13. ________________ is an algorithmic approach that breaks a problem into several sub-problems that are similar to the original problem but smaller in size, solves the sub-problem recursively, and then combines these solutions to create a solution to the original problem.

14. All kinds of sorting algorithms that are based on comparisons between the \( N \) elements to be sorted must be completed at least ________ time.

15. A well known protocol that is used by mail servers to transfer e-mail is called ________.

三、問答題

1. List the components of a typical operating system and summarize the role of each in a single phrase (8%).

2. What is the difference between a traditional database and a knowledge base for an expert system (6%)?

3. Draw a binary search tree structure you can use to store the list U, R, S, W, T, V, Y, X, and Z for future searching. Explain how you create this binary search tree (6%).

4. Show how to sort \( n \) integers in the range 0 to \( n^2 - 1 \) in \( O(n) \) time (10%).

5. Solve the recurrence \( T(n) = 4T(n/2) + n \) using the recursion tree method (10%).
Caching is the strategy that holds output for a device that cannot accept interleaved data stream.

14. What's the two's complement form of \(-17\) using patterns of eight bits: (A) 11101111 (B) 11101110 (C) 00010001 (D) 11001111

15. Which of the following is not a part of the machine cycle: (A) Fetch (B) Encode (C) Decode (D) Execute

二、填充題（每題 2 分）

1. The amount of space between dots on a screen is called ______________

2. If a read/write head touches a hard disk surface, this is called ______________

3. A network in which all computers have equal status and share resources is called ______________

4. A set of facts and a set of rules about those facts is called ______________

5. An ______________ is a decision support system for senior-level executives, who make decisions that affect an entire company.

6. The kind of software that allocates people and resources, monitors schedules, and produces status reports is called ______________

7. An operating system feature that automatically configures new hardware is called ______________

8. The objective orientation property that permits a subclass to retain the characteristics of a higher class is called ______________

9. What is the name of the kind of analysis that lets a user change spreadsheet values and then observe the resulting effect? ______________

10. A system of safeguards to protect a computer system and data from damage or unauthorized access is called ______________

11. If a system uses only one byte of storage to store floating-point numbers. The high-order bit of the byte is the sign bit, the three bits following the sign bit are the exponent field, and the remaining four bits are the mantissa field. Moreover, the exponent field is interpreted as an integer stored using the three-bit excessive. Encode \(-3.5\) into the abovementioned floating-point format: ______________

12. The register that contains the address of the next instruction to be executed is called ______________
一、選擇題(每題2分，答錯倒扣0.5分，若無正確選項，請答以上皆非)
1. Data and instructions are put into primary storage by (A) memory (B)
   secondary storage (C) the control unit (D) the ALU
2. A screen that is lighter and slimmer than a CRT is a(n) (A) OCR (B)
   graphics card (C) flat panel (D) terminal
3. Several small disk packs that work together as a unit is called (A) CD-ROM
   (B) RAID (C) WORM (D) MO
4. Hashing, to get an address, is the process of applying a formula to a (A) key
   (B) file (C) record (D) character
5. Assigning more sectors to outer disk tracks is called (A) zone recording (B)
   data transfer (C) randomizing (D) sectoring
6. The physical layout of a LAN is called (A) link (B) switch (C) topology
   (D) contention
7. The scope and true nature of a problem is determined during (A) systems
   design (B) systems development (C) preliminary investigation (D) systems analysis
8. A plan to trace data to its source is called (A) an audit trail (B) typing (C) a
   structure (D) volume testing
9. Management of an operating system is handled by (A) an interpreter (B)
   utility programs (C) the supervisor program (D) the CPU
10. The time between the user’s request and the computer’s reply is called (A)
    concurrent time (B) allocation time (C) response time (D) event time
11. Consider the following page-reference strings: 1, 2, 3, 4, 7, 1, 4, 5, 3, 7, 5, 2,
    3. Suppose that X page faults would occur for the least-recently used (LRU)
    algorithm with 3 frames. Remember that all frames are initially empty, so your
    first unique pages will all cost one fault each. What is X mod 4? (A) 0 (B) 1
    (C) 2 (D) 3
12. Assume a page size of 8K bytes and that a page table entry takes 4 bytes, how
    many levels of page tables would be required to map 64-bit address space if
    the top-level page table fit into a single page? (A) 3 (B) 4 (C) 5 (D) 6
13. Which of the following statements about the I/O system are incorrect?
    (1) Data striping provides high data transfer rate and improves reliability as well.
    (2) DMA is good for transferring a large amount of data from/to a disk.
    (3) Swap space cannot be managed by the normal file system.