單選題，每題 4 分

1. The _____ works with one source statement at a time, reading it, translating it to machine-level, executing the resulting binary instructions, and then moving on to the next source statement.
   A. compiler
   B. non-procedural language
   C. interpreter
   D. none of the above

2. The dynamic binding is a mechanism that a function being called is looked up at _____
   A. Compile time
   B. Link time
   C. Load time
   D. Execution time

3. Recursion is memory-intensive because _____.
   A. it must occur numerous times before it terminates
   B. previous function calls are still open when the function calls itself and the arguments of these previous calls still occupy space on the call stack
   C. many copies of the function code are created
   D. it requires large data values

4. The maximum number of comparisons needed for the binary search of a 2000 element array is
   A. 9
   B. 15
   C. 11
   D. 14
   E. 10

5. What is the subnet number of the IP address 140.117.17.224 with the subnet mask 255.255.255.128?
   A. 140.117.0.0
   B. 140.117.17.0
   C. 140.117.17.128
   D. 140.117.17.224
   E. 140.117.17.255

6. The source port identifier tells the destination station _____.
   A. which computer sent the TCP packet.
   B. which application layer process the packet is from.
   C. the IP address of the source computer.
   D. the IP address of the destination computer.

7. The Transmission Control Protocol uses _____ so that the destination station can reassemble the packets into the correct order.
   A. addresses
   B. sequence numbers
   C. port numbers
   D. subnet mask

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8. Which of the following is not a function of the transport layer?
    A. End-to-end delivery of the message
    B. Taking messages from the application layer
    C. Routing
    D. Breaking long messages into smaller packets

9. On average, the quicksort is an algorithm in which of the following classes?
    A. $\Theta(\lg n)$
    B. $\Theta(n)$
    C. $\Theta(n \lg n)$
    D. $\Theta(n^2)$

10. Which of the following is not a step in the process of compiling a program?
    A. Lexical analysis
    B. Parsing the program
    C. Executing the program
    D. Code generation

11. Which of the following is a First In First Out structure?
    A. Array
    B. Stack
    C. Queue
    D. Tree

12. If a program attempts to modify the contents of memory locations that do not belong to it, the operating system's _____ routine intervenes and terminates the program.
    A. reliability
    B. security
    C. processor management
    D. memory protection

13. When a virtual address points to a page that is not in physical memory, a(n) _____ is recognized and a swap-in operation begins.
    A. interrupt
    B. page fault
    C. polling signal
    D. page interrupt

14. _____ occurs when two or more programs each control a resource needed by the other.
    A. Polling
    B. An interrupt
    C. Deadlock
    D. Spooling

15. _____ occurs when the system finds itself spending so much time swapping pages into and out from memory that little time is left for useful work.
    A. Spooling
    B. Thrashing
    C. An interrupt
    D. A polling signal

16. Given the relation X below:

X:	A	B	C
	2	5	7
	3	3	3
	4	4	2
	5	2	8

What value will be retrieved by the following query?

TEMP ← SELECT from X where B = C

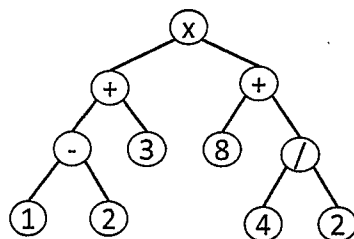RESULT ← PROJECT B from TEMP

A. 2
B. 3
C. 4
D. 5

問答題，每題 6 分

1. Please briefly define the following terms and explain the differences between them. Give examples if you would like.
   a) In-memory Computing vs. In-database Computing
   b) NoSQL databases vs. NewSQL databases

2. Please briefly define the following terms in Functional Programming Languages. Give examples if you would like.
   a) Higher-order functions
   b) Closure

3. What is the output of a post-order traversal of the below tree?

4. Suppose that k is an integer array starting at memory address 5000, $kPtr$ is a pointer to k, and each integer is stored in 8 bytes of memory, what location does $kPtr + 5$ point to?

5. Please write a C function *concat(str1, str2, out)* that concatenates two given strings, *str1* and *str2*, and store the result into the new variable *out*. For example,

   concat("foo", "bar", out);

   will replace the variable out with *"foobar"*. Please DO NOT use any string manipulation functions in C Standard Library.

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6. Consider a relation R(A,B,C,D,E,F) and a set of functional dependencies
   FD = {A->CD, C->BE, B->F, F->A} that hold on R. Please
   a) find at least 2 candidate keys of R.
   b) use Armstrong axioms to show that A ->BF also hold on R.

This examination consists of 50 questions, divided over 5 sections; 2 points for each correct answer.

I. Choose the right alternative

Instructions: Each of the following 30 sentences has a blank; choose the word that fits best.

1. Are cars getting wider every year, or are parking spaces getting ____?
a. fewer　　　　　b. narrower　　　　　c. scarcer　　　　　d. less

2. Sleep ____ her when she worries about her life.
a. escapes　　　　b. deceives　　　　　c. eludes　　　　　d. denies

3. Quite honestly, I do not think ____ of Angelina Jolie as an actress.
a. much　　　　　b. little　　　　　c. few　　　　　d. lot

4. ____ of George Michael's songs do you like best, "Careless Whisper" or "Last Christmas"?
a. Whichever　　　b. What　　　　　c. Which　　　　　d. Either

5. It is a miracle that, ____ such small brains, birds can sing and fly and take care of themselves.
a. through　　　　b. because of　　　　c. within　　　　　d. with

6. They have been married for 29 years, and still have eyes for no one ____ each other.
a. despite　　　　b. accept　　　　　c. but　　　　　d. than

7. How can I ____ my father to understand that I don't want to work in his scrap metal business?
a. make　　　　　b. let　　　　　c. talk to　　　　　d. convince

8. Amy was fired from her job because her superior did not think her work of a ____ level.
a. hilarious　　　　b. elevated　　　　c. considerable　　　d. satisfactory

9. This cold snap will ____ the sale of hats and scarves.
a. geniculate　　　b. initiate　　　　c. stimulate　　　　d. emulate

10. What is the ____ of Taiwan for Japanese tourists?
a. appeal　　　　b. destination　　　　c. reason　　　　d. favorite

11. I wonder sometimes how the handicapped manage to ____ the uneven sidewalks of Kaohsiung.
a. walk　　　　　b. sidestep　　　　c. negotiate　　　　d. direct

12. Margaret ____ drinks in the kitchen when Alice arrived.
a. makes　　　　　b. is making　　　　c. was making　　　　d. has been making

13. Jeremiah says his favorite hobby is sleeping. But can sleeping really be ____ as a hobby?
a. charged　　　　b. memorialized　　　c. criticized　　　　d. characterized

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14. When hungry, ____.
a. this restaurant is the place you want to be!
b. food smells so deliciously
c. your energy just goes downhill
d. one can think of nothing but food

15. Australia and Brazil both ____ affected by severe floods recently.
a. have been　　　　　b. are being　　　　c. were to be　　　　d. could be

16. My cat's name is Sweetie and she really lives ____ that name.
a. like　　　　　　　b. so as　　　　　　c. up to　　　　　　d. following

17. Some people take Pierre for a Frenchman, but, ____, he is Canadian.
a. on the contrary　　b. meanwhile　　　　c. actually　　　　　d. indeed

18. Prof. Lin said she really had enough of my excuses and that she wanted some ____ from me.
a. action　　　　　　b. acting　　　　　　c. acted　　　　　　d. active

19. Carla would not ____ a word about what Charles did to her last night.
a. be telling　　　　b. understand　　　　c. show　　　　　　d. utter

20. I'm sorry to say that I haven't spoken to Jeff since we had that ____.
a. falling out　　　　b. quarreling　　　　c. misdemeanor　　d. going on

21. I forgot to buy eggs, so there aren't ____ in the refrigerator.
a. no eggs　　　　　b. there　　　　　　c. any　　　　　　d. inside

22. Was it President-Elect Trump who placed the call to President Tsai, or ____?
a. otherwise　　　　b. the other way around　　c. neither　　d. elsewhere

23. After his fatal accident, the young father was ____ by his wife and three children.
a. revived　　　　　b. surveyed　　　　　c. survived　　　　d. revitalized

24. Carrefour's vegetables are ____ less fresh than those at the traditional market.
a. remarkably　　　b. markedly　　　　　c. marked　　　　　d. marketed

25. Do animals have an ____ of the future, you think?
a. aspiration　　　　b. illusion　　　　　c. afterthought　　d. awareness

26. Sabrina was nervous at the conference because she was going to present a ____.
a. paper　　　　　　b. presentation　　　c. gift　　　　　　d. article

27. I cannot get over the fact that Jasmine married a man 30 years her ____!
a. elder　　　　　　b. older　　　　　　c. superior　　　　d. senior

28. The fire in our apartment building made me talk to neighbors I would not ____ even have met.
a. otherwise　　　　b. elsewhere　　　　　c. outside　　　　　d. therefore

29. Doctors do not _____ lead the healthiest lives.
a. carefully   b. life-style   c. necessarily   d. knowingly

30. Once the children _____ together for a while, their earlier squabbles were forgotten.
a. played   b. play   c. playing   d. had been playing

II. Match verbs with phrases

Instructions: for phrases 31 –35, determine which verb from the box fits best. Use each verb only once.

a. bewilder	b. interpret	c. collect	d. negotiate	e. forge

31. To _____ samples

32. To _____ a spouse

33. To _____ a curve

34. To _____ a law

35. To _____ a passport

III. Match nouns with phrases

Instructions: for phrases 36-40, determine which noun from the box fits best. Use each noun only once.

a. envy	b. error	c. escape	d. evocation	e. ignorance

36. An _____ of justice

37. An _____ of childhood

38. Impelled by _____

39. A narrow _____

40. An _____ too deep to remedy

IV. Match words with words of similar meaning

Instructions: Match the words in the box with the words 41-45 that come closest in meanings. Use each word only once.

a. compromised	b. acoustic	c. hump	d. sophisticated	e. sound

41. worldly

42. sonic

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43. endangered

44. protuberance

45. healthy

V. Reading Comprehension

Instructions: Read the following texts and select the best answer to questions 46-50.

Management gurus dub them "super-consumers:" they make up only a tenth of customers but they account for 30-70% of sales, an even greater share of profits and almost 100% of "customer insights," says a new book, *Super-Consumers*, written by Eddie Yoon.

These people are not defined simply by the amount of stuff they buy (though they tend to be heavy users), but by their attitude to the product. They regard the things that they consume as answers to powerful emotional needs. Super-consumers exist in every imaginable consumer category, from the glamorous to the staggeringly mundane. There are people who wax lyrical about the serial numbers inside toilet rolls or who worship at the altar of Kraft's Velveeta processed cheese, which they call "liquid gold."

But the most important role of super-consumers is to force companies to focus on their core business. Managers love to immerse themselves in the side-disciplines of business—analyzing big data or re-engineering supply chains. Super-consumers remind them that these are just a means to an end. Executives need to make sure that they often spend time with them—sitting in on product tests, joining chat rooms and hanging out at customer conventions. Video rental company Blockbuster kept its accountants happy but alienated its core customers by charging late fees. Netflix, by contrast, keeps its disciples on board with constant binge-watching fodder.

(Adapted from *The Economist*, Dec. 3, 2016)

46. Super-consumers,
a. are valuable because they make up a tenth of customers
b. are valuable to management gurus because they are heavy users of stuff
c. have a powerful emotional bond with certain products they prefer
d. live in a world of imaginable consumer categories

47. The examples of people waxing lyrical about serial numbers inside toilet rolls and the processed cheese of the Velveeta brand are examples of
a. the interest of super-consumers in glamorous consumer categories
b. the interest of super-consumers in mundane consumer categories
c. the interest of super-consumers in, respectively, glamorous and mundane consumer categories
d. the interest of super-consumers in, respectively, mundane and glamorous consumer categories

48. Managers tend to
a. lose focus on their companies' core business
b. underrate the importance of analyzing big data or re-engineering supply chains
c. waste time joining chat rooms and hanging out at customer conventions
d. consider super-consumers just a means to an end

49. Executives should spend time with super-consumers because
a. super-consumers have powerful emotional needs
b. super-consumers exist in so many consumer categories
c. super-consumers make up the largest section of a company's customers
d. super-consumers offer valuable customer insights

50. The contrast between Blockbuster and Netflix is that
a. Blockbuster kept its accountants happy, while Netflix did not
b. Blockbuster lost its core customers because of late fees, while Netflix did so by offering binge-watching fodder
c. Netflix gives its core customers exactly what they want while Blockbuster did not
d. Netflix caters for its disciples while Blockbuster concentrated on aliens as their core customers

End of the MA entrance Examination

1. (15%) Pokemon GO 這款手機遊戲在去年襲捲全球造成轟動，雖然說與剛推出時的玩家數有相當的差距，但目前有尚有一些人在手機內保有這款遊戲 App。請從遊戲本身的娛樂性、實用性、以及社交性等角度來分析這個現象，說明 (1)為何這個遊戲一開始就能造成轟動(5%)，(2)為何有很大一部份的玩家在三個月內就停止遊玩(5%)，(2)為何有一部份的玩家於三個月後仍持續遊玩(5%)。

2. (20%) 現代人承受相當重的科技壓力，請問科技在工作上會形成哪些型態的壓力？(10%) 由於壓力可能不見得永遠都是壞的，請問一般公司該如何協助它的員工面對不同型態的壓力？(10%)

3. (15%) 何謂 Virtual Reality (VR)、Augmented Reality (AR)、Substitutional Reality (SR)以及 Mixed Reality (MR)？這幾個概念分別為何？彼此的關係又如何？請各舉出一些例子來說明之(15%)。

4. (25%) 請解釋下列這些名詞：(1) e-Business(5%)，(2) B2B2C (5%)，(3) IoT (5%)，(4) O2O (5 %)，(5) C2C (5%)

5. (25%) (1) 請定義供應鏈管理 (5%)，(2) 何謂即時化生產技術 (Just in Time, JIT) (5%)，(3) 何謂冷鏈 (cold chain)？通常冷鏈會用在什麼情形之下？請以一個實例說明之(6%)，(4) 在供應鏈管理研究中，報僮模型 (Newsvendor) 一直都是很熱門的議題，請說明報僮模型 是如何運作(9%)

1. (14%)

(a) How long does it take to determine if an undirected graph contains a vertex that is connected to no other vertex by using the following data structures to represent a graph: (1) an adjacency matrix? (2) an adjacency list. (8%)

(b) Suppose we use Depth-First-Search on a binary search tree, starting from the root. The edge to a left child is always traversed before an edge to the right child. In what traversal order are the nodes visited? Finished? (6%)

2. (8%)

A "connected component" consists of all the vertices reachable from a given vertex, and the edges incident on those vertices. Write an algorithm (pseudocode) based on Depth-First-Search that counts the number of connected components in an undirected graph.

3. (10%)

Write an algorithm (pseudocode) that takes an array containing n distinct integers and calculates the sum of the k ($k <= n$) largest numbers in the array.

4. (8%)

Analyze the time required (time complexity) for the worst-case and the average-case in insertion sort.

5. (10%)

Write a recursive *delete* method for singly-linked lists with integer data that deletes the first occurrence of a given integer i from the list s and returns the resulting list.

6. (15%)

Consider the following C-like function:

```
int functionName(int a[], int b)
{
    if (b == 1) {
        return a[0];
    }
    return a[b-1]*functionName(a, b/2);
}// end of functionName
```

(a) What does the above function do? (5%)

(b) Analyze the time complexity of the above function. (10%)

7. (20%)

Consider the following infix expression:

(X+Y)*(W-Z)

(a) What are the corresponding postfix and prefix expressions? (10%)

(b) Write an algorithm to evaluate a postfix expression. (10%)

8. (15%)

Briefly explain and give an example for each of the following data structures:

(a) a set (3%)

(b) a bag (3%)

(c) a hypergraph (3%)

(d) a bipartite graph (3%)

(e) a hash table (3%)