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3日(五) 第2節

I. Multiple Choice (40%, 5 points for each)

1. An OS may put resource restrictions on processes to prevent ____; however, if an OS puts too many restrictions, _____ may occur.
   a. starvation, deadlock
   b. deadlock, starvation
   c. segmentation, paging
   d. paging, segmentation

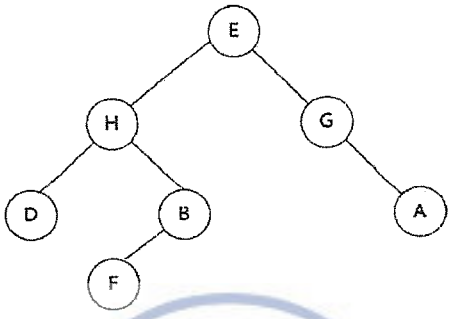
2. Swapping in OS, multiprogramming with swapping is called ____; whereas multiprogramming without swapping is called ____.
   a. partitioning, demand paging
   b. demand segmentation, framing
   c. demand paging, partitioning
   d. framing, demand segmentation

3. In the _____ key method, _____ key is publicly known.
   a. asymmetric, decryption
   b. symmetric, decryption
   c. asymmetric, encryption
   d. symmetric, encryption

4. In the TCP/IP protocol, _____ layer is responsible for node-to-node delivery; whereas ____ layer is responsible for source-to-destination delivery.
   a. session, data link
   b. application, transport
   c. network, session
   d. data link, network

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 3日(五) 第2節

5. Given the following expression tree, convert it to the Prefix and Postfix notations.



a. Prefix: DFBHAGE; Postfix: EHDBFGA
b. Prefix: FDBHAGE; Postfix: AGEFBDH
c. Prefix: AGEFBDH; Postfix: FDBHAGE
d. Prefix: EHDBFGA; Postfix: DFBHAGE

6. What is the maximum and minimum number of nodes in a balanced AVL tree of height 4?

a. Max= 31; Min= 11
b. Max= 30; Min= 12
c. Max= 31; Min= 12
d. Max= 30; Min= 11

7. The worst complexity of a selection sort is _____, and the worst complexity of a merge sort is _____.

a. $O(n^2)$; $O(n*\log n)$
b. $O(n*\log n)$; $O(n^2)$
c. $O(n^2)$; $O(\log n)$
d. $O(n^2*\log n)$; $O(\log n)$

8. Which of the following statement is NOT true?

a. SQL databases are vertically scalable; whereas NoSQL databases are horizontally scalable.
b. Table-based databases is the major type of SQL databases; whereas both document-based and key-value are the types of noSQL databases.
c. SQL databases is relational databases; whereas NoSQL is non-relational databases.
d. SQL databases are built to store data without a predefined schema; whereas NoSQL databases are best suited for complex queries.

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 3日(五) 第 2節

II. Answer the following questions (60%)

1. What is the output most likely to derive from the following code segment? (10%)

```
public class Main {
  public static void main(String[] args) {
    int result = sum(5, 15);
    System.out.println(result);
  }
  public static int sum(int input, int tmp) {
    if (tmp >= input) {
      return tmp + sum(input, tmp - 5);
    } else {
      System.out.println(tmp);
      return tmp;
    }
  }
}
```

2. A relation R has three attributes abc. Given each of the following functional dependencies, what is the candidate key(s) for R? (15%)

   (1). a→ b, a → c

   (2). c → a

   (3). bca → a, a → b

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 3日(五) 第 2節

3. Briefly explain the differences between supervised and unsupervised learning in machine learning. Based on the following metrics in the table, put a mark (V) on the cell if the model type is a form of supervised/unsupervised learning. (35%)

	Supervised Learning	**Unsupervised Learning**
Classification		
Clustering		
Dimensionality Reduction		
K-means		
KNN		
Regression		
SVM		

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 112 學年度 碩士班暨碩士在職專班 招生考試試題

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3日（五）第四節

Essay Questions (100%) *(You may answer the questions in either Traditional Chinese or English.)*

1. **(40%)** One of the Taiwanese political opinion leaders adopted the idea of "canary in the mine pit" to describe the election results in the end of 2022. Actually, the metaphor of "canary" is not exclusive to the field of politics. "Canary in the coal mine" was widely adopted to describe the economic settings of Singapore in 2019. Likewise, "canary development", "canary testing", or even "canary solutions" has been introduced to the IT industry for decades. In the era of cloud services, the canary tools have been available online. For instance, a tool of "Automated Canary Analysis" called Kayenta was introduced by Google and Netflix in 2018. The open-source tool is integrated with various monitoring tools such as Stackdriver, Prometheus, Datadog, and Netflix Atlas.

(a) What is "canary development", "canary testing", or "canary solutions" in the IT industry? (5 pts)

(b) Besides the canary, IT developers generally need to follow one of the following frameworks to design their software products/services: MVC, MVP, and MVVM. Please explain and compare these three different software architectural patterns carefully. (10 pts)

(c) To develop IT products, especially software modules, "long parameter list", "divergent change", "shotgun surgery", and even "a big ball of mud" are common problems. Scholars and practitioners have provided multiple solutions such as the agile development methods like Scrum or Kanban with clean architecture and domain-driven design (DDD). Pair programming and mob programming are also increasingly popular due to their contributions to productivity with high quality. Please describe how to implement the DDD with Scrum or Kanban during your information systems development process. (15 pts)

(d) Apparently, DDD is not the silver bullet. Please provide a scenario when the development group(s) better adopt the traditional analysis or object-oriented analysis and design (OOAD) with waterfall approach instead of the DDD with the agile methods. Also, please explain why you will prefer the traditional analysis or OOAD with the waterfall approach rather than the DDD with the agile development methods in your proposed scenario in details. (10 pts)

2. **(15%)** *"Create an environment with digital affordance and for poetic dwelling."* This is the main slogan proposed by the current president Dr. Tsai-Yen Li for 2022 NCCU Presidential Election. President Li said that he wishes to transform the university into a digital, diverse, strong, public, and poetic place. As a prospective student, you may be interested in what and how the new president will do to make NCCU a better place for faculty, students, and alumni to work, learn, and relax.

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3日（五）第四節

In fact, "digital affordance" has been a popular research target in the field of information systems for at least a decade. One of the premier journals, *MIS Quarterly*, just awarded its "Impact Award" to a paper discussed the concept of affordance in 2011. According to your knowledge, please describe and explain the definition of "digital affordance". Also, please provide a possible solution to "create an environment with digital affordance and for poetic dwelling" for an organization. (Note: it is **NOT** necessary to provide a solution for NCCU or any other college campuses.) (15 pts)

3. **(45%)** "*Squid Game*", "*Alice in Borderland*", "*Extraordinary Attorney Woo*" "*First Love*", "*Transit Love*", and "*Single's Inferno*". These online video on-demand programs and several others on the over-the-top media services from South Korea and Japan did make people around the world crazy for their stories and cultures. For instance, Utada Hikaru's song which released in 1999 re-entered the 2022 music charts in Taiwan because of "*First Love*". "*Transit Love*" attracted multiple new tourists from around the world to visit Jeju Island. Netflix started a lawsuit with SK Broadband due to the tremendous amount of streaming to watch "*Squid Game*". The digital entertainment channels and materials are changing our daily lives in different forms.

(a) The ongoing lawsuit between Netflix and SK Broadband is about net neutrality. What is net neutrality? Do you support Netflix or SK Broadband? Please analyze the possible concerns regarding to this issue, and then provide a solution if the similar debate occurs in Taiwan. You should consider the current situation of net neutrality and the ISPs in Taiwan to provide your solution. (15 pts)

(b) In the game of "The King of Diamonds" introduced in "*Alice in Borderland*", a typical scenario of "Keynesian beauty contest" with "Nash equilibrium" was adopted to develop the game strategy:

> *Five participants need to choose an integer from 0 to 100 in the given time. The average of the five chosen numbers will be multiplied by 0.8 to decide the target number. Winner of each round will be the person who chooses the number closest to the calculated target number. This constitutes one round. All losers will lose a point. Participant(s) will be eliminated once they reach -10 points. If participants are all rational, the Nash equilibrium of this game will be apparent. However, the Nash equilibrium may not be optimal solution because people may be irrational. Participants will need to guess others' guess to win this game.*

Now you are going to do research **on information systems (IS)** (including IT strategy, supply chain management, e-commerce, digital marketing, etc.) **with the adoption of Nash equilibrium**, please provide a possible IS-related research question and simply explain why it is important to study. It is okay if the topic has been discussed by past scholars. The application of "Keynesian beauty contest" is not necessary. (15 pts)

(c) In the beginning episodes of "*Transit Love Season 2*", participants used MBTI to know each other. MBTI (Myers-Briggs Type Indicator) is a tool to know individual's psychological preferences in how the person

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3日（五）第四節

perceives the world and makes decisions. Specifically, the combination of the four different dichotomies creates 16 personalities.

Dichotomies	
Extraversion (**E**)	(**I**) Introversion
Sensing (**S**)	(**N**) Intuition
Thinking (**T**)	(**F**) Feeling
Judging (**J**)	(**P**) Perception

Examples can be shown in the following table. For instance, Hsu has a MBTI result of INTJ. It means Hsu may be an introvert person (I) who prefers to intuitively take in information (N), think twice when making decision (T), and generally follow rules and step-by-step instructions (J). People claim that INTJ individuals are "masterminds" who are experts in contingency planning and entailment organizing.

Table name: employee
Data types: (id: int; last_name: varchar; MBTI: varchar; salary: int; supervisor_id: int)

id	last_name	MBTI	salary	supervisor_id
3	Hsu	INTJ	78010	7
52	Lin	ENFJ	78000	7
6	Kim	ESTP	78000	7
19	Weng	ENTJ	72050	1
2	Zheng	ISFJ	78010	3
4	Chuang	ISFP	83040	7
5	Chou	INFP	78200	7
30	Lee	ESFP	72050	2
22	Chao	ENFJ	78000	7
8	Shi	INFJ	78000	7

Based on the information provided above, **write a SQL query** to find the highest salary received by the employee or employees who works under the supervisor id 7 **AND** who is identified as an extravert person. We need to receive the output list with the last name, MBTI, and salary. Also, alphabetically sort by the last names if we have more than one result. (15 pts)

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　112　學年度 碩士班暨碩士在職專班 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	考試時間	2 月 3 日 (五) 第二節

一、選擇題，選出最為正確的選項（共 10 題，佔 40 分，每題 4 分）

1. 以下二進制運算的敘述何者**正確**？

(A) 101010101 是符合 odd parity (B) 01000110 是符合 odd parity (C) 11111110 XOR 00000000 = 11111110 (D) 0000001 OR 0000000 = 0000000 (E) 以上皆是

2. 以下敘述何者**正確**？

(A) CPU 有算數邏輯單元（Arithmetic/logic unit） (B) ARM 使用 RISC 設計架構 (C) 在有 pipeline 的 CPU 中，fetch 可同時與 execute 進行 (D) USB 是使用 serial communication (E) 以上皆是

3. 以下敘述何者**正確**？

(A) FIFO 是 stack 的行為 (B) 作業系統是採用分時（time sharing）的策略來調配多個 processes 共享 CPU 資源，但是 Ethernet 系統是採用分頻（frequency division） (C) Horizontal Scaling 是指由超大型主機取代原先由小主機的工作負擔 (D) Horizontal Scaling 又稱為 scale out (E) 以上皆非

4. 以下關於 frame 的專業術語敘述何者**正確**？

(A) H.264 影片是由數種不同的 frame 組成的 (B) RAM 被切割為固定長度的基本管理單位是 frame (C) 乙太網路的基本傳輸單位是 frame (D) 802.11g 的基本傳輸單位是 frame (E) 以上皆是

5. 以下關於 process 執行的敘述何者**正確**？

(A) Semaphore 至少需要兩個 variables 設計實作，以負責軟體系統某個資源一次只能一個 process 使用 (B) Critical region 表示這個程式區段被設計一次只能有一個 process 執行 (C) Critical region 不會導致 mutual exclusion 的情況發生 (D) Mutual exclusion 會導致 deadlock (E) 以上皆非

6. 以下關於網路技術的敘述何者**錯誤**？

(A) 802.11b 最高只有 11Mbps 的理論傳輸速率 (B) 802.3u (100BASE-T) 只有 100Mbps 的理論傳輸速率 (C) 802.15 是 WAN (Wireless Area Network) 的一種，藍牙隸屬於此協定 (D) 802.16 是 WiMAX 的標準，可以提供 100Mbps 的速度，是 4G 技術的一種 (E) 以上皆是

7. 以下關於網路訊號 collision 的敘述何者**錯誤**？

(A) CSMA/CD 不允許發生 collision (B) CSMA/CA 有可能發生 collision (C) CSMA 技術可能因為 hidden terminal problem 發生 collision (D) 採用 RTS/CTS 仍舊有可能發生 collision (E) 以上皆是

8. 以下關於 SQL 的運算結果何者**錯誤**？

A table

L	M	N
X	P	1
Y	Q	7
Z	R	6

B table

X	Y
9	7
4	3

(A) FINAL ← SELECT FROM B WHERE X = 9; FINAL 只有一個 tuple。

(B) FINAL ← PROJECT L FROM A; FINAL 只有一個 tuple。

(C) FINAL ← SELECT FROM A WHERE L=Z; FINAL 只有一個 tuple。

(D) FINAL ← JOIN A and B WHERE A.N = B.Y; FINAL 只有一個 tuple。

(E) 以上皆是

考試科目	計算機概論	系所別	資訊管理學系／科技組	考試時間	2 月 3 日 (五) 第二節

9. 以下關於人工智慧的描述何者**錯誤**？
(A) 在訓練樣本不足時，增加模型的複雜度仍舊可能得到更高的訓練準確率（accuracy） (B) PCA（Principal Component Analysis）是一種降維（Dimension Reduction）的手段，降維演算法需要標籤（label）進行運算 (C) 循環神經網路（RNN）常會出現梯度消失（gradient vanishing）或是梯度爆炸（gradient explosion）的現象，這是因為 RNN 的參數與層數較多 (D) ChatGPT 是一種基於 GPT 的自迴歸語言模型，Transformer 最大的特色是自注意力機制（self- attention） (E) 以上皆是

10. 以下關於資訊安全的描述何者**錯誤**？
(A) 封包竊聽（Packet Sniffing）是網路安全的重要議題，ARP spoofing 可以使封包被傳送至偽造的 IP 位址 (B) 在 WiFi 的環境中，每一張在 BSS 之內的 NIC 都可以聽到所有的 layer 2 frame (C) 在 NAT 的環境中，內部的 TCP SYN 封包可以穿過 NAT server (D) 若有一個秘密的訊息要由 X 傳給 Y，可以使用 Y 的公鑰以及 X 的私鑰對訊息進行加密 (E) 以上皆是

二、問答題（共 8 大題，佔 60 分，每題配分標示於題目後）

1. 請說明 WiFi 網路中，a) BSSID 以及 SSID 用途的不同。b) AP 發出 Beacon Frame 的原因。（6 分）
2. 請說明編譯器（compiler）以及直譯器（interpreter）的運作原理差別、優劣。（6 分）
3. 請說明虛擬機器（virtual machine）與容器（container）的運作原理差別、優劣。（6 分）
4. 請說明若無外部標籤，如何評價兩個聚類演算法（clustering algorithm）的優劣？（6 分）
5. 請舉出至少四種能夠降低人工智慧模型中 overfitting 的方法。（8 分）
6. 請舉出兩個 5G 電信網路優於 3G/4G 電信網路的技術，以及該技術的說明。（8 分）
7. 給定一個 n*n 的方陣（名為 grid），請撰寫一個 pseudocode function LLV() 能輸出另一個 m*m 方陣（名為 maxLocalGrid），且 m=n-2，且 maxLocalGrid[i][j]的值等同於以 grid[i+1][j+1]為中心的 3*3 方陣內的最大值。註：矩陣可使用 list of list, array of array 等方式表示。n 必大於 3。（10 分）

範例一：

9	9	8	1
5	6	2	6
8	2	6	4
6	2	2	2

9	9
8	6

範例二：

1	1	1	1	1
1	1	1	1	1
1	1	2	1	1
1	1	1	1	1
1	1	1	1	1

2	2	2
2	2	2
2	2	2

8. Balanced string 表示為一字串擁有同等數量的 L 與 R 字元，且該字串只包含 L 及 R 字元。若有一個 balanced string 為 s，請撰寫一個 pseudocode function BSS() 將此 s 字串拆解（split）為數個子字串（substrings），而每一個子字串同樣為 balanced string。此 BSS() 函式的輸入為 s 字串，此 BSS() 函式的輸出值為最多可拆解的子字串個數。註：輸入之 s 必定為 balanced string。（10 分）
範例一：若 s 為 RLRRLLRLRL，則拆解結果之子字串為 RL, RRLL, RL, RL，函式輸出值為 4。
範例二：若 s 為 RLRRRLLRLL，則拆解結果之子字串為 RL, RRRLLRLL，函式輸出值為 2。
範例三：若 s 為 LLLRRRR，則拆解結果之子字串為 RRRLLL，函式輸出值為 1。

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(丙組)	考試時間	2月3日(五)第4節

I. Dynamic Programming:

Given two strings X and Y, the longest common subsequence (LCS) problem is to find a longest subsequence common to both X and Y.

1.1 (10%) L[m,n] denote the LCS of two strings X[0..m] and Y[0..n]. Define the recurrence equation on L[m,n], and define the dynamic programming algorithm to solve the LCS problem.

1.2 (10%)Consider the following two strings:

X = ACACACBAACCAA
Y = CAACABCACA

Show the complete table L to compute L[12, 9].

II. AVL and Splay Binary Search Tree:

An AVL tree is a binary search tree where the difference on height of sub trees is less than or equal to 1. A Splay tree is a binary search tree where a node is splayed after it is accessed. "splay" means to move the splay node to the root. For T.get(k), the splay node is the node that has key k, or the parent node of the exiting external node. For T. put(k), the splay node is the node that has key k.

2.1 (10%) Build an AVL tree T by inserting the following keys one by one.
108, 72, 99, 29, 97, 22, 69, 120, 208, 27, 33, 53, 54, 48, 26, 49.

2.2 (10%) Define a sorting algorithm that takes T and prints its keys in an increasing order. Apply the algorithm on the tree constructed in2.1.

2.3 (10%) Consider the result of 2.2 as a splay tree T. Show T and the result after calling T. put(118)

III. Hash Table:

Consider a hash table storing the following keys:
108, 72, 99, 29, 97, 22, 69, 120, 208, 27, 33, 53, 54, 48, 26, 49.
Let N=27. h(k) = k mod 27.

3.1 (10%) Show the hash table that handles collision with liner probing.
3.2 (10%) Show the hash table that handles collision with double hashing.
Let d(k) = 13- (k mod 13).

IV. Tree Traversal:

4.1 (10%) Represent the expression 9 * (3 * 5) -28/(8-1)< 105 + 2 * (3 + 4)-18 using a binary tree. (An internal node stores an operator, e.g., *,/, +,-, and an external node stores a value, e.g., 3, 5.)

4.2 (10%) Write the pseudo code that evaluates such kind of an expression.

4.3 (10%) Write the pseudo code that prints a binary tree expression given the root node v with correct parentheses.

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。