國立中山大學 110 學年度
碩士暨碩士專班招生考試試題

科目名稱：管理資訊系統【資管系碩士班甲組】

－作答注意事項－

考試時間：100 分鐘

- **考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。**請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。

- **答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示**，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請衡酌作答。

- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，其後果由考生自行負擔。

- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。

- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。

- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。

- 試題採雙面列印，考生應注意試題頁數確實作答。

- 違規者依本校招生考試試場規則及違規處理辦法處理。

1.人工智慧(Artificial Intelligence)是近年來相當受到注目的資訊發展，而其中的發展理論可以分為兩大學派，分別為法則學派(Rule-based Approach)與機器學習學派(Machine Learning Approach)。
(1)機器學習學派有四種不同類型，分別為非監督式學習(Unsupervised)、半監督式學習(Semi-supervised)、監督式學習(Supervised)與增強式學習(Reinforcements Learning)，試說明這四種不同類型，並舉例說明之。(12%)
(2)機器學習學派與法則學派兩者的特性與區別在哪？兩者與傳統的統計學方法差別又在哪？(13%)

2.(1)新興技術區塊鏈(Blockchain)在現今產業應用越來越多，請問區塊鏈是什麼？有哪些特性呢？(10%)
(2)區塊鏈除了比特幣(Bitcoin)、以太幣(Ether)等數位貨幣外，就你所知，還有哪些產業應用？試舉一例說明這些應用。而這些區塊鏈應用，原來是想解決產業什麼樣的問題呢？為什麼會需要使用到區塊鏈技術呢？如果靠其他方法或是其他資訊技術，有沒有辦法解決相同的問題呢？ (15%)

3.目前全球市值最高的前七大公司例如 Facebook, Amazon ,Google 大都是所謂的「平台經營模式」，請問，何謂平台經營模式？其與傳統經營模式相比有何特色？其在經營上與傳統模式相比，又有那些優勢？(25%)

4.資訊安全目前一直是所有組織最關心與擔憂的議題，一個組織要能夠有健全的資訊安全管理，必須要由組織的許多的構面與層次（例如政策、組織、人員、制度、科技等等)同時來建立，請問，如果你是一個資安顧問，你要如何建立一個完整的資訊安全管理架構，來嚇阻、預防與偵測資安的威脅？（提示：ISO 27001）(25%)

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科目名稱：資料結構【資管系碩士班乙組】

1. AVL tree operations. (16%; 4% for each)
   (A) Please draw the result of inserting the keys 6,5,3,9,10 into an empty AVL tree.
   (B) Please draw the result after inserting the keys 7,8,11 into the AVL tree from (A).
   (C) Please draw the result after removing the key 6 from the AVL tree from (B).
   (D) Please draw the result after removing the key 11 from the AVL tree from (C).

2. (10%; 5% for each)
   (A) What is the minimum number of nodes in an AVL tree to achieve the height = 9?
   (B) What is the maximum number of nodes in an AVL tree with height = 8?
   Note that the height is 1 for a tree with only one node.

3. (4%) (A) Dijkstra's algorithm will fail in what kind of situation?
   (4%) (B) Floyd-Warshall algorithm will fail in what kind of situation?
   (6%) (C) Complete the following pseudo code of Floyd-Warshall algorithm.

   ```
   let dist be a |V| × |V| array of minimum distances initialized to ∞
   for each vertex v
      dist[v][v] ← 0
   for each edge (u, v)
      dist[u][v] ← weight(u, v)
   for k from 1 to |V|
      for i from 1 to |V|
        for j from 1 to |V|
          if dist[i][j] > dist[i][k] + dist[k][j]
   _____
   ```

4. (10%) Given the frequencies of characters shown in the following table, please encode these characters to binary codes using Huffman coding.

A	45
B	13
C	12
D	16
E	9
F	5

5. (24%)

    (6%) (A) Write a procedure to reverse an array of integers.

    (6%) (B) Analyzc the time complexity (runtime formula) of your answer in (A)?

    (6%) (C) Write a procedure to calculate n! for a given integer n and analyze the time complexity of your procedure?

    (6%) (D) How many disk moves are needed in the recursive procedure for solving the n-disk Hanoi tower problem? Prove your answer.

6. (26%)

    For a graph G = (V, E), V = {1, 2, 3, 4, 5, 6, 7}, E = {(1, 2), (2, 3), (3, 4), (1, 5), (2, 5), (1, 6), (1, 7), (5, 4), (6, 7)}, and the cost for above edges are {11, 5, 12, 18, 20, 6, 11, 14, 23}, respectively.

    (5%) (A) Use Prim's algorithm to find the minimum spanning tree of G and give the cost.

    (5%) (B) How to detect a cycle in the above algorithm?

    (6%) (C) Starting from node 1, use Depth First Search (DFS) and Breadth First Search (BFS) to determine the minimum spanning tree of graph G.

    (4%) (D) Can DFS or BFS guarantee to find the optimal solution? Why?

    (6%) (E) Write a procedure to find (list) all connected components of a graph.

28. In Python 3, which of the following is used to define a block of code (e.g. body of loop)?
    A. Curly braces
    B. Indentation
    C. Semicolon
    D. Parenthesis

29. Which of the following is NOT considered the reason for the recent AI boom?
    A. The global investment of AI
    B. The accessibility of cheap computation
    C. The exponential growth of data
    D. The advances of learning algorithms

30. Which of the following about split-apply-combine strategy of data analytics is FALSE?
    A. It can be implemented by SQL
    B. It should not be used to replace loops
    C. It can help parallelize computations
    D. It is widely used in daily data management tasks

31. Which of the following about Deep Neural Network is FALSE?
    A. The trained models are usually called black-box models
    B. Compared to traditional machine learning algorithms, it has more hyperparameters to tune
    C. It takes more time to do manual feature engineering
    D. It usually requires comparatively more computing resources to train a model

32. Which of the following is NOT a common feature of object-oriented programming languages?
    A. Parallelism
    B. Polymorphism
    C. Encapsulation
    D. Inheritance

33. Which of the following is NOT a common feature of functional programming languages?
    A. Lazy Evaluation
    B. Higher-order functions
    C. Recursion
    D. Inheritance

34. Which of the following about cloud, fog, and edge computing is FALSE?
    A. Cloud computing is often used to process urgent requests in the local network
    B. To improve response times, fog computing can be used to process computation-intensive requests
    C. They help promote decentralized storages and computations
    D. Amazon Web Services can be considered cloud computing platforms

35. Which of the following about data structures is TRUE?
    A. Arrays are dynamic data structures able to increase their sizes at runtime
    B. The length of a linked list is usually fixed
    C. Data elements in a linked list must be stored in adjacent memory space
    D. Linked lists can be used to implement stacks

36. Suppose we have a table in the third normal form (3NF) in a relational database. Which of the following statement is FALSE?
    A. The table is also in the 2NF
    B. The table may have multiple candidate keys
    C. Every non-prime attribute is non-transitively dependent on every key of the table
    D. For each of the functional dependency A->B that exists, A is the super key of the table

37. Consider the following tables, A and B, in a relational database:

A:

id	val
1	A
3	X
5	C

B:

id	val
3	X
5	Y
6	Z

Which of the following SQL statement can be used to concatenate A and B?

    A. SELECT * FROM A UNION ALL SELECT * FROM B
    B. SELECT * FROM A FULL OUTER JOIN B ON A.id = B.id
    C. SELECT * FROM A INNER JOIN B ON A.id = B.id
    D. SELECT * FROM A LEFT JOIN B ON A.id = B.id

38. Which of the following is NOT considered a kind of NoSQL databases?
    A. Graph database
    B. Document database
    C. Object-relational database
    D. Key-value database

39. Which of the following is the postfix expression of math representation A * B / C + D - E?
    A. A B * C / D + E -
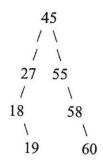   B. A B * C + D / E −
    C. / * A B - + C D E
    D. - + / * A B C D E

40. Which of the following is the post-order traversal of the below binary search tree?

```
            45
           /  \
          /    \
        27      55
        /         \
      18           58
        \            \
         19           60
```

 A. 18 19 27 45 55 58 60
 B. 45 27 18 19 55 58 60
 C. 19 18 27 55 58 60 45
 D. 19 18 27 60 58 55 45

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碩士暨碩士專班招生考試試題

科目名稱：計算機概論【資管系碩士班甲組、乙組】

單選題, 每題 2.5 分

1. Which of the following statements about memory is FALSE?
   A. Static RAM is an example of volatile memory
   B. Flash memory is a type of nonvolatile memory that can be erased electronically and rewritten
   C. Dynamic RAM is faster than static RAM
   D. Read-only memory (ROM) is a type of nonvolatile memory

2. Which of the following best describes the principle of least privilege?
   A. Data access restrictions are lifted to ensure data integrity
   B. Data is encrypted and password protected
   C. Users should not share access details with others
   D. Users' access privileges are limited to the lowest level necessary to perform required tasks

3. Which of the following about the binary search algorithm is TRUE?
   A. It is not possible for a binary search to find the value 2 in the array of [1, 3, 7, 9, 4, 2, 11]
   B. The maximum number of comparisons required to perform a binary search of a 1000 element array is 9
   C. The best-case time complexity of a binary search is $O(\log N)$, with N the number of elements in an array
   D. An iterative implementation of the binary search has a space complexity of $O(N)$, with N the number of elements in an array

4. Which of the following about web application development is FALSE?
   A. CSS allows web designers to change the layout and appearance of the webpage
   B. HTML stands for hypertext markup language and uses hashtags to specify the content of webpages
   C. JavaScript can be used to display a prompt box that prompts the user to input some text
   D. JavaScript adds interactivity to webpages

5. Which of the following provides remote users with a secure connection to the organization network?
   A. VPN
   B. https
   C. Ethernet
   D. FTP

6. Which of the following about deep learning frameworks is FALSE?
   A. PyTorch uses dynamic computation graphs
   B. TensorFlow is an open-source deep learning framework developed by Google
   C. Keras is officially integrated with PyTorch in the latest release of PyTorch
   D. TensorFlow 2.x supports dynamic computation graphs

7. Which of the following about IP addresses and domain names is FALSE?
   A. A DNS server translates an IP address to its corresponding domain name
   B. An IPv6 address is 128 bits in length and written as a string of hexadecimal digits
   C. An IPv4 address is 32 bits and often written in dotted decimal notation
   D. A domain name is a text-based name of a computer or server that is easier for humans to memorize

8. The Hamming distance between two binary strings is defined as the number of bit positions in which two bits are different. Which of the following can be used to find the differences between two binary strings in computing Hamming distance?
   A. OR
   B. XOR
   C. AND
   D. NOT

9. Which of the following is NOT an advantage of solid-state drives (SSDs) over traditional hard disks?
   A. Faster transfer rates
   B. Less power consumption
   C. Lighter weight
   D. Lower cost per gigabyte

10. Amazon EC2 is an example of _____.
    A. IaaS
    B. SaaS
    C. PaaS
    D. DaaS

11. Consider an operating system that uses paging for virtual memory management. Assume that there are 4 page frames which are initially empty. Given the page reference string 1, 2, 3, 4, 5, 1, 3, 1, 6, 3, 2, 3, how many page faults occur if the optimal page replacement is used?
    A. 5
    B. 6
    C. 8
    D. 9

12. Consider the addition of two 8-bit 2's complement integers. Which of the following is the binary representation of 6 + (-8)?
    A. 00000010
    B. 00001110
    C. 11110001
    D. 11111110

13. Given two vertices, *s* and *t*, in a graph, which of the two traversals, breadth-first search (BFS) and depth-first search (DFS), can be used to determine if there is a path from *s* to *t*?
    A. Only BFS
    B. Only DFS
    C. Both BFS and DFS
    D. Neither BFS nor DFS

14. Which of the following about Wi-Fi networks is FALSE?
    A. Most Wi-Fi is based on the 802.15 standards developed by IEEE
    B. Wi-Fi accesses the network in conjunction with the TCP/IP standard
    C. Most devices support multiple Wi-Fi standards
    D. Wi-Fi is often used to provide hot spots

15. Which of the following about network architectures is TRUE?
    A. Only one computer can act as a server on a client/server network
    B. Each device on a peer-to-peer network can share its resources with other devices
    C. One client computer crashing can affect the other computers on a client/server network
    D. A computer can act as either a client or a server, but not both, on a peer-to-peer network

16. In 2020, Amazon Web Services was hit by an attack that floods the target with massive amounts of data to disrupt normal traffic. What is this attack called?
    A. Phishing
    B. Ransomware
    C. Malware attack
    D. DDoS

17. Which of the following about drones is TRUE?
    A. The flight of drones cannot operate by an onboard computer or an autopilot
    B. A drone is an aircraft that operates by a human on board
    C. A drone is also known as an unmanned aerial vehicle (UAV)
    D. Drones are for hobbyists and cannot be used to monitor crop growth

18. Which of the following is a small, high-speed storage location within a processor that temporarily hold data and instructions?
    A. ALU
    B. CU
    C. register
    D. RAM

19. Wearable devices, such as smartwatches, can monitor blood pressure and heart rates and send alerts in case of emergency, which is an example of _____.
    A. big data
    B. wireless communication
    C. cloud computing
    D. internet of things

20. Which of the following about RAID is TRUE?
    A. RAID 0 writes data to two drives at the same time to duplicate the data
    B. RAID 1 provides data reliability via redundancy
    C. Mirroring splits data and instructions across multiple drives in the array
    D. RAID stands for reliable array of inexpensive disks

21. Which of the following is a last-in fast-out data structure?
    A. array
    B. stack
    C. queue
    D. tree

22. In C/C++ programming, it requires at least _____ byte(s) when an integer number 32768 is stored as characters in computer memory.
    A. 2
    B. 4
    C. 5
    D. 8

23. Which of the following is NOT a common data format/structure to save and describe network data?
    A. adjacency matrix
    B. hash table
    C. adjacency list
    D. edge list

24. Consider the below C/C++ statement:

    int i = 1;
    const int *iPtr = &i;

    Which of the following is FALSE?

    A. iPtr is a variable that stores a memory address
    B. Statement *iPtr = 10 is invalid
    C. iPtr is a pointer variable that points to an object of type int
    D. The data value of the object that iPtr points to can be modified

25. Consider the below C/C++ program:

```
#include <stdio.h>
int main (){
    char aStr[ ] = "A string";
    void *aPtr = &aStr;
    printf("%s\n", ((char*) aPtr) );
}
```

We would like to compile and run the program. Which of the following statement is TRUE?

A. It will show compilation errors
B. It will show run-time errors
C. It will show "A string"
D. It will show "A"

26. Consider the below C/C++ program:

```
struct strutXY{ int x, y; };

#include <stdio.h>
void passXY(struct strutXY *xy){
    xy -> x = 1; xy -> y = 2;
}
int main(void) {
    struct strutXY s;  s.x = 0; s.y = 0;
    passXY(&s);
    printf("x = %d, y = %d\n", s.x, s.y);
}
```
We would like to compile and run the program. Which of the following statement is TRUE?

A. It will show compilation errors
B. It will show run-time errors
C. It will show "x = 0, y = 0"
D. It will show "x = 1, y = 2"

27. Which of the following about recursion is TRUE?
A. We should always replace iterations with recursions if possible
B. Recursion usually uses less memory than iteration as the code is more concise and clearer
C. Recursion usually has higher algorithm performance
D. Any problems that can be solved by recursions can also be solved by iterations