

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9日(三)第二節
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**I. Multiple Choice (40%, 4 points for each)**

1. By using public key encryption to secure data:
  - a. both the keys used to encrypt and decrypt the data are public
  - b. both the keys used to encrypt and decrypt the data are private
  - c. the key used to encrypt is public; the key used to decrypt is private
  - d. the key used to encrypt is private; the key used to decrypt is public
  
2. Which of the following statement is NOT true?
  - a. screen host firewall lacks defense in depth
  - b. both SSL and TLS provide the same end-to-end security properties
  - c. the OSI layer 6 (presentation) includes protocols that handle encryption
  - d. using the same key to encrypt both directions of a communication channel can lead to reflection attacks
  
3. Which of the following evaluation metric is available for classification models:
  - a. r squared
  - b. root mean squared error
  - c. mean Absolute Error
  - d. gini coefficient
  
4. Instead of sending documents to a printer, the \_\_\_\_\_ process sends them into to a \_\_\_\_\_ to wait for the resources.
  - a. buffering; spooler
  - b. buffering; buffer
  - c. spooling; spooler
  - d. spooling; buffer
  
5. \_\_\_\_\_ coordinates most of the operations in the computer; \_\_\_\_\_ performs arithmetic and comparison operations.
  - a. control unit; ALU
  - b. control unit; GPU
  - c. calculate unit; ALU
  - d. calculate unit; GPU

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6. Which of the following is *Not* the functions of data warehouse?
- data Cleaning
  - data Consolidation
  - data Integration
  - data Protection
7. For the RAID configurations, \_\_\_\_\_ writes data on two drives at the same time; whereas \_\_\_\_\_ splits data, instructions, and information across multiple drives in the array.
- mirroring; striping
  - striping; mirroring
  - extraction; transformation
  - transformation; extraction
8. CPU use \_\_\_\_\_ cycle to execute programs.
- fetch-execute-decode
  - fetch-decode-execute
  - decode-execute-fetch
  - decode-fetch-execute
9. The data model of a DBMS is often determined at the \_\_\_\_\_ level; the \_\_\_\_\_ level defines where data is stored on the storage devices.
- conceptual; internal
  - conceptual; external
  - internal; conceptual
  - external; conceptual
10. \_\_\_\_\_ search for an unordered list; \_\_\_\_\_ search for an ordered list.
- hash; bubble
  - bubble; hash
  - sequential; binary
  - binary; sequential

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**II. Answer the following questions (60%)**

1. What is the output most likely to derive from the following code segment? (5%)

```
#include <stdio.h>
#include <string.h>
int main()
{
    char str [10];
    strcpy(str, "NCCU" );
    strcpy(&str [ 1 ], "MIS" );
    printf ( "%s \n" , str );
}
```

2. What is the output most likely to derive from the following code segment? (5%)

```
#include <stdio.h>
#include <string.h>
int main()
{
    char str[20];
    strcpy(str,"1,3,5,7,9");
    int length = strlen(str);
    for(int i = 0; i < length; i++) {
        if(str[i] >= '0' && str[i] <= '5')
            str[i] = (str[i] + '0' - 5) %5 + '0';
    }
    printf("%s\n", str);
}
```

3. Name and describe three kinds of pipeline hazards. (9%)

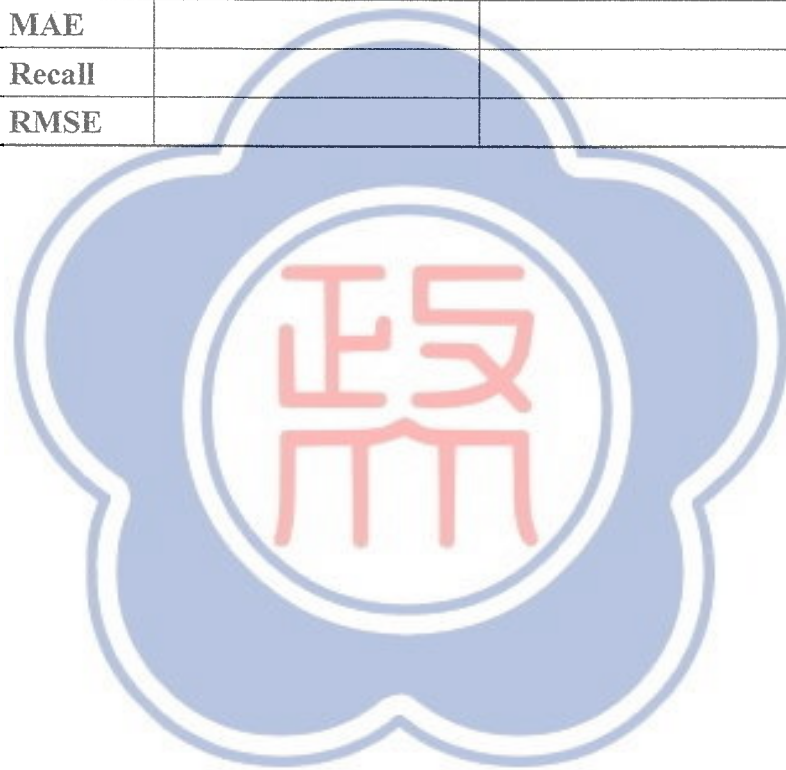
4. How many subset(s) does a screened subnet include? List and describe the subset(s). (10%)

5. What is round-robin scheduling? (4%) Provide one advantage and one disadvantage regarding small quantum sizes. (6%)

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6. What is the difference between classification and regression in machine learning (3%)? Based on the following evaluation metrics in the table, put a mark (V) on the cell if the evaluation metric is available for evaluating the model type, classification vs. regression (18%).

Metrics	Classification	Regression
Accuracy		
AUC		
F1-score		
MAE		
Recall		
RMSE		



備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。
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一、是非題 (共 10 題，佔 30 分，答對每題 3 分，請使用 T 表示正確；F 表示錯誤。)

1. 假設有一個二進位數字  $D = 1011101$ ，且  $r = 3$ ，則  $D * 2^r$  為十進位之 1350。
2. 一隻 userspace 的程式想要與作業系統核心 (kernel) 溝通時，可以透過系統呼叫 (system call)，此時 CPU 會觸發一個系統中斷要求 (system interrupt request)，並查詢 interrupt vector table，找到後續 interrupt handlers (或稱 interrupt service routine) 的位址，並執行相對應的中斷處理程式。
3. Pipeline 是網路傳輸上重要的機制，可以使得 sender 同時傳送多的封包給 receiver。在 Go-Back-N 的 pipeline 機制中，若發生封包 timeout，則 sender 必定會一次性重傳 N 個封包。
4. 802.11ax 技術可支援 ISM 頻段的 2.4GHz 與 5GHz 頻段，其主要新技術為正交頻分多址 (OFDMA)，相較於傳統的 OFDM 架構，可使得使用頻譜的效率上升，但 OFDMA 需要較精確的時間同步。
5. 考慮以下兩個資料庫表格與操作語法，JOIN A and B where  $A.N < B.Y$  所產生新的資料庫表格共有三個 tuples。

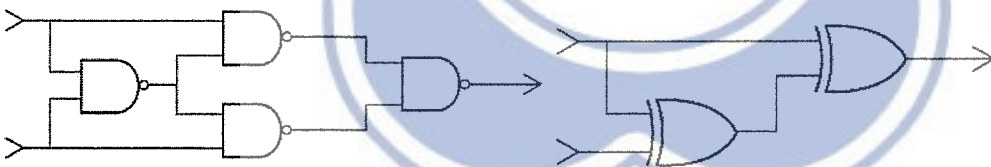
A relation

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

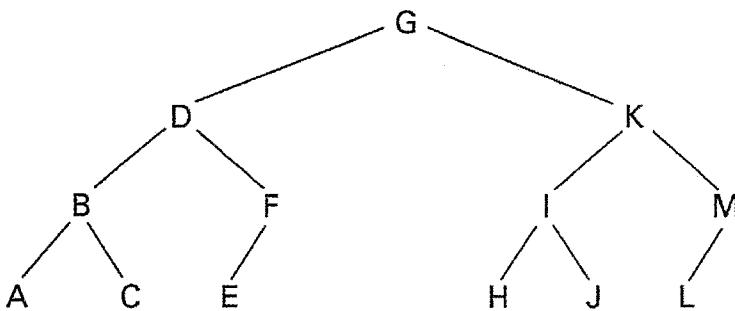
B relation

X	Y
9	7
4	3

6. 考慮 Dijkstra's Algorithm 中，若有 N 個節點以及 E 個邊，完成計算其最短路徑時間為  $O(|N|^2)$ ，所需要交換的訊息數量為  $O(|N| * |E|)$ 。
7. 考慮以下兩個邏輯閘，若輸入皆為 0 的時候，其輸出皆為 0。



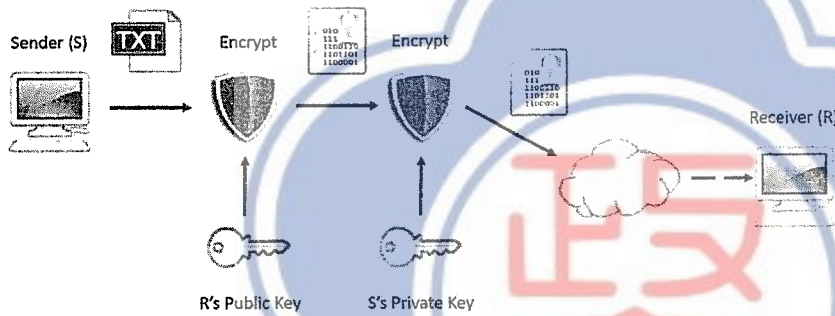
8. 10.10.10.10 是屬於 private IP address，這是屬於 Class A 區段的 IP。一個 Class A 可以包含  $2^{24}$  個 IP address。Class A 也可以表示為 /8。
9. NAT 的服務可以不需要依賴 DHCP。
10. 子樹 K 的 BFS (Breadth First Search) 之順序為 H、J、L、I、M、K。



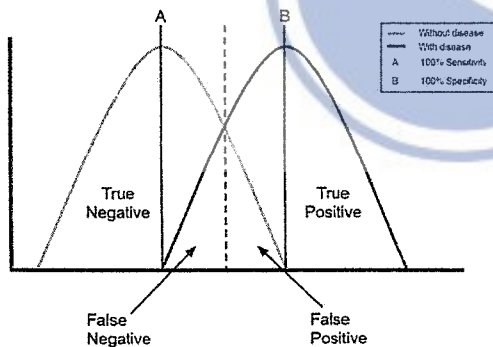
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二、問答題 (共 10 大題，佔 70 分，每題配分標於題目後)

- 網路封包標頭中常常使用 checksum 作為資料是否傳遞正確的檢查機制，請計算以下兩個十六位元的數字的 sum 以及 checksum 值？(4 分)  
01100110 01100000    01010101 01010101
- 假設有一份 40 terabytes 的資料要從波士頓到拉斯維加斯的資料中心 (約 2715.4 英里，4370 公里)，若你有一條專用的 1Gbps 光纖 (propagation speed  $2.5 * 10^8$ m/s) 於兩資料中心之間，請問使用光纖傳遞此資料較快，抑或是使用 FedEx over-night delivery (24 小時到貨) 實體傳輸 40 terabytes 的硬碟較快？請給出計算過程與結果。(8 分)
- 請說明一個 12GB 的大型程式，如何一個只有 8GB 實體記憶體的 64 位元電腦上被執行？請以作業系統中 context switch、memory & process management 等觀念說明 (但不限於這些觀念)。(8 分)
- 請說明以下加解密的流程之用意。(8 分)



- 試說明在類神經網路中，若遇到 overfitting 以及 imbalance 資料時，分別應該如何處理？(8 分)
- 請說明下圖各區塊與線段的意義。1) False Positive 區塊之線下面積之意義。2) True Negative 之意義。3) 中間虛線之意義。4) 標記為 A 之線段 100% sensitivity 之意義。(8 分)



- 請說明為何 802.11 的 RTS/CTS 功能可以解決 Hidden Terminal Problem。(4 分)
- 請寫出  $(A * B - C) * D + E$  的 1) expression tree、2) prefix 表示式以及 3) postfix 表示式。(6 分)
- 請說明 Ethernet 的 binary back-off 機制。(8 分)
- 請寫 pseudocode 解決以下問題。給定一個非負整數 n，請撰寫一個函式 isPowerofTwo(n)，若 n 可表示為  $2^x$ ，且 x 為整數，則該函式 return True，反之則 False。(8 分)

備註	一、作答於試題上者，不予計分。 二、試題請隨卷繳交。
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**Essay Questions (100%)** (You may answer the questions in either Traditional Chinese or English.)

1. **Meta** (NASDAQ: FB; previously known as Facebook) faced multiple changes and challenges in 2021. One of the big challenges for this company was the incident of a small talk from Frances Haugen, a Facebook whistleblower, in October. She mentioned, "*there were conflicts of interest between what was good for the public and what was good for Facebook. And Facebook, over and over again, chose to optimize for its own interests, like making more money.*" It raised the privacy concern once again after an American docudrama film "*The Social Dilemma*" released in 2020. Please answer the following questions:
  - (a) Can social media platforms monitor users' personal information and the information generated from usage to help improve user experience? Please explain in any MIS perspectives. (10 pts)
  - (b) Should the social media use its own standard or algorithm to control the dissemination of misinformation? Use the sociotechnical approach to explain. (10 pts)
  - (c) Facebook changed its company's name to Meta to highlight the new development focus on metaverse. How will the metaverse have impact on businesses? How will we solve the potential privacy and security issues? What will be the payment method(s) on the metaverse? Describe your vision and reasons. (5 pts)
  - (d) Do you believe Meta (Facebook) will dominate the niche market of metaverse? Why or why not? (5 pts)
2. **MOS Burger in Taiwan** (1259.TWO; also known as An-Shin Food Services) currently uses their mobile app to ask users make order online and then pick up their meals in-person or using delivery services. The company announced that it will create a new sub-company to help handle all the digital services including social media management and mobile app which is currently outsourced. The Tokyo-based international fast-food chain is now the second-largest fast-food company in Taiwan after McDonald's. Please answer the following questions:
  - (a) Analyze the pros and cons for MOS Burger in Taiwan's digital strategy between current outsourcing and future self-built services. And please provide your suggestions on MOS Burger's future endeavors on digital services. (15 pts)
  - (b) The news about MOS Burger in Taiwan's new direction on digital services astonished its long-term outsourcing partners. Currently, the partner companies typically use operational and analytical CRM systems with some techniques such as data mining and OLAP to catch the hidden patterns from customers at MOS Burger in Taiwan. Such methods can create adequate and efficient O2O marketing campaigns to stimulate the sales of its meals. Please explain the above information in detail to describe the possible current collaboration between MOS Burger in Taiwan and its partners. And then, try to provide a possible

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solution for the partner companies to face the upcoming changes. (15 pts)

3. **Dcard** started its YouTube channel in 2016 and gradually expanded its 'Dcard Video' team. As of January 2022, its YouTube channel has more than 66 thousand subscribers and 136 million video views. The Dcard Video team members such as Rio, Leo, Zona, Akimo, Daniel, and Manman can be now seen as YouTubers (though they are actually serving for planning, film editing, and social marketing). The Taiwanese local social media platform also started its own e-commerce platform called “好物研究室” (Good Choice Taiwan) in 2018. Instead of just a 'forum', Dcard is apparently adopting diversification strategy to achieve its sustainable goal: “to strike a chord with everyone”. Please answer the following questions:

- (a) In your opinion, analyze the reason why Dcard adopts the diversification strategy. And how will the Dcard Video team and Good Choice Taiwan meet the sustainable goal? (10 pts)
- (b) Write a SQL query that'll identify returning active Dcard users of Good Choice Taiwan from the following table. A returning active Dcard user is a Dcard that has made a second purchase within 7 days of any other of his or her purchases. Output a list of dcard\_id of these returning active users. (15 pts)

Table name: dcard\_transactions

Data types: (id: int, dcard\_id: int, item: varchar, created\_at: datetime, revenue: int)

id	dcard_id	item	created_at	revenue
1	1158	燕麥輕食飲	2022-01-02	274
2	1377	杏仁奶系列	2022-01-05	151
3	1619	石墨烯塑型機能褲	2022-01-05	269
4	1003	經典款融蠟燈	2022-01-05	145
5	1501	氣球狗 LED 氣氛小夜燈	2022-01-12	133
6	1619	韓版簡約款融蠟燈	2022-01-13	450
7	1490	護手霜	2022-01-24	799
8	1377	燕麥輕食飲	2022-01-08	548
9	1793	燕麥輕食飲	2022-01-16	258
10	1490	紐西蘭有機植物奶	2022-01-07	360
11	1134	石墨烯塑型機能褲	2022-01-11	259
12	1719	護手霜	2022-01-09	799
13	1566	氣球狗 LED 氣氛小夜燈	2022-01-19	135
14	1501	燕麥輕食飲	2022-01-08	274
15	1793	紐西蘭有機植物奶	2022-01-21	358

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(c) The Dcard company is currently hiring for multiple positions at the moment of its 10<sup>th</sup> anniversary. For the “Junior Web Frontend Developer” position, this company provides the following information (we selectively list some as follows):

- You will need to join different delivery teams to cooperate with project manages, engineers, and designers for the product development on social media, e-commerce, and advertisement.
- Optimize all the units of the frontend systems with good implementation efficiency plus excellent user interface design and experience under dynamic devices and browsers.
- Strategize how to conduct SEO for the stable optimized websites in different regions with various languages.
- Enjoy the engineering culture of YAGNI, Boy Scout Rule, & programming quality w/ stability, performance, maintainability, and reusability.
- We use the GitHub flow to conduct the tasks. All the PRs should be reviewed before ‘merge’. After each PR is created, CI will generate the test environment for PR automatically. 3 to 4 releases per day in average.
- You should have experiences on web development, React, JavaScript, CSS, and html. An open mind to learn and join teamwork is expected.

According to the above information provided, please answer the following questions:

- (i) What is YAGNI? How will you merge with this engineering culture if your programming style is totally different? (5 pts)
- (ii) Git flow, GitHub flow, and Gitlab flow are three major types of work flow commonly adopted by the IT industry in recent years. Please briefly introduce and compare the three different types of IT work flow. (5 pts)
- (iii) Dcard is now entering the Japanese market with a new name “Dtto Japan”. It is expected that this company will try to enter more markets in the near future. Please briefly provide your ideas on how to conduct SEO for the stable optimized websites in different regions with various languages for the Dcard company. (5 pts)

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- 一、作答於試題上者，不予計分。
- 二、試題請隨卷繳交。

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An effective Sorting algorithm has played an essential role in implementation of many applications. You are required to answer questions of different sorting algorithms.

Consider the following keys.

17, 35, 12, 28, 16, 5, 18, 7, 19, 92, 48, 3, 22, 1

I. Heap-Sort:

- (10%) Construct a Min-Heap of the above keys.
- (10%) Describe an algorithm to sort keys with a min-heap.
- (10%) Show how to apply the algorithm on the constructed min-heap to sort these keys.

II. BST-Sort:

- (10%) Construct an AVL tree of the above keys.
- (10%) Describe an algorithm to sort keys with an AVL tree.
- (10%) Show how to apply the algorithm on the constructed AVL tree to sort these keys.

III. Merge-Sort:

- (10%) Describe the merge sort algorithm.
- (10%) Show how to apply the algorithm to sort the above keys step by step.

IV. In-place Quick-Sort:

(20%) Use the first element as a pivot and show how to apply in-place quicksort step by step to sort these keys. Consider these keys initially in the array as below:

[17, 35, 12, 28, 16, 5, 18, 7, 19, 92, 48, 3, 22, 1]

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註

- 作答於試題上者，不予計分。
- 試題請隨卷繳交。