

# 國立中山大學 111 學年度 碩士班暨碩士在職專班招生考試試題

科目名稱：計算機概論【資管系碩士班甲組、乙組】

## — 作答注意事項 —

考試時間：100 分鐘

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- 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。

# 國立中山大學 111 學年度碩士班暨碩士在職專班招生考試試題

科目名稱：計算機概論【資管系碩士班甲組、乙組】

題號：442001

※本科目依簡章規定「不可以」使用計算機(選擇題)

共 7 頁第 1 頁

第 1~20 題為單選題，每題 3 分，第 21~30 題為複選題，每題四分（選項全對才給分）。

1. Which data structure is often used when implementing the depth first search algorithm?
  - A. Heap
  - B. Queue
  - C. Stack
  - D. Tree
  - E. None of the above
2. Which of the following best describes a NAND gate?
  - A. An AND followed by a NOT
  - B. A NOT followed by an AND
  - C. An XOR followed by a NOT
  - D. A NOT followed by an OR
  - E. An OR followed by a NOT
3. What is the 8-bit 2's complement representation of the decimal number -5?
  - A. 00000101
  - B. 11111010
  - C. 11111011
  - D. 10000101
  - E. None of the above
4. Which of the following best describes paging?
  - A. The process a computer goes through when dividing data into disk sectors.
  - B. The technique of swapping items between memory and storage.
  - C. When a computer or mobile device executes instructions.
  - D. The conversion of data into readable, usable information.
  - E. None of the above
5. Which of the following statements about storage devices/media is FALSE?
  - A. A group of two or more integrated hard drives is called a RAID.
  - B. Solid-state drives have less power consumption than traditional hard disks.
  - C. Defragmentation is not required for solid-state drives.
  - D. USB flash drives normally run faster than solid-state drives.
  - E. None of the above

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共 7 頁第 2 頁

6. Consider the below C program.

```
#include <stdio.h>
int getSteps(int n);

int main() {
    printf("%d", getSteps(3));
}

int getSteps(int n) {
    if (1 == n) return 0;

    if (0 == n % 2)
        return 1 + getSteps(n/2);
    else
        return 1 + getSteps(3*n+1);
}
```

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

- A. It will show compilation errors
  - B. It will show run-time errors
  - C. It will show 6
  - D. It will show 7
  - E. It will show 8
7. Consider the relation Product(pNo, pName, unitPrice, category). Which attribute(s) is the best choice to be used as a search key to build a B+ tree for efficiently evaluating the following SQL statement?
- ```
SELECT pName
FROM Product
WHERE unitPrice <= 1000 AND unitPrice >= 300
```
- A. pNo
  - B. pName
  - C. unitPrice
  - D. category
  - E. pNo, category
8. What is the time complexity of the binary search algorithm? Assume the number of elements in the array is N.
- A.  $O(1)$
  - B.  $O(N)$
  - C.  $O(\log_2 N)$
  - D.  $O(\log \log N)$
  - E.  $(N \log_2 N)$

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共 7 頁第 3 頁

9. Consider the following C code.

```
#include<stdio.h>
int main() {
    int array[] = {0, 3, 5, 1, 4};
    printf("%d", array[5]);
}
```

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

- A. It will show compilation errors
  - B. It will show run-time errors
  - C. It will show 1
  - D. It will show 4
  - E. It will show some junk value
10. Which of the following about operation systems is TRUE?
- A. An operating system is an application software that manages the computer hardware and provides an interface between the hardware and the user.
  - B. Microsoft Windows is an open-source software.
  - C. Android is a Windows-like operating system.
  - D. iOS is an operating system for Mac computers.
  - E. None of the above
11. With the even parity and ASCII code, which of the following is correct?
- A. 01101011
  - B. 00011011
  - C. 00100101
  - D. 10110110
  - E. None of the above
12. What is the network number of the IP address 140.117.17.200 with the subnet mask 255.255.255.224?
- A. 140.117.17.0
  - B. 140.117.17.128
  - C. 140.117.17.192
  - D. 140.117.17.224
  - E. 140.117.17.240
13. What is the height of a complete binary tree with 8192 nodes?
- A. 8192
  - B. 4096
  - C. 12
  - D. 13
  - E. 14

# 國立中山大學 111 學年度碩士班暨碩士在職專班招生考試試題

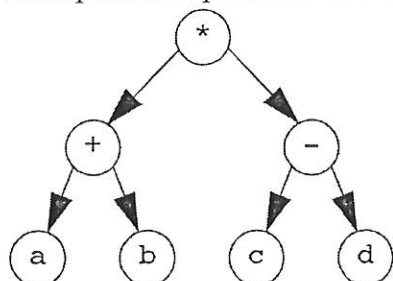
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※本科目依簡章規定「不可以」使用計算機(選擇題)

共 7 頁第 4 頁

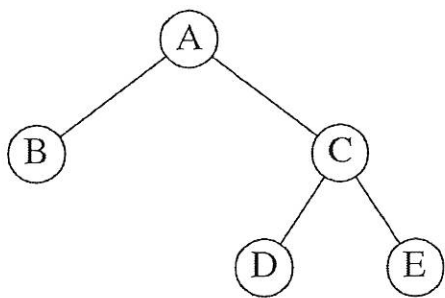
14. What postfix expression does the expression tree below represent?



- A.  $a + b * c - d$
- B.  $(a + b) * (c - d)$
- C.  $a b c d + - *$
- D.  $a b + c d - *$
- E. None of the above

15. The IPv6 specification uses addresses to identify hosts that consist of:

- A. 16 bits
- B. 32 bits
- C. 64 bits
- D. 128 bits
- E. 256 bits



16. Which of the following is an in-order traversal of the above tree?

- A. ABCDE
- B. ABDCE
- C. BDECA
- D. EDCBA
- E. BADCE

17. What is reinforcement learning?

- A. A kind of e-learning reinforced by classmates
- B. An educational technology to improve the learning performance
- C. A machine learning method based on maximizing the reward
- D. An unsupervised machine learning algorithm
- E. None of the above

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共 7 頁第 5 頁

18. Which of the following technique is for using in local area network?
- A. Long-Term Evolution
  - B. Ultra-Wide Band
  - C. 5G
  - D. Bluetooth
  - E. Ethernet
19. Which of the following instruction level parallelism mechanisms highly depends on the compiler optimization but requires only a simple hardware?
- A. Out-of-order execution
  - B. Branch prediction
  - C. Superscalar
  - D. Pipelining
  - E. VLIW
20. Which of the following operating systems is not a Unix-like system?
- A. FreeBSD
  - B. Linux
  - C. Solaris
  - D. macOS
  - E. DOS
21. (複選) Which of the following are main components of a CPU?
- A. Arithmetic Logic Unit
  - B. Codec
  - C. Registers
  - D. Control Unit
  - E. USB Controller
22. (複選) Which of the following principles are associated with object-oriented programming?
- A. Opcode mnemonics
  - B. Inheritance
  - C. Encapsulation
  - D. Polymorphism
  - E. Abstraction
23. (複選) Which of the following encryption methods are symmetric-key algorithms?
- A. AES
  - B. RSA
  - C. 3DES
  - D. DES
  - E. ChaCha20

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共 7 頁第 6 頁

24. (複選) Wi-Fi 6E can run on which of the following frequency spectrums?
- A. 2.4 GHz
  - B. 3.5 GHz
  - C. 5 GHz
  - D. 6 GHz
  - E. None of the above
25. (複選) Which of the following descriptions for blockchain technology is correct?
- A. Using daisy chain topology
  - B. A decentralized mechanism
  - C. Proof of work is popularly used
  - D. Using cryptographic hash algorithms
  - E. None of the above
26. (複選) Which of the following about recursion is TRUE?
- A. A recursive function is a function that calls itself.
  - B. When a problem can be solved either recursively or iteratively, the recursive version usually incurs extra computational overheads.
  - C. One cannot use for-loops in a recursive function.
  - D. When a base case is never reached in a recursive function, it results in stack overflow.
  - E. None of the above
27. (複選) Consider the relation  $T(A1, A2, A3, A4, A5, A6, A7)$  and the following functional dependencies:
- $A1 \rightarrow A3$
  - $A2 \rightarrow A4$
  - $A4 \rightarrow A5$
  - $\{A1, A2\} \rightarrow \{A6, A7\}$
  - $A6 \rightarrow A1$
  - $A7 \rightarrow A2$
- Which of the following statements is TRUE?
- A.  $(A1, A3)$  is a key.
  - B.  $(A3, A6, A7)$  is a key.
  - C.  $(A1, A4, A7)$  is a key.
  - D.  $(A2, A6)$  is a key.
  - E.  $(A1, A2)$  is a key.

# 國立中山大學 111 學年度碩士班暨碩士在職專班招生考試試題

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共 7 頁第 7 頁

28. (複選) Which of the following about deep learning is TRUE?
- A. Convolutional neural networks (CNNs) are commonly used to process images.
  - B. Recurrent neural networks (RNNs) can be used to process sequential data.
  - C. Deep learning is loosely inspired by the human brain.
  - D. The “deep” in deep learning refers to the number of nodes.
  - E. None of the above
29. (複選) Which of the following storage are non-volatile?
- A. SDRAM
  - B. DRAM
  - C. ROM
  - D. Flash memory
  - E. Static RAM
30. (複選) Which of the following about the relational database is TRUE?
- A. If a relation is in BCNF, it also satisfies 3NF.
  - B. A relation may have multiple candidate keys.
  - C. A key is a minimal set of attributes that can uniquely identify tuples in a relation.
  - D. A foreign key is also a superkey.
  - E. If a relation is in 2NF, it also satisfies 3NF.



# 國立中山大學 111 學年度 碩士班暨碩士在職專班招生考試試題

科目名稱：管理資訊系統【資管系碩士班甲組】

## — 作答注意事項 —

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# 國立中山大學 111 學年度碩士班暨碩士在職專班招生考試試題

科目名稱：管理資訊系統【資管系碩士班甲組】

題號：442003

※本科目依簡章規定「不可以」使用計算機(問答申論題)

共 1 頁第 1 頁

- 一、金融科技是目前相當熱門的議題，請回答下列問題
  - 1、何謂金融科技？(5%)
  - 2、金融科技的應用可以分成哪幾大類？(10%)
  - 3、請為上題每類舉一例說明之(5%)。
- 二、近來NFT吸引到許多產業的關注，請回答下列相關問題。
  - 1、請問何謂NFT？(5%)
  - 2、請試舉三種可能的NFT產業應用(5%)。
  - 3、請說明NFT與一般的區塊鏈應用有何異同？(5%)
- 三、近來元宇宙出現在各個媒體中，請回答下列相關問題。
  - 1、何謂元宇宙？(5%)
  - 2、請問可能用到的技術有哪些？(10%)
  - 3、舉出元宇宙可能的三種應用(5%)。
- 四、隱私悖論近來常被提出討論，請回答下列相關問題。
  - 1、請說明何為隱私悖論？(5%)
  - 2、並舉出兩種情境來說明(5%)
  - 3、另外請提出至少可能的三種悖論成因(5%)。
- 五、近來臉書的推薦演算法飽受質疑，請回答下列問題。
  - 1、請問一般推薦系統演算法，主要可分為哪幾類？(10%)
  - 2、承上，請為每類提出一種代表性的演算法？(5%)
- 六、許多平台以補貼參與者的方式進行擴張，例如滴滴出行補貼計程車以及消費者，以增加市場佔有率。
  - 1、請以波特的五力模式分析平台需具備什麼特性才適合以補貼方式進行市場擴張？(10%)
  - 2、若以上述原則判斷，請問滴滴出行適合採取補貼模式嗎？(5%)

# 國立中山大學 111 學年度 碩士班暨碩士在職專班招生考試試題

科目名稱：資料結構【資管系碩士班乙組】

## — 作答注意事項 —

考試時間：100 分鐘

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科目名稱：資料結構【資管系碩士班乙組】

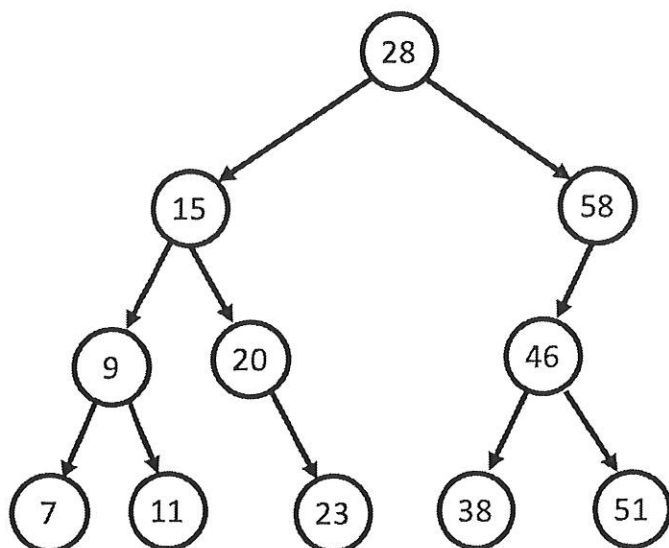
題號：442002

※本科目依簡章規定「不可以」使用計算機(混合題)

共 6 頁第 1 頁

## 一、單選題(共 82 分)

1. A heap is an implementation of a (3%)
  - A. stack
  - B. priority queue
  - C. linked list
  - D. cyclic graph
2. Which of the following data structure is not based on a binary tree? (3%)
  - A. Min Heap
  - B. Red Black Tree
  - C. AVL Tree
  - D. Stack
3. What is the breadth-first search order for the following tree? (4%)



- A. 28 15 58 9 20 46 7 11 23 38 51
  - B. 28 15 9 7 11 20 23 58 46 38 51
  - C. 7 9 11 15 20 23 28 38 46 51 58
  - D. 7 11 23 38 51 9 20 46 15 58 28
4. What is the time complexity of the following code? (4%)

```
-----  
int i, j, sum = 0;  
for(i=0; i<n; i++){  
    for(j=0; j<n; j++){  
        for(k=0; k<1; k++){  
            sum++;  
        }  
    }  
}
```

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※本科目依簡章規定「不可以」使用計算機(混合題)

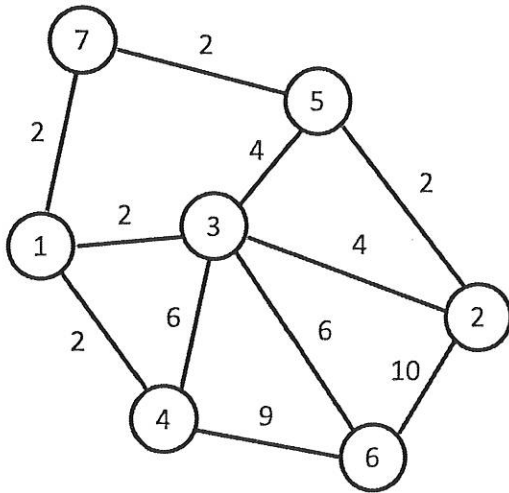
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- A.  $O(1)$
- B.  $O(n)$
- C.  $O(n^2)$
- D.  $O(n^3)$

5. A binary search tree is generated in order with the following numbers: 3, 7, 1, 2, 5, 6, 10, 17, 4. How many nodes are in the right subtree? (4%)
- A. 6
  - B. 1
  - C. 3
  - D. 5

6. What is the answer to the following postfix expression? (4%)  
 $912*-62+-$
- A. 10
  - B. 30
  - C. -1
  - D. -15

7. What is the sum of edge weights of the minimal spanning tree of the following graph? (4%)



- A. 14
  - B. 16
  - C. 18
  - D. 10
8. In a complete graph of  $n$  vertices, how many edges are there? (4%)
- A.  $n^2/2$
  - B.  $n(n-1)/2$
  - C.  $n$
  - D.  $2n$

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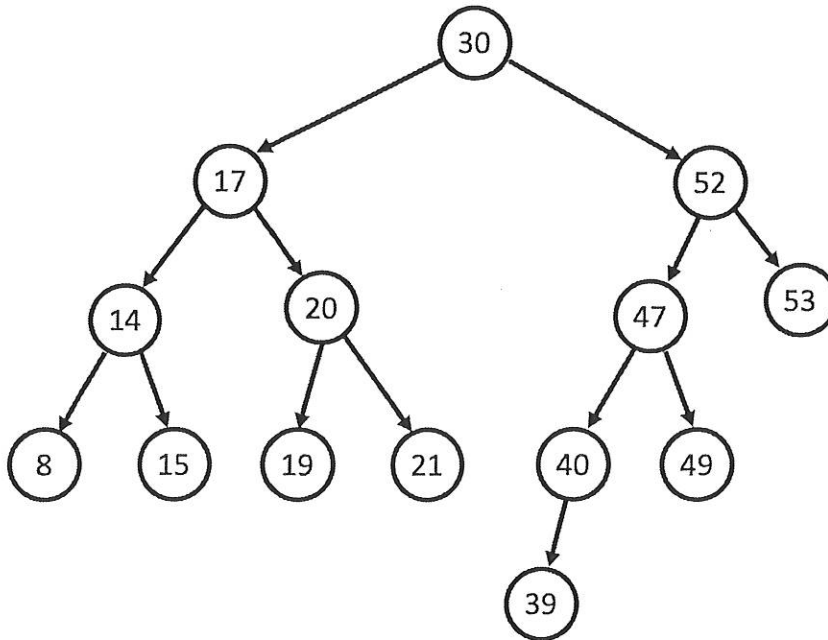
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9. What is the height of 12345 nodes in an AVL tree? (4%)

- A. 6172
- B. 1
- C. 13
- D. 14

10. For the following tree, what is the 5<sup>th</sup> node we visit if we perform a pre-order traversal? (4%)



- A. 20
- B. 21
- C. 39
- D. 15

11. For the tree in question 10, what is the 10<sup>th</sup> node we visit if we perform an in-order traversal? (4%)

- A. 49
- B. 40
- C. 47
- D. 53

12. If the following numbers "7", "3", "2", "5" are inserted into a queue, what would be their order for removal? (4%)

- A. 7325
- B. 5237
- C. 7532
- D. None of the above

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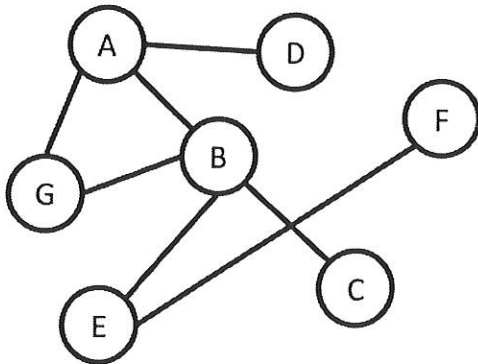
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13. Which vertex is NOT a cut vertex in the following graph? (4%)



- A. B
- B. E
- C. G
- D. A

14. In the implementation of quick sort, we divide the problem on the base of pivot element and: (3%)

- A. there is explicit combine process to conquer the solution
- B. no work is needed to combine the sub-arrays, the array is already sorted
- C. merge the subarrays
- D. none of the above

15. Which of the following is not *return optimal solution*? (3%)

- A. dynamic programming
- B. backtracking
- C. branch and bound
- D. greedy method

16. Breadth-First-Search is better compared to Depth-First-Search in the case of: (3%)

- A. the graph's width is large
- B. the graph's depth is large
- C. the graph has a large number of nodes
- D. the graph has a large number of edges

17. What algorithm technique is used in the implementation of Kruskal's solution for the minimum spanning tree? (3%)

- A. greedy technique
- B. divide-and-conquer technique
- C. dynamic programming technique
- D. the algorithm combines more than one of the above techniques

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18. Optimal merge pattern is a pattern that relates to the merging of two or more sorted files into a single sorted file. The files  $f_1$ ,  $f_2$ ,  $f_3$  are files containing 30, 20, 10 records, respectively. What is the optimal merge value? (4%)
- A. 110
  - B. 90
  - C. 60
  - D. 50
19. If the graph is represented as an adjacency matrix, the time complexity of Kruskal's algorithm is: (4%)
- A.  $O(E \log V)$
  - B.  $O(V \log E)$
  - C.  $O(V^2)$
  - D.  $O(\log E)$
20. In job sequencing problem, each job has a defined deadline and some profit associated with it. The objective is to find a sequence of jobs, which is completed within their deadlines and gives maximum profit. The solution is based on: (4%)
- A. greedy method
  - B. branch and bound
  - C. dynamic programming
  - D. divide and conquer
21. Which is the optimal solution in the case of the above problem in which the five jobs have profits 20, 15, 5, 10, 1, and deadlines 2, 2, 3, 3, 3, respectively. (4%)
- A. (1, 3, 4)
  - B. (4, 2, 3)
  - C. (1, 2, 4)
  - D. none of the above
22. Given a set of items each having a specific value and weight, the fractional knapsack problem is to find the maximal value of fractions of items that can fit into the knapsack. Which is the optimal value in the above problem for the case that the capacity of knapsack is 10, the five items have values 12, 32, 40, 30, 50, and weights 4, 8, 2, 6, 1, respectively: (4%)
- A. 128
  - B. 124
  - C. 122
  - D. none of the above



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## 二、問答題(共 18 分)

- Let  $comp1(n)$  be the number of comparisons performed by quick sort when sorting an array of  $n$  components. Let  $comp2(n)$  and  $exchange(n)$  be the number of comparisons and the number of exchange performed by bubble sort, respectively.
  - Write down equations defining  $comp1(n)$  when  $n \leq 1$  and when  $n > 1$  for the best case and for the worst case. (6%)
  - Derive  $comp2(n)$  and  $exchange(n)$  for the average case and the best case. (6%)
- Design a procedure that takes two arrays, and returns *true* if the arrays have no elements in common. Your procedure should have time complexity  $O(n \log m)$ , where  $n$  is the size of the larger array and  $m$  is the size of the smaller array. (6%)