

注意：考試開始鈴響前，不得翻閱試題，  
並不得書寫、畫記、作答。


國立清華大學 110 學年度碩士班考試入學試題

系所班組別：資訊系統與應用研究所

科目代碼：2401

考試科目：計算機概論

### — 作答注意事項 —

1. 請核對答案卷（卡）上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「 由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「國立清華大學試場規則及違規處理辦法」，無法因本試題封面作答注意事項中未列明而稱未知悉。

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一、單選題，共 26 題，每題 2 分，答錯倒扣 1/5 題分。

1. Which of the following statements is **NOT** true?
  - (a) 3D graphics deals with converting three-dimensional shapes into images.
  - (b) OpenGL is a windows programming APIs for creating 3D graphics applications.
  - (c) A frame buffer represents block a memory for the storage of processed image pixels.
  - (d) Texture mapping is used to enhance the details of object's surface.
  - (e) Reflection and refraction are two common types of light-surface interaction.
2. Suppose the points (1, 0, 0), (1, 1, 1), and (1, 0, 2) are the vertices of a planar patch. Which of the following line segments is **normal** to the surface of the patch?
  - (a) The line segment from (1, 0, 0) to (1, 1, 0)
  - (b) The line segment from (1, 1, 1) to (2, 1, 1)
  - (c) The line segment from (1, 0, 0) to (1, 1, 1)
  - (d) The line segment from (1, 2, 3) to (2, 2, 2)
  - (e) The line segment from (1, 2, 3) to (1, 2, 2)
3. Determine the **tightest** big-O complexity of the recurrence:

$$T(n) = T(n - 1) + 1, \quad T(0) = 0$$

- (a)  $O(1)$
- (b)  $O(n)$
- (c)  $O(n \log n)$
- (d)  $O(n^2)$
- (e)  $O(n^3)$

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4. Determine the **tightest** big-O complexity of the recurrence:

$$T(n) = 2T\left(\frac{n}{2}\right) + n^2, \quad T(1) = 0$$

- (a)  $O(1)$
  - (b)  $O(n)$
  - (c)  $O(n \log n)$
  - (d)  $O(n^2)$
  - (e)  $O(n^3)$
5. Which of the following connection does **NOT** belong to wide area networks?
- (a) WiFi
  - (b) P2P
  - (c) Dial-up
  - (d) Cable
  - (e) WiMax
6. Which of the following term is **NOT** the feature of object-oriented programming?
- (a) Encapsulation.
  - (b) Abstraction.
  - (c) Inheritance.
  - (d) Polymorphism.
  - (e) Modularity.

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7. What is the output of the following program?

```
int a[] = {1,2,3,4};
int *p = a;

*(p++) += 100;
*(++p) += 100;
for( int i = 0; i < 4; i++) printf ("%d", a[i]);
```

- (a) 101 102 3 4
  - (b) 101 2 103 4
  - (c) 1 102 103 4
  - (d) 1 102 3 104
  - (e) 1 2 103 104
8. Which of the following statements is **NOT** true?
- (a) The arithmetic logic unit (ALU) performs logic, shift, and arithmetic operations on data.
  - (b) SRAM and DRAM are two main types of memory in computer system.
  - (c) Cache memory is faster than main memory but slower than the CPU and its registers.
  - (d) SCSI, FireWire, USB, HDMI are common controllers used in computer system.
  - (e) Direct memory access (DMA) allows I/O devices to transfer data between each other without passing the data through CPU.

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9. A computer has 32 MB of memory. How many bits are needed to address any single byte in memory?
- (a) 8 bits.
  - (b) 16 bits.
  - (c) 24 bits.
  - (d) 25 bits.
  - (e) 32 bits.
10. What is **NOT** the necessary condition for deadlock?
- (a) Resource holding.
  - (b) Mutual exclusion.
  - (c) Circular waiting.
  - (d) Starvation.
  - (e) No preemption.
11. Which of the following uses UDP as the transport protocol?
- (a) HTTP.
  - (b) DNS.
  - (c) SMTP.
  - (d) Telnet.
  - (e) None of the above.

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12. What is the child process known as when it completes execution but the parent keeps executing?
- (a) Orphan.
  - (b) Zombie.
  - (c) Body.
  - (d) Dead.
  - (e) None of the above.
13. Which search method takes less memory?
- (a) Depth-First search.
  - (b) Breadth-First search.
  - (c) Linear search.
  - (d) Optimal search.
  - (e) Random search.
14. Which of the following processors has a fixed length of instructions?
- (a) CISC.
  - (b) RISC.
  - (c) EPIC.
  - (d) Multi-core.
  - (e) None of the above.
15. What is the octal equivalent of 1100101.001010 ?
- (a) 624.12
  - (b) 624.21
  - (c) 154.12
  - (d) 154.21
  - (e) 145.12
16. A particular system that contains intelligent agents is called \_\_\_\_.
- (a) AI system.
  - (b) AI Ecosystem.
  - (c) Agency.
  - (d) Autonomous system.
  - (e) None of the above.

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17. What is the minimum number of states required to recognize an octal number divisible by 3?

- (a) 1
- (b) 2
- (c) 3
- (d) 5
- (e) 7

18. Please sort the following functions in descending order of their growth rate.

w)  $\log(n!)$  x)  $1001^{\log(n)}$  y)  $(n-10)!$  z)  $n \cdot 2^n$

- (a)  $y > z > x > w$
- (b)  $z > y > w > x$
- (c)  $z > y > x > w$
- (d)  $y > z > w > x$
- (e)  $x > y > z > w$

19. Let A, B, C, and D be numbers. Given a postfix expression:

$AB+CA-*D+ABC+/-$

What is the corresponding infix expression?

- (a)  $((A+B)*(C-A)+D)/(A-(B+C))$
- (b)  $((A+B*C)-A+D)/(A-(B+C))$
- (c)  $((A+B)*(C-A))/((D+A)-(B+C))$
- (d)  $(A*(B+C)-A)+(D+A-B)/C$
- (e)  $A*(B-(C+A))+D+A-B/C$

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20. The ANSI/SPARC has established a three-level architecture for a DBMS: conceptual, external, and internal. Which of the following is true?
- (a) The conceptual level defines the low-level access methods and how bytes are transferred.
  - (b) The conceptual level interacts directly with the users.
  - (c) The internal level determines where data is actually stored on the storage devices.
  - (d) The external level interacts directly with the hardware. The data model is defined on this level, and the main functions of the DBMS are also on this level.
  - (e) The external level is an intermediary and frees users from dealing with the internal level.
21. For security attacks, which of the following is NOT true.
- (a) Replaying attack includes several strategies to slow down or totally interrupt the service of the system.
  - (b) Snooping attack refers to unauthorized access to or interception of data. An unauthorized entity may intercept the transmission and use the contents for their own benefit.
  - (c) Masquerading (spoofing) attack happens when the attacker impersonates somebody else.
  - (d) Modification attack modifies the information to make it beneficial to the attackers.
  - (e) Repudiation attack is performed by one of the sender or the receiver to deny that the message has been sent or received.



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\*請在【答案卡】作答

22. For the following function foo, which statement is true?

```
int foo(int n)
    if (n<=1) return 1;
    else return n*foo(n-1);
```

- (a) If  $n > 1$ , the returned value of function foo must be even.
  - (b) The time complexity of function foo is  $\Theta(n^2)$ .
  - (c) For any integer  $n \geq 1$ , function foo calculates the value of  $\sum_{i=1}^n i$ .
  - (d) The value returned by foo(2.8) is 3.
  - (e) All the above statements are true.
23. We sequentially insert the following numbers: 19, 4, 26, 2, 13, 25 into an initially empty binary search tree. What is the preorder traversal sequence of the resulting tree?
- (a) 2, 4, 13, 19, 25, 26
  - (b) 19, 4, 2, 13, 26, 25
  - (c) 19, 4, 2, 26, 13, 25
  - (d) 2, 13, 4, 25, 26, 19
  - (e) 19, 4, 26, 2, 3, 2
24. For sorting  $n$  integers, which of the following statements is true?
- (a) Both quick sort and merge sort have  $O(n \log n)$  worst-case time complexity.
  - (b) Both quick sort and merge sort are stable sorting algorithms.
  - (c) Both quick sort and merge sort do not need extra space.
  - (d) Heap sort achieves  $O(n \log n)$  average-case time complexity.
  - (e) Heap sort needs extra space during sorting.

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\*請在【答案卡】作答

25. Which of the following statements is **NOT** true?

- (a) If a problem is NP-complete, then there exists no polynomial-time algorithm for it.
- (b) If a problem is NP-complete, then it is also NP-hard.
- (c) The halting problem is not solvable by a computer.
- (d) For random access, an array is more efficient than a linked list.
- (e) A heap is always a complete tree.

26. Consider the AVL tree resulting from sequentially inserting the following numbers into an empty AVL tree: 40, 60, 55, 15, 20, 2, 25, 30. What is the sum of the numbers in the leaf nodes in the AVL tree?

- (a) 90
- (b) 130
- (c) 155
- (d) 160
- (e) 170

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二、多選題，共 16 題，每題 3 分。每題至少有一個選項為正確。所有選項均答對，得該題分數；答錯一個選項得 3/5 題分；答錯兩個選項得 1/5 題分；答錯多於兩個選項或未作答得 0 分。

27. Which are fundamental steps for producing an image using 3D graphics?

- (a) Modeling.
- (b) Animating.
- (c) Rendering.
- (d) Displaying.
- (e) Supersampling.

28. Which of the following light types belong(s) to reflected light?

- (a) Ambient light.
- (b) Spot light.
- (c) Diffuse light.
- (d) Refraction light.
- (e) Specular light.

29. Which of the following terms belong(s) to TCP/IP protocol layers?

- (a) Physical.
- (b) Data link.
- (c) Network.
- (d) Transport.
- (e) Application.

30. Which of the following programming languages is/are object-oriented paradigm?

- (a) Smalltalk
- (b) C++
- (c) C#
- (d) Java
- (e) Pascal

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31. What kinds of buses are used to connect CPU and memory?
- (a) Data bus
  - (b) Address bus
  - (c) Control bus
  - (d) Video bus
  - (e) Instruction bus
32. In which of the following situations do an overflow never occur?
- (a) Adding two positive integers.
  - (b) Adding one positive integer to a negative integer.
  - (c) Subtracting one positive integer from a negative integer.
  - (d) Subtracting two negative integers.
  - (e) All of the above situations.
33. Which of the following methods are used in black-box testing?
- (a) Exhaustive testing.
  - (b) Condition testing.
  - (c) Random testing.
  - (d) Loop testing.
  - (e) Boundary-value testing.
34. Which of the character encoding results are **NOT** true based on Huffman coding with the given frequency: T(12), U(8), V(9), W(20), X(31), Y(14), Z(8)?
- (a) T: 000.
  - (b) U: 11
  - (c) V: 1110
  - (d) X: 011
  - (e) Y: 01.

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35. Which of the following compression methods are lossy?
- (a) Huffman coding.
  - (b) Lempel Ziv encoding.
  - (c) JPEG.
  - (d) Run-length encoding.
  - (e) MP3.
36. Which of the following statements are true?
- (a) Depth-first search is identical to the closed list in Graph search.
  - (b) Alpha-beta pruning is used to calculate the feasibility of whole game tree.
  - (c) Alpha-beta pruning can be applied to trees of any depth and it is possible to prune entire subtree rather than leaves.
  - (d) The minimax search is depth-first search, and therefore at one time we just have to consider the nodes along a single path in the tree.
  - (e) The minimax decision is dependent on the pruned values.
37. Which of the following statements are true?
- (a) State-space search is the most straightforward approach for planning algorithm.
  - (b) Forward state-space search is also called as regression planning.
  - (c) The complexity of minimax algorithm is the same as BFS.
  - (d) Hill climbing search is also called optimal local search because it grabs a good neighbor state without thinking ahead about where to go next.
  - (e) Average of path cost from start node to current node is utilized as the evaluation function in A\* approach.

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38. Trees and graphs are fundamental data structures. Which of the following statements are true?
- (a) A weighted graph may have multiple minimum spanning trees of the same cost.
  - (b) For two nodes in a graph, there may exist multiple shortest paths of the same length linking the two nodes.
  - (c) For two nodes in a tree, there may exist multiple shortest paths of the same length linking the two nodes.
  - (d) For a graph with  $n$  nodes and  $m$  edges, its minimum spanning tree has at least  $(n-1)$  edges.
  - (e) For a tree with  $n$  nodes and  $m$  edges,  $n+m < 2n$  must hold.
39. Binary search tree (BST) stores keys in its nodes. Which of the following statements are true?
- (a) For a binary search tree with  $n$  nodes, searching a key in BST takes  $O(\log n)$  time in worst case.
  - (b) A binary search tree of height  $h$  has at most  $2^{h-1}$  nodes.
  - (c) Performing an inorder traversal on a binary search tree results in a sorted list of keys in ascending order.
  - (d) AVL trees are also binary search trees.
  - (e) Given the preorder and inorder traversal sequences of a BST, we can reconstruct a unique BST.
40. Which of the following statements is **NOT** true?
- (a) Dijkstra algorithm cannot correctly calculate the shortest paths if there exist negative edge weights in the graph.
  - (b) Bellman-Ford algorithm can detect negative cycles in a graph.
  - (c) Given an unweighted graph with a node  $v$ , employing Breadth-First Search (BFS) starting on  $v$  obtains the single-source shortest paths with source node  $v$ .
  - (d) Floyd-Warshall algorithm for finding all-pair shortest paths works for graph with negative edge weights (but with no negative cycles).
  - (e) The worst-case time and space complexities of the Floyd-Warshall algorithm are both  $\Theta(n^3)$ .

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41. Which of the following statements are true?
- (a) A heap is always a complete binary tree.
  - (b) Doubly linked list is suitable for random access.
  - (c) A sparse matrix has many zero elements.
  - (d) Given a max heap with  $n$  nodes. A Push operation takes  $O(\log n)$  time, and a Pop operation takes  $O(1)$  time.
  - (e) A binary tree's postorder and inorder traversal sequences are different.
42. Which of the following statements are true?
- (a) SQL (Structured Query Language) is used to perform operations such as search, insert, and delete on advanced data structures for setting up Turing tests.
  - (b) A genetic algorithm discovers a solution through an evolutionary process involving many generations of trial solutions.
  - (c) In data mining, cluster analysis tries to find properties of data items with the computation power provided by cluster computing.
  - (d) Hashing can be used as authenticating messages transferred over the Internet, such as MD5.
  - (e) The Standard Template Library (STL) in the C++ programming environment contains a collection of predefined classes for machine learning tasks, such as Support Vector Machines.