

選擇題(單選) 30題，每題2分，共60分，請在每題的選項內選擇最適當的答案。

注意：答錯倒扣1分，扣至零分為止。(不答不倒扣)

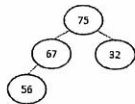
※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

1. Which is the firmware that contains instructions for starting up a computer?
(A) FLOPS (B) BIOS (C) CMOS (D) MIPS (E) DOS
2. A printer's resolution is measured in _____.
(A) pixels per inch (ppi) (B) dots per inch (dpi) (C) bits per inch (bpi) (D) pages per minute (ppm)
(E) characters per inch (cpi)
3. Multitasking on a single-CPU system is achieved primarily via a technique called _____.
(A) virtual memory (B) pipelining (C) micro kernel (D) time sharing (E) code splitting.
4. In object-oriented programming, the capability of being able to assign different meanings or usages to a method in different contexts is called _____.
(A) abstraction (B) polymorphism (C) inheritance (D) protection (E) encapsulation
5. One advantage of object-oriented programming is *code reusability*. Which of the following features in an object-oriented language primarily supports this?
(A) abstraction (B) polymorphism (C) inheritance (D) protection (E) encapsulation
6. Which is the type of bar chart that is very popular for illustrating a project's schedule?
(A) Pi chart (B) Gantt chart (C) flow chart (D) PERT chart (E) decision tree
7. Which of the following types of databases is more suitable for handling multimedia contents than the others?
(A) relational (B) transitional (C) multidimensional (D) network (E) object-oriented
8. Which of the following statements about XML is incorrect?
(A) It is a markup language.
(B) Users may define their own tags.
(C) It is a textual data format.
(D) It is a replacement for HTML.
(E) It does not concern the presentation style.
9. Which of the following is designed to replace `telnet` and `rlogin` for a secure login to a remote computer and for subsequent communications?
(A) HTTP (B) SSL (C) RSH (D) HTTPS (E) SSH
10. Which of the following cryptographic algorithms is commonly used for encryption in the public key infrastructure?
(A) RSA (B) DES (C) AES (D) MD5 (E) SHA-1
11. A(n) _____ is a construct that can be defined to store a collection of data.
(A) data structure (B) function pointer (C) abstract data type (D) method (E) operation contract
12. The specifications of an ADT's operations indicate _____.
(A) what the operations do (B) how to implement the operations (C) how to store the data in the ADT
(D) how to carry out the operations (E) none of the above
13. _____ is the ability of a class to derive properties from a previously defined class.
(A) Encapsulation (B) Inheritance (C) Polymorphism (D) Information hiding (E) Modularization

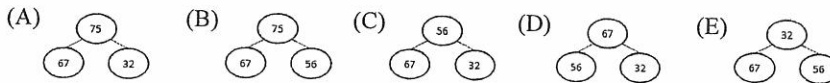
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14. After execution of the following C++ statements, what value does the variable `q` contain?
- ```
int *p = new int;
int *q = p;
*q = 10;
delete p;
p = NULL;
```
- (A) the address of `p` (B) the address of the deallocated memory cell (C) the value `NULL` (D) the value 10 (E) none of the above
15. Which of the following is NOT a valid prefix expression?
- (A) `--ab+cd` (B) `/a+bc` (C) `***abcd` (D) `*-abcd` (E) `-*+abcd`.
16. Which of the following C++ statements inserts a new node, pointed to by `newPtr`, into an empty queue represented by a linear linked list?
- (A) `newPtr->next = backPtr;`  
 (B) `backPtr->next = newPtr; frontPtr = newPtr;`  
 (C) `newPtr->next = backPtr; newPtr->next = frontPtr;`  
 (D) `frontPtr = newPtr; backPtr = newPtr;`  
 (E) `frontPtr = newPtr; backPtr = NULL;`
17. Which of the following is NOT a property of a complete binary tree of height  $h$ ?
- (A) All nodes at level  $h-2$  and above have two children each.  
 (B) When a node at level  $h-1$  has children, all nodes to its left at the same level have two children each.  
 (C) When a node at level  $h-1$  has one child, it is a left child.  
 (D) All leaves are at level  $h$ .  
 (E) None of the above.
18. Locating a particular item in a binary search tree of  $n$  nodes requires at most \_\_\_\_\_ comparisons.
- (A)  $n$  (B)  $n/2$  (C)  $(n/2) - 2$  (D)  $\lceil \log_2(n+1) \rceil$  (E)  $n \log_2 n$
19. A heap is a \_\_\_\_\_.
- (A) general tree (B) binary search tree (C) full binary tree (D) complete binary tree (E) hash table
20. A \_\_\_\_\_ has an edge between each pair of distinct vertices.
- (A) complete graph (B) disconnected graph (C) bipartite graph (D) directed graph (E) multigraph
21. The \_\_\_\_\_ of a process contains temporary data such as function parameters, return addresses, and local variables.
- (A) text section (B) data section (C) program counter (D) stack (E) heap
22. Which is the missing condition in the following algorithm?
- ```
emptyQueue() // return true if empty, false if queue has data
  if (_____ )
    return true
  else
    return false
end emptyQueue
```
- (A) `head` does not equal `rear`
 (B) `head->next` is `NULL`
 (C) `head` equal `rear`
 (D) `rear` is `NULL`
 (E) `rear->next` is `NULL`

23. Consider the following heap:



What would be the heap obtained after a delete operation?



24. What is the major benefit of using an adjacency matrix to store the vertices and edges of a graph?
- (A) It finds all vertices adjacent to a given vertex efficiently.
 (B) It determines whether there is an edge from vertex i to vertex j efficiently.
 (C) The number of vertices is not fixed in advance.
 (D) It requires less memory space than an adjacency list implementation when the graph is sparse.
 (E) None of the above.
25. A linked list is a good structure for a list because
- (A) it does not use much memory space.
 (B) it is fast to traverse.
 (C) its implementation can be easily translated into machine code.
 (D) data are easily inserted and deleted anywhere in the list.
 (E) none of the above.
26. An algorithm is analyzed to be at most $O(n^2)$ -time. Which of the following functions cannot possibly be the actual running time?
- (A) $2^{\log n}$ (B) $n^{2.1}$ (C) $1000n^2$ (D) $2n^{1.9}$ (E) $n \log n$
27. Which of the following sorting algorithms is in-place and $O(n \log n)$ -time in the worst case?
- (A) Quicksort (B) Heapsort (C) Insertion Sort (D) Bubble Sort (E) Radix Sort
28. Which of the following statements about (undirected) graphs and trees is incorrect?
- (A) A tree is a connected graph without cycles.
 (B) A spanning tree of a graph G is a maximal subgraph of G without cycles.
 (C) Every graph has at least two distinct spanning trees.
 (D) A tree of n vertices has exactly $n - 1$ edges.
 (E) A connected graph with n vertices and $n - 1$ edges must be a tree.
29. An undirected graph is _____ if the removal of an arbitrary vertex and all the edges incident to it does not break the graph into disconnected components.
- (A) connected (B) biconnected (C) strongly connected (D) regularly connected (E) tightly connected
30. NP is an important class of algorithmic decision problems. Which of the following pairs of words best represent the term NP?
- (A) Not/Precise (B) Nondeterministic/Precise (C) Nondeterministic/Polynomial (D) Not/Polynomial (E) Not/Polymorphic

問答題 2 題，每題 20 分，共 40 分。
請在答案卷內依序作答，否則不予以計分。

1. Let $h_1(\text{key}) = \text{key} \% \text{HashTableSize}$ and $h_2(\text{key}) = 7 - (\text{key} \% 7)$ be the hash functions of **double hashing**. h_1 determines the starting location of a search key and h_2 calculates probe steps when collisions occur. Implement the following ADT hash operation `tableDelete` in the C++ programming language, assuming that users never insert duplicated keys into the hash table.

```
const int HashTableSize = 11; // the maximum size of hash table

struct HashTableEntry
{
    int status; // the status of a table entry, and is 0, 1, and -1 when
                // the entry is empty, occupied, and deleted, respectively.
    int key;
};

class Hash
{
    Hash::Hash() { NumItems = 0;
                  for(int i=0; i<HashTableSize; i++) table[i].status = 0; }
public:
    bool tableDelete(int key); // If the deletion is successful, returns
                               // true; otherwise returns false.
    ...
private:
    int NumItems; // the number of items in the hash table
    HashTableEntry table[MAXHASH];
};

bool Hash::tableDelete(int key)
{
    ...
}
```

2. The celebrated Floyd's algorithm for computing the lengths of the shortest paths for all pairs of vertices in a weighted undirected graph is an application of the *dynamic programming* design method. Dynamic programming typically starts by defining a set of recurrence relations characterizing the solutions, which are then converted to a real algorithm. Please define as precisely as possible a suitable set of recurrence relations that would lead to Floyd's algorithm. Note that you are required to give the recurrence relations, not the algorithm/code. (Hint: assuming the vertices are numbered 1, 2, 3, ..., consider the paths between an arbitrary pair of vertices that go via vertices numbered at most 0, i.e., via no other vertex, those going via vertices numbered at most 1, those going via vertices numbered at most 2, those going via vertices numbered at most 3, and so on. Let $L(i,j,k)$ denote the length of the shortest path between a pair of vertices i and j that goes via vertices numbered at most k . Develop the recurrence relations around L .)