

# 國立中山大學 107 學年度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】

題號：442001

※本科目依簡章規定「不可以」使用計算機(混合題)

共 4 頁 第 1 頁

單選題(每題 5 分)：

1. Which of the following about Functional Programming Languages is FALSE?
  - A. Closure is created by parental functions and is enclosed with the information of parental functions.
  - B. Higher-order functions are functions that can either take other functions as arguments or return them as results.
  - C. A "Map" function is usually used to reduce a set of elements/values to a single element by combining elements via a supplied function.
  - D. Iterations are usually implemented by recursions.
2. Which of the following software framework/package is NOT commonly used in processing massive datasets larger than main memory?
  - A. Apache Spark
  - B. Apache Hadoop
  - C. H2O
  - D. Pandas
3. Which of the following is usually considered semi-structured data?
  - A. JSON
  - B. Email body text
  - C. Video file
  - D. Table data in relational databases
4. Suppose that *ary* is an C array and *aryPtr* is an C pointer to the array, which expression refers to the address of element 3?
  - A. `*(aryPtr + 3)`
  - B. `aryPtr[3]`
  - C. `ary(t + 3)`
  - D. `&ary[3]`

5. Evaluate the below C statement.

`const int * const xPtr = &x;`

Which of the following is TRUE?

- A. *xPtr* is a pointer variable that points to an object of type `const`
- B. The data value of the object that *xPtr* points to can be modified
- C. The memory address saved in *xPtr* cannot be modified
- D. Statement `xPtr = &y` is valid

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試題隨卷繳回

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6. Which of the following about MapReduce Programming Model is TRUE?

- A. MapReduce is often used in iterative data processing
- B. MapReduce is a common programming model implemented in Apache Spark
- C. The concept of MapReduce originated from object-oriented programming
- D. Combiners in MapReduce may help reduce data transmission among multiple data nodes

7. Consider the following table 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

How many rows and columns in the output after running below SQL query?

**SELECT A.\* from A LEFT JOIN B ON A.id = B.id**

- A. 3 rows and 2 columns
- B. 3 rows and 4 columns
- C. 2 rows and 2 columns
- D. 2 rows and 4 columns

8. It typically takes up \_\_\_\_\_ bit(s) when an integer number 5 is stored as a character in computer memory.

- A. 8
- B. 5
- C. 16
- D. 1

9. In IPv6, what is the broadcast address?

- A. All ones
- B. All zeros
- C. 255.255.255.255
- D. None

10. What is the function of Time to Live field in the Internet protocol?

- A. Limiting the response time of servers
- B. Specifying the time of transmission
- C. Limiting the hop number of a packet
- D. To improve the privacy of message by restricting its lifetime

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11. Which of the following is trusted for vouching the authenticity of the person or organization using the authentication?
- A. Civil court
  - B. Certificate authority
  - C. Fingerprint advisory board
  - D. Computing center
12. What is reinforcement learning?
- A. A kind of e-learning reinforced by classmates
  - B. An educational technology to improve the learning performance
  - C. An unsupervised machine learning algorithm
  - D. A kind of machine learning method based on maximizing the reward
13. Which of the following algorithms represents an optimal solution in time complexity for sorting a list?
- A. Insertion sort
  - B. Bubble sort
  - C. Selection sort
  - D. Merge sort
14. If the longest path in a binary tree contains four nodes, what is the maximum number of nodes in the entire tree?
- A. 4
  - B. 7
  - C. 15
  - D. 31
15. Which of the following is a technique for controlling access to a critical section?
- A. Spooling
  - B. Time sharing
  - C. Semaphore
  - D. Booting
16. Which of the following equations is correct?
- A.  $P(X|Y) = P(Y|X) P(X) / P(Y)$
  - B.  $P(X|Y) = P(Y|X) P(X)$
  - C.  $P(X|Y) = P(Y|X) / P(Y)$
  - D.  $P(X|Y) = P(Y|X) P(X) P(Y)$

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問答題(每題 10 分)：

1. Please write a recursive C/C++ function *reverse(n)* that prints reversed positive integer number *n*.  
For example,  
*reverse (9876);*  
will print  
*6789*
2. Write a recursive binary search function in C/C++.

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This examination consists of 50 questions, divided over 5 sections; 2 points for each correct answer. Indicate your choice on the answer sheet provided.

## I. Choose the right alternative

Instructions: Each of the following 25 sentences has a blank; of the alternatives given, choose the word that fits best

1. The accused man \_\_\_\_\_ his innocence to the judge.  
a. decreed                      b. declared                      c. determined                      d. decried
2. I felt that Hermione was a bit too \_\_\_\_\_ of Ron.  
a. critical                      b. arrogant                      c. judicious                      d. unfavorable
3. As \_\_\_\_\_ last year, Carla has been going out with Niko.  
a. in                      b. of                      c. for                      d. since
4. I think that persistence, \_\_\_\_\_ than intelligence, is the key to academic success.  
a. notwithstanding                      b. as well as                      c. foremost                      d. rather
5. It was so embarrassing for her: Jeff suggested she \_\_\_\_\_ a shower once in a while!  
a. takes                      b. take                      c. taking                      d. had taken
6. Key to being good at this job is to recognize \_\_\_\_\_ you need to do and then doing it.  
a. why                      b. when                      c. what                      d. how
7. Is the president the right man to deal with the \_\_\_\_\_ conflict in North Korea?  
a. danger                      b. suddenly                      c. current                      d. engaging
8. If you do not pay me back today, I shall be \_\_\_\_\_ to take legal action!  
a. held                      b. ordered                      c. commanded                      d. forced
9. Joe was \_\_\_\_\_ with himself for letting things get so out of control.  
a. deceived                      b. determined                      c. furious                      d. confused
10. I never know what she'll do next: she is such a \_\_\_\_\_ woman.  
a. capricious                      b. arbitrary                      c. surprise                      d. staid
11. He may be a powerful man, but he does not \_\_\_\_\_ much good breeding.  
a. display                      b. offer                      c. raise                      d. comprise
12. This is just a fast food joint; for real fine dining you'll have to go \_\_\_\_\_.  
a. nowhere                      b. somewhere                      c. elsewhere                      d. anywhere
13. His car may be 23 years old, but he has kept it in \_\_\_\_\_ condition.  
a. meticulous                      b. metallic                      c. meretricious                      d. mint
14. I used to believe his stories, but found out too late how \_\_\_\_\_ he really is.  
a. dubious                      b. mendacious                      c. reputable                      d. docile

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15. Don't get \_\_\_\_! It is just a little cut in your finger!  
a. absurd                      b. abject                      c. heretical                      d. hysterical
16. How would she have reacted, you think, if she \_\_\_\_ me?  
a. was                      b. like                      c. were                      d. is
17. Cheerfulness is one of Jasper's most sympathetic \_\_\_\_\_.  
a. characters                      b. facts                      c. attributes                      d. standards
18. I don't quite trust that insurance salesman: his talk is just a bit too \_\_\_\_\_.  
a. glib                      b. glad                      c. gross                      d. grim
19. The Taiwanese are really getting \_\_\_\_ about the air pollution on the island.  
a. upfront                      b. upright                      c. uptight                      d. upset
20. By \_\_\_\_ slinking up to the mouse, the cat managed to kill the little rodent.  
a. stealthily                      b. secretly                      c. leisurely                      d. carefully
21. She would have been given that film role, \_\_\_\_ she not resisted Harvey Weinstein's sordid advances.  
a. if                      b. because                      c. had                      d. when
22. After hitting the nail with a final hammer blow, \_\_\_\_\_.  
a. the painting brightened John's new apartment wall  
b. John's apartment suddenly looks bright and cheerful  
c. it luckily just missed John's thumb  
d. John put away his tools and happily hung the bright painting on the wall
23. It is supposed to be a very healthy food, but fish still is a bit of \_\_\_\_ taste.  
a. an acquired                      b. an inquiring                      c. a confused                      d. a condoned
24. \_\_\_\_ that picture of that starving polar bear? It was all over the internet.  
a. Have you been seeing                      b. Saw you                      c. Did you see                      d. Did you look
25. So sad to hear of Amy's death: \_\_\_\_ was a life full of heart-break.  
a. her's                      b. her                      c. she                      d. for her

**II. Match verbs with sentences**

*Instructions: for sentences 26–30, determine which verb from the box fits best. No verb should be used more than once.*

a. writhe	b. meander	c. allay	d. coalesce
e. low			

26. To \_\_\_\_ the fears of the freshman students the teacher started with an easy class.
27. Lower back pain made Rudy \_\_\_\_ with pain.
28. The milk, flower, vanilla, and sugar started to \_\_\_\_ into a delicious pudding.

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29. In need of being milked, the cows could be heard to \_\_\_\_ in the stable.

30. Rivers are usually prettiest when they \_\_\_\_.

### III. Match nouns with sentences

Instructions: for sentences 31-35, determine which noun from the box fits best. No noun should be used more than once.

a. bane	b. onus	c. grimace	d. harbinger
e. platitude			

31. I guess the \_\_\_\_ is on you to find out what went wrong in our department.

32. When she tried to walk on her injured leg, a \_\_\_\_ of pain appeared on her face.

33. In impoverished American inner cities, drugs are the \_\_\_\_ of many young people.

34. He claims to "think outside the box": but can someone who uses such a \_\_\_\_ really ever do so?

35. Can that smile on my boss's face this morning be the \_\_\_\_ of a salary raise?

### IV. Match words with words of similar meaning

Instructions: Match the words in the box with the words 36-40 that come closest in meanings. Use each word only once.

a. calling	b. craft	c. abandon	d. gaffe	e. shriek
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36. blunder

37. cunning

38. scream

39. quit

40. occupation

### V. Reading Comprehension

Instructions: Read the following two texts and select the best answer to questions 41-50.

Text 1

Wherever it is widely practiced, polygamy (specifically polygyny, the taking of multiple wives) destabilizes society, largely because it is a form of inequality which creates an urgent distress in the hearts, and loins, of young men. If a rich man has a Lamborghini, that does not mean that a poor man has to walk, for the supply of cars is not fixed. By contrast, every time a rich man takes an extra wife, another poor man must remain single. If the richest and most powerful 10% of men have, say, four wives each, the bottom 30% of men cannot marry. Young men will take desperate measures to avoid this state.

This is one of the reasons why the Arab Spring erupted, why the jihadists of Boko Haram and Islamic State were able to conquer swathes of Nigeria, Iraq and Syria, and why the polygamous parts of

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Indonesia and Haiti are so turbulent. Polygamous societies are bloodier, more likely to invade their neighbors and more prone to collapse than others are. The taking of multiple wives is a feature of life in all of the 20 most unstable countries on the Fragile States Index compiled by the Fund for Peace, an NGO.

(Adapted from *The Economist*, Dec 23<sup>rd</sup> 2017-Jan 5, 2018)

41. The relation between the terms “polygamy” and “polygyny” is:
- a. polygamy can apply to women having multiple husbands; polygyny only to men having multiple wives
  - b. polygyny can apply to women having multiple husbands; polygamy only to men having multiple wives
  - c. polygamy is based on agreement between husband(s) and wife/wives whereas polygyny is the forceful taking of multiple wives
  - d. polygamy destabilizes societies, whereas polygyny does not
42. The inequality caused by polygamy that this text deals with is that
- a. between men and women
  - b. between young men and older men
  - c. between bloodier and more peaceful nations
  - d. between rich men and poor men
43. A Lamborghini is an expensive Italian sports car. The point the article makes with reference to this car is that
- a. poor people cannot afford such expensive cars
  - b. if a rich man has a Lamborghini, he can still give a ride to a poorer man
  - c. for someone to possess a Lamborghini does not mean that others will have to go without a car; but for someone to have multiple wives, others will have to go without wife
  - d. Lamborghinis cannot easily be fixed but, if you are rich this does not mean that you have to walk
44. The relation between polygamy and destabilizing events such as the Arab Spring is that
- a. in order to have many wives, young men invade parts of other countries than their own
  - b. frustrated by their inability to find a wife, many young men resort to violence of all kind to find a wife
  - c. Polygamy leads to turbulence in families with many wives taking desperate measures
  - d. The having of many wives leads to distress in the hearts and loins of young men
45. Polygamy is a feature of
- a. the 20 most fragile states of the world
  - b. the richest and most powerful 10% of countries
  - c. bloody societies, close to collapse
  - d. the bottom 30 % of nations (in terms of wealth and power)

## Text 2

To biologists, fermentation is the anaerobic metabolizing of sugars. It is what the yeast used to make bread, beer, and wine does when it turns carbohydrates into alcohol and carbon dioxide without the benefit of oxygen. But not all fermentation processes are anaerobic. *Tempeh*, a Javanese food made from soya beans inoculated with spores of *Rhizopus*, a parasitic fungus, requires air to circulate if the mold is to grow into a solid cake around the beans. In his book *The Art of Fermentation*, Sandor Katz prefers a broader definition: “the transformation of food by various bacteria, fungi and the enzymes they produce”.

Not all microbial transformations are desirable. Leave a head of cabbage in brine for a week or a month and you will have delicious sauerkraut. Leave it on the kitchen counter for a month and you will have a slimy mess. But the line between fermented and rotten is not always so stark. Sometimes, like beauty, it exists in the beholder’s eye. With the exception of some Nordic types, Westerners tend to be



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repulsed by stinky, fermented fish. But they will happily eat stinky, fermented milk in the form of Gorgonzola or Stilton. Many East and South-East Asians, who consume fish sauce regularly, eschew cheese.

(Adapted from *The Economist*, Dec 23<sup>rd</sup> 2017-Jan 5, 2018)

46. According to this text, with regard to fermentation,
- a. biologist use a narrower definition of this process than Sandor Katz
  - b. one should limit defining it to the anaerobic metabolizing of sugars
  - c. spores of *Rhizopus* are needed to make bread, beer, and wine
  - d. one should do without the benefit of oxygen
47. Tempeh
- a. requires the benefit of oxygen if it is to turn into a solid cake
  - b. is a parasitic fungus
  - c. is the result of anaerobic fermentation
  - d. is used to inoculate soya beans with spores of *Rhizopus*
48. The slimy mess into which cabbage turns if left on the kitchen counter for a month
- a. is not the result of fermentation in the way Sandor Katz defines it
  - b. is an undesirable result of fermentation
  - c. is not fermented in Sandor Katz's sense, but the result of a microbial transformation
  - d. can be turned into delicious sauerkraut if put in brine for a week or a month
49. Whether to call food fermented or rotten
- a. depends on your definition of beauty
  - b. can be subject to dispute
  - c. can be easily determined by how stinky the food is
  - d. is quite clear, except for Nordic types
50. About fish sauce and its East and South East Asians consumers the article says:
- a. it is fermented, like cheese, but whereas Asians love the sauce, they hate the cheese
  - b. unlike cheese, it is not fermented; that is why Asians love it
  - c. it is stinky but Asians still consume it regularly
  - d. it is stinky, but much less so than Gorgonzola or Stilton, and thus Asians can eat it

The End of the MA Entrance Exam

# 國立中山大學 107 學年度碩士暨碩士專班招生考試試題

科目名稱：資料結構【資管系碩士班乙組】

題號：442003

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1. (10%)

Assume that you have a binary search tree with  $n$  elements and a height  $h = O(\log(n))$ . Is it possible to find the  $k$ -th largest element without scanning through all  $n$  elements (assuming  $k < n$ )? If yes, describe an algorithm; if not, provide a counterexample.

2. (10%)

Write a recursive method that changes a given input tree (the data in a node is an integer) so that it becomes the mirror image of the original tree (for example, Fig. 1). Assume you have a node class that has the basic methods implemented: `getLeft()`, `getRight()`, `setLeft()`, `setRight()`, `getValue()`.

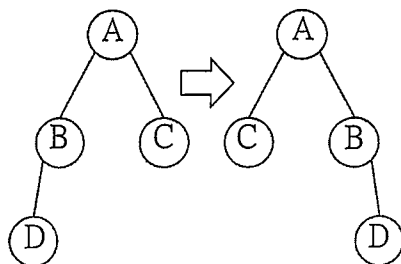


Fig. 1

3. (15%)

Assume that DLL is a doubly linked list with a head node and at least one other internal node  $M$  which is not the last node. Each node has a `next` pointer and a `prev` pointer. Write a few lines of code to manipulate the above two pointers to insert a node  $P$  immediately after the node  $M$ , and then to swap head node and  $M$ . You can draw pictures to justify your code.

4. (15%)

For each of the following situations, give the best sorting algorithm.

- (a) The array is mostly sorted already (only a few elements are in the wrong place). (2%)
- (b) In a large data set, all the data has only one of about 10 values for sorting purposes. (2%)
- (c) You need an  $O(n \log n)$  sort even in the worst case and you cannot use any extra space except for a few local variables. (2%)
- (d) The data to be sorted is too big to fit in memory, so most of it is on disk. (3%)
- (e) You have many data sets to sort separately, and each one has only around 10 elements. (3%)
- (f) Instead of sorting the entire data set, you only need the  $k$  smallest elements where  $k$  is an input to the algorithm but is likely to be much smaller than the size of the entire data set. (3%)

5. (10%)

Suppose you have a table that contains one million records. Three columns are included in the table, name (size: 5B), major (size: 7B) and address (size: 20B). Assume a block size is 4 KB, a block pointer/tree pointer is 6B, and a record pointer is 9B. Consider the following index:

CREATE INDEX Transaction

ON Student (name, major, address);

- (a) Assuming all the nodes are 100% full, how many layers are included in a  $B^+$ -tree? (4%)
  - (b) Assuming all the nodes are 100% full, how many nodes does each layer have? (6%)
- (You must show the calculation steps to defend your answers)

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6. (10%)

Given an array containing the input digits: 52735491

(a) Perform a *merge* sort and show how the order of the digits changes step by step (3%) and provide its complexity (2%).

(b) Perform a *selection* sort and show how the order of the digits changes step by step (3%) and provide its complexity (2%).

7. (5%)

In figure 2,

(a) Start from vertex a and follow the alphabetical order. Perform depth first search and show the order of the visited vertices. (2%)

(b) Show the order of adding the cost of the edges to the minimum spanning tree by using Kruskal' s algorithm. (3%)

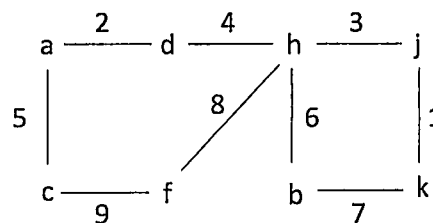


Fig. 2

8. (12%)

Analyze the time complexity for each of the conditions. Please include appropriate explanations to defend your answers:

(a) In binary search tree, find the minimum value and delete it. (4%)

(b) In binary min heap, find the minimum value and delete it. (4%)

(c) The worst case of finding a word in a dictionary that has been categorized into a sorted array (4%)

9. (6%)

Suppose a graph that has  $k$  nodes and its structure is similar to figure 3,

(a) how many edges are included in the graph? (3%)

(b) assuming  $k=4$ , provide an adjacency matrix to represent the graph. (3%)

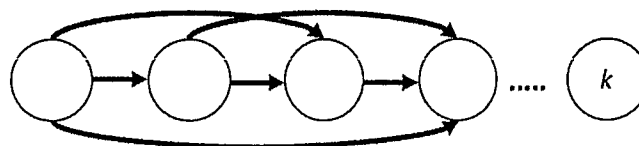


Fig. 3

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10. (7%)

(a) In figure 4, use Dijkstra's algorithm to compute the lowest-cost paths from A to E. (3%)

(b) Does the path generated by the algorithm lead to the lowest cost? If positive, defend your answer; if negative, provide the best path and defend your answer. (4%)

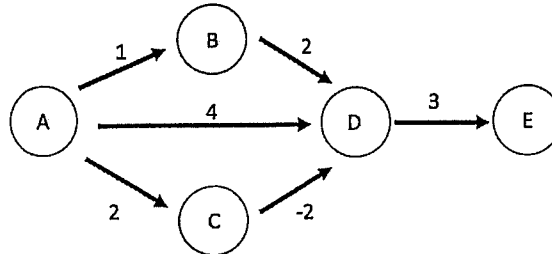


Fig. 4

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1. (25%) 何謂金融科技(Fintech)? 金融科技對銀行及保險業帶來哪些重要的衝擊? 請詳細說明之。
2. (25%) 目前社群網路(Social Network)的普及率極高, 請問企業在社群網路上可以執行哪些商業策略? 如果善用社群網路來行銷其產品可以得到哪些績效? 企業社群網路策略的關鍵成功因素為何?
3. (25%) (1) 何謂「先免費後增值模式」(Freemium)? 何時會遇到這種模式? 試舉例說明之(10%), (2) 在網路經濟體系下, 由於數位服務及網路平台的誕生, 企業競爭法則也促進新的力量, 稱為網路外部性(Network Externalities)或是網路效應(Network Effect), 試解釋說明何謂「網路外部性」? 何時會存在網路外部性?(15%)
4. (25%) (1) 雲端運算有三種服務配置模式, 分別為軟體即服務(Software as a Service)、平台即服務(Platform as a Service)及基礎設施即服務(Infrastructure as a Service), 請舉例說明這三種模式的差異性(15%), (2) 雲端服務龍頭公司亞馬遜及微軟在 2017 年時, 不約而同地提出邊緣運算(Edge Computing)的重要性, 請解釋說明邊緣運算與傳統的雲端運算差別點在哪? 會對目前的雲端運算服務帶來哪些影響呢?(10%)