network Data Representation)

Layer 7: _____ (e-1) _____ Layer, protocol: _____ (e-2) _____

(f)[4%]: 請列出至少四點分層模型的優點？

(g)[6%]: 當遇到網路相關故障問題時，根據 OSI 模型可使用哪三種結構化故障排除途徑並簡述其操作方式？

2. 請參考下圖作答



本題中所有題目皆假設上圖及其衍生之圖形是以 adjacency list 存放且經過字母的排序，亦即所有頂點在 adjacency list 中都以字母順序依序連接存放。

(a)[3%]: 若要對上圖進行 DFS(Depth-First Search)通常可使用何種資料結構輔助？該資料結構之運作原理為何？

(b)[3%]: 若要對上圖進行 BFS(Breadth-First Search)通常可使用何種資料結構輔助？該資料結構之運作原理為何？

(c)[5%]: 試從頂點 A 採用(a)小題的資料結構不使用遞迴(recursive)方法建立 Depth-first spanning tree，並繪出結果。

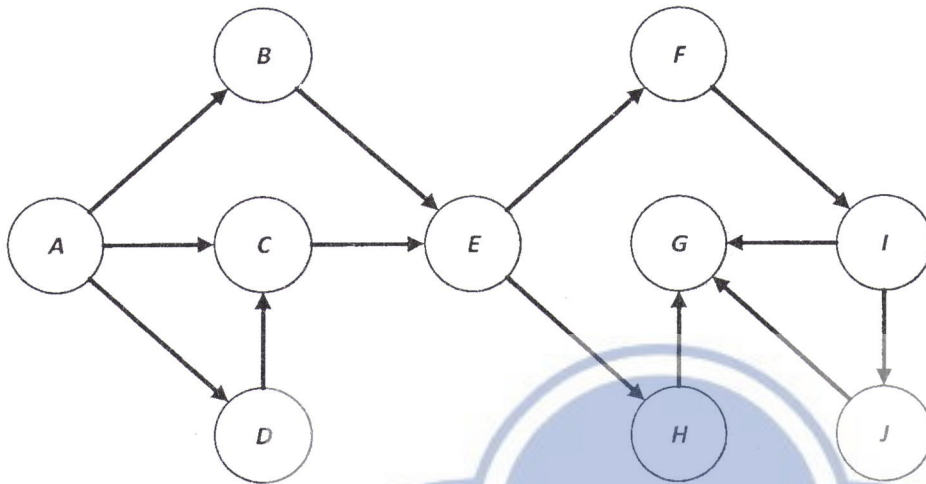
(d)[5%]: 試從頂點 A 採用(b)小題的資料結構建立 Breadth-first spanning tree，並繪出結果。

(e)[5%]: 試從頂點 A 採用遞迴(recursive)方法建立 Depth-first spanning tree，並繪出結果。

(f)[4%]: 若原圖改為下圖之有向圖(directed graph)，試從頂點 A 採用遞迴(recursive)方法建立 Depth-first

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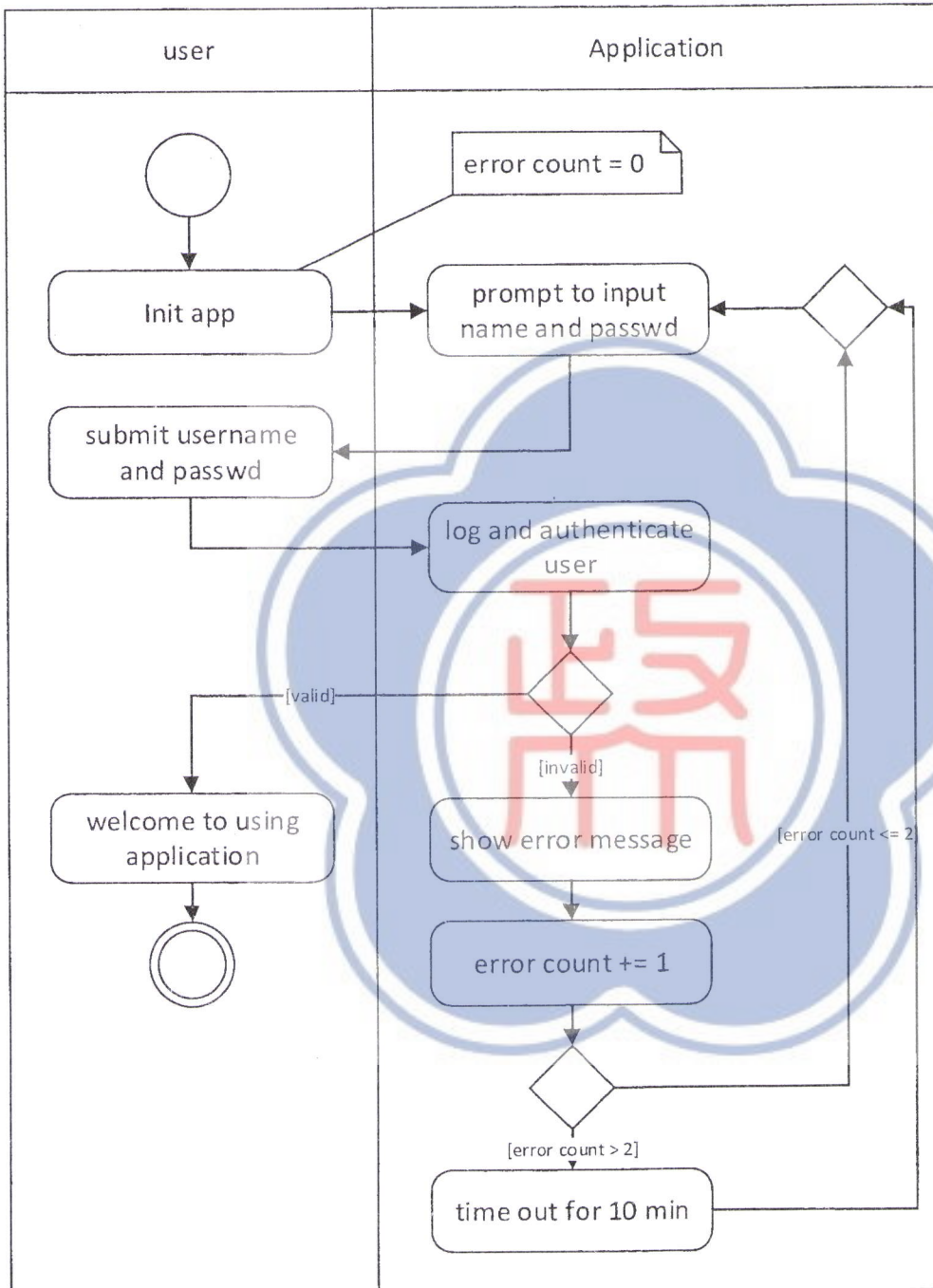
spanning tree，並繪出結果。



3. (a)[2%]: 關聯式資料庫正規化(normalization)之目的為何?
- (b)[3%]: 請說明滿足第三正規化(3rd Normal Form)之充分必要條件。(若答案中包含前階段之正規化，需一併述明該正規化定義)
- (c)[10%]: 今有一關聯式資料表 Professor，資料欄位與相關規則如下列所述：
- Professor(professor id, professor name, professor office, student id, student name, student office, student designated laptop id, laptop owner id, laptop id, laptop brand, assistant name, assistant id, assistant office)
- 資料規則：
- A. Assistant 可以同時幫多位 professors 工作。
 - B. Professor 只能有一位 assistant 幫忙。
 - C. Professor 與 assistant 有各自專屬的 office, student 共用 office。
 - D. Student 可以同時幫多位 professors 工作。
 - E. Student 只可以使用一台 laptop。
 - F. Student 使用的 laptop 必須歸幫其工作的某位 professor 所擁有。
 - G. Laptop 必歸某位 professor 所擁有。
 - H. Professor 可以擁有多台 laptops。
- 請將該資料表進行第三正規化拆解，以底線註明每個 Primary Key，且每個 Foreign Key 畫個箭頭指向其所參照之 Primary Key。
- (d)[2%]: 若將 Professor 資料表經您第三正規化拆解後的結果建置於資料庫中，前述的八項(A~H)資料規則有哪些仍無法被保證資料操作時能遵循其規則限制？
- (e)[3%]: 若您是資料庫管理員面對仍有如上題無法確保的規則限制，您會採用哪些技術來解決？
- (f)[10%]: 請繪出第三正規化後相對之實體關係圖(Entity-Relationship Diagram)。

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4. 現有某系統 activity diagram 如下：



(a)[5%]: 試說明該 activity diagram 所要表達之活動其完整處理流程。

(b)[15%]: 今使用者抱怨該系統流程，在輸入錯誤多次時等候時間過久，且該流程亦無法完全杜絕機器人自動試探帳號密碼之攻擊，請針對此兩點缺失改善流程並繪出新的 activity diagram。

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I. **True/False (15%):** Write **True** or **False** to answer each question.

1. Different industries have distinct business processes. When adopting the package ERP software, firms should customize the package software in order to fit with their existing business processes.
2. Shopping.com receives a fee after steering a customer to a participating Web site where he or she makes a purchase. As long as Shopping.com maintains a significant amount of visitors, the revenue model is feasible.
3. 104 would like to build a human resource system to capture information about talents of senior managers and top executives. As 104 is known for recruiting service and the service is specially designed for headhunting of upper level managers, the firm expects the system to be flexible and adjustable for various clients' requests. 104 should outsource the system to the third-party vendors.
4. The most common reasons for failure of large IT projects are user resistance and rigid organizational structures and processes.
5. In order to demonstrate the strategic value of the IT projects, a firm should develop the information system plan and make sure IT investments consistent with its strategic planning.

II. **Multiple Choices (15%):** Write the **Capital letter ONLY** that represents the best answer to the exam questions.

1. The Internet enables long tail sales. Why is the long tail business model viable? Which products do you think that best fit with the long tail business model?
 - A. The Internet enables unlimited shelf space for the market of less popular products sold to customers beyond local audience. The phenomenon is critical to the music industry as genres of music are diverse, digital presentation of products is feasible, and distribution cost is ignorable.
 - B. The Internet allows marketers inexpensively access to customers for products where demand is low. If we combine enough non-hits on the long tail, we may get a market potentially as big as the hits. The phenomenon is critical to the shoes industry as products vary in sizes, colors, and seasons, and customer preferences are diverse.
 - C. The Internet allows marketers inexpensively access to customers. The phenomenon is critical to fresh vegetables as firms were limited to local audience in the past.
2. Studies of returns from IT investments show that there is considerable variation in the returns firms receive. Some firms invest a great deal and receive a great deal; others invest an equal amount and receive few returns. Which of the following is the best answer to explain the above observation?
 - A. Returns of IT investments depend on market conditions. So, firms face projects with higher uncertainty receive fewer returns.
 - B. Most of time information technologies change how a firm operates the business. Firms need to change their

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existing business processes before they can really reap the advantages of new information technologies

C. Those firms that receive little from IT investments do not provide appropriate business requirement analysis

D. Those firms that receive little from IT investments do not properly use service level agreement (SLA) to regulate their relationships with vendors. So, delivered projects from vendors are unsatisfied.

3. Customers can use travel websites such as ezTravel to find out information and prices of hotels. Friends Group is a hotel franchise. The firm would like to invest in new information systems. You are a consultant hired to help the firm with the new system. One way to start the project is to identify a firm's business problem. On the basis of Porter's competitive force model, which of the following is most important to the firm?

- A. suppliers
- B. customer influences
- C. competitors

4. Web browser software requests Web pages from the Internet using which protocol? Which layer of the protocol is?

- A. URL, internet layer
- B. HTTP, application layer
- C. HTML, application layer

5. If there are 30 products listed in the Product File that means there are 30

- A. fields
- B. entities
- C. records
- D. relationships

III、

Essay Questions (70%)

1. Recent news shows that the British intelligence agency GCHQ has been targeting GPRS roaming exchange, a hub for GPRS connection from roaming users. By hacking into exchange networks operated by telecom companies, GCHQ can track every user in the world who is roaming with their smartphone. When roaming, all the Internet surfing and accesses to corporate networks go through these exchanges, and can be eavesdropped on by passively "sniffing" all data, all web pages and all emails. Can you briefly explain what sniffing is, the impact of such sniffing, and how to protect your data from sniffing? (10%)

2. If you were setting up the Web site for farmers' association (農會) to help farmers sell directly from farm to market (25%)

- (a) What management, organization, and technology issues might you encounter?
- (b) An IT project includes intuition, planning, execution, control and close stages. Firms usually prepare a

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<p>project execution plan before the execution stage, and use the plan as the guideline for the execution and the control stages. As a project manager, you are asked to prepare a project execution plan. How do you structure the execution plan?</p> <p>3. 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. Working as an IT consultant, you are invited to provide suggestions on this issue (20%)</p> <p>(a) Do you think that all firms should adopt enterprise applications like ERP to enable information transparency among different departments?</p> <p>(b) As enterprise applications are costly, you are asked to provide at least <u>2 alternatives</u>. For each option, please supply with a brief description of the option and the comparison with enterprise applications.</p> <p>4. The two major smartphone platforms are iPhone(iOS) and Android. For the former, applications are developed using Objective C and are available to customers through the AppStore. For the latter, applications are developed using Java and are available through the Android Market. Various consumer-oriented mobile applications (B2C) are developed such as m-bus routes and m-reservation. If you were hired as an IT consultant by a firm offering B2B IT solutions, how would you suggest the firm react to the new technology development? (15%)</p>					
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考題分三部分：

- 一、程式設計與系統開發部分
- 二、資料庫部分
- 三、網路通訊部分

一、程式設計與系統開發部分

1. 試說明 MVC (Model-View-Controller) 的意義，並說明在開發應用系統時如何使用 MVC。(25%)
2. 在開發網頁應用 (Web Application) 系統時，常用 HTML 設計使用者介面。在瀏覽器中 HTML 會被轉為 DOM (Document Object Model)。試說明 DOM 的意義以及在網頁畫面控制的功能。(25%)

二、資料庫部分

3. 在設計關聯式資料庫的 ERM (Entity-relationship model) 時，常會實施正規化 (normalization)，試分別說明第一正規格式 (First Normal Form, 1NF)、第二正規格式 (Second Normal Form, 2NF)、第三正規格式 (Third Normal Form, 3NF) 的意義。(30%)

三、網路通訊部分

4. 何謂 Ajax (Asynchronous JavaScript and XML)？利用 Ajax 作為網頁應用系統的通訊機制有何優點？(20%)

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

1. Operations including get, put, and remove of an AVL tree with n nodes take $O(\log n)$ time.
2. Operations including get, put, and remove of an ordered map with n entries realized by a skip list take $O(\log n)$ time (expected).
3. Operations including get, put, and remove of an ordered map with n entries realized by a hash table take $O(1)$ time (without collision).
4. An array-based stack takes $O(n)$ time in average for push(k) when it grows up with the constant incremental strategy while it is full.
5. An array-based stack takes $O(1)$ time in average for push(k) when it grows up with the double-size strategy while it is full.
6. A heap storing n values has height $O(\log n)$, and its methods insert(k) and removeMin() take $O(\log n)$ time. It follows that it takes $O(n \log n)$ time for sorting n elements with a heap
7. A heap with n keys can be implemented as an array of length n , where for the node at rank i , the left child is at rank $2i$ and the right child is at rank $2i+1$
8. Merge-sort and quick-sort are quadratic sorting algorithms, i.e., it takes $O(n^2)$ time for sorting n elements.
9. A list-based queue takes $O(1)$ time for dequeue() and enqueue() with the first of the queue at the tail of the list.
10. An object is "polymorphism" if it has one form but behaves its methods in different ways.
11. A size n arraylist using array-based implementation takes $O(1)$ time for removing $A[i]$.
12. A size n arraylist using linked-list-based implementation takes $O(1)$ time for getting $A[i]$.
13. In the pre-order traversal of a tree, a node is visited (executing the operation) before all its descendants.
14. In the in-order traversal of a binary tree, a node is visited (executing the operation) before both its descendants.
15. The height of a binary tree is less than $\log n$, where n is the number of external nodes.
16. Removing the tail in a doubly linked list takes $O(1)$ time.
17. Removing the head in a singly linked list takes $O(1)$ time.
18. A binary search tree maintains the relations between sibling nodes, e.g., the value stored in the left child is less than the value stored in the right child.
19. A max heap has its minimal key stored in the last node (the right most node of the bottom layer).
20. A path in a graph is a sequence of alternating vertices and edges that starts at a vertex and ends at a vertex such that each edge is not incident to its predecessor and successor vertex.

II. Steven plans to travel around Taiwan this summer break. Below is the undirected cost traveling between two places. (Taipei, Kaoshinug, 650), (Taipei, Taidong, 750), (Taipei, Haulian, 500), (Hualian, Taidong, 350), (Hualian, GreenIsland, 850), (Taidong, Kaoshiung, 450), (Taidong, GreenIsland, 800), (Kaoshiung, Kenting, 400), (Taidong, Kenting, 300), (Taipei, Taichung, 400), (Taichung, Nanto, 300), (Nanto, Hualian, 400).

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<p>II.1 (6%) Draw an undirected graph that includes all the above information with vertices (labeled with the place name) and edges (labeled with the cost)</p> <p>II.2 (8%) Draw the edge list structure of the graph</p> <p>II.3 (8%) Draw the adjacency matrix structure of the graph</p> <p>II.4 (8%) Find the minimal spanning tree step by step using Kruskal's algorithm.</p> <p>III. Design algorithms to compute the average of the n elements of an integer array A, starting from index s.</p> <p>III.1 (10%) The first idea is using a loop without recursion. Complete the following pseudo code and analyze its time complexity</p> <p>Algorithm: IterativeAverage(A, s, n):</p> <p>Input: an array A and an integer s as the starting index and an integer n as the number of elements to calculate</p> <p>Output: The average of the n integers in A, starting from the index s up to n elements</p> <p>III.2 (10%) The second idea is using linear recursion (one recursion). Complete the following pseudo code and analyze its time complexity with the recurrence equation.</p> <p>Algorithm: LinearRecursionAverage(A, s, n):</p> <p>Input: an array A and an integer s as the starting index and an integer n as the number of elements to calculate</p> <p>Output: The average of the n integers in A, starting from the index s up to n elements</p> <p>III.3 (10%) The third idea is using binary recursion (two recursions). Complete the following pseudo code and analyze its time complexity with the recurrence equation.</p> <p>Algorithm: BinaryRecursionAverage(A, s, n):</p> <p>Input: an array A and an integer s as the starting index and an integer n as the number of elements to calculate</p> <p>Output: The average of the n integers in A, starting from the index s up to n elements</p>					
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