

1. (20 points) For each of the following statements, please indicate TRUE or FALSE and briefly explain your reason. (2 points each, you must give your reason to get the points.)
- (1-a) The syntax rules of C++ programming language can be described by a context-free grammar.
  - (1-b) There is ambiguity in the syntax of Java programming language.
  - (1-c) Hardware support is required for the implementation of dynamic linking.
  - (1-d) The input of a linker can only be compiled programs.
  - (1-e) A B-tree of order  $M$  is a height-balanced binary search tree
  - (1-f) Macro in an assembly language is exactly the same as the in-line function in C++ programming language.
  - (1-g) Given two different LL(1) grammars  $G_1$  and  $G_2$ , it can be shown that whether  $G_1$  and  $G_2$  generate the same language.
  - (1-h)  $3 \cdot \Omega(2n \cdot \sin(n^2)) = O(n)$ .
  - (1-i) For searching, when there are duplicate keys, binary search is a search algorithm better than searching with hashing.
  - (1-j) The worst-case time complexity of radix sort for  $n$  data objects is  $O(n)$ .
2. (20 points) For each of the following language constructs or data structures, please describe briefly how it might be used in the implementation of a compiler:  
Example: (2-x) *char* in C language  
**Answer:** hold the character of source program being processed  
 (2 points each)
- (2-a) Binary tree
  - (2-b) *enum* in C language
  - (2-c) File
  - (2-d) Graph
  - (2-e) Linked list
  - (2-f) Queue
  - (2-g) Sparse matrix
  - (2-h) Stack
  - (2-i) *struct* in C language
  - (2-j) *union* in C language
3. (10 points) Explain the following terms: (2 points each)
- (3-a) YACC
  - (3-b) AVL tree
  - (3-c) Heap sort
  - (3-d) Shift-reduce conflict
  - (3-e) DFA

(背面仍有題目,請繼續作答)

4. (10 points) System performance.
- A timesharing system has 10 jobs that are running concurrently and the time slice is 50 milliseconds. If the average job performs I/O every 30 milliseconds and the I/O takes 13 milliseconds to complete, what is the average processor utilization?
  - A batch system can read 100 cards a minute and print 100 lines a minute. The average batch job needs 250 milliseconds in running time and prints 50 lines for output. The average number of cards for a batch job is 200. The card reader input tray is 2 feet long and a card is  $1/50^{\text{th}}$  of an inch thick! How often on average should the operator have to fill up the card reader?  
Note: 1 foot = 12 inches.
5. (10 points) A high performance computer is used to run CPU intensive jobs. Somehow, the throughput is low; the CPU is often idle, but the disk is always busy. What do you think is the reason for the low throughput?
6. (5 points) A computer has six tape drives, with  $n$  processes competing for them. Each process needs at most two drives. For what values of  $n$  is the system deadlock free?
7. (15 points) A system has three kinds of jobs: CPU bound jobs that compute for a long time, Disk I/O bound jobs that read and write data files on a disk, and VDU I/O bound jobs that interactive with the user.
- Discuss the implementations of the
    - long term scheduler,
    - medium term scheduler, and
    - short term schedulerfor such a system.
  - If CPU bound jobs arrive at 1 every 10 minutes, Disk bound jobs arrive at 1 every 2 minutes, and Interactive I/O bound jobs arrive at 1 every minute, given that the average time in the system for each job is 2.5 minutes, what is the service rate?
8. (10 points) Consider a computer system in which the holes in memory are (in order) 10K, 4K, 20K, and 18K. After servicing requests of 12K, 10K, and 9K, what is the largest hole in the system for (a) best-fit, (b) worst-fit, and (c) first-fit?