

考試科目	計算機概論	所別	資訊科學系乙組 ⁹³²	考試時間	4月20日上午第1節 星期日
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- A. Show all details for non-trivial questions to receive partial credit, in case your answer is wrong.
B. You do not have to write everything in English.

1.	(20%, 1% for each problem) True, False, or select a number.
()	(a) The key to measuring the efficiency of an algorithm is to find out how long it takes to run on a specific machine.
()	(b) The largest integer can be represented by 8 bits using unsigned integer is 256.
()	(c) The binary search algorithm is a good algorithm for searching an unordered list.
()	(d) NOT [(x<y) OR NOT (x<z)] (assume that x=1,y=2,z=3)
()	(e) All the logic circuits can be realized using only AND, OR, and NOT gates.
()	(f) RAM is divided into cells of different size, in general.
()	(g) Access to the beginning of a RAM takes less time than access to the end of a RAM.
()	(h) The sizes of MAR and the size of MDR are the same, in general.
()	(i) The data store on a disk or on a tape both needs an address mechanism for data retrieval.
()	(j) Which of the following tasks the computers will have better performance than human: (1) computation, (2) recognition, (3) reasoning, (4) learning, (5) none of the above tasks?
()	(k) Which of the following functions is handled by operating system? (1) language translation, (2) memory management, (3) file system management, (4) scheduling, (5) all of the above functions.
()	(l) One can fetch or store part of a memory cell.
()	(m) Direct access to an I/O device is much faster than random access to a memory location.
()	(n) Memory fetch and store both will destroy the content in the memory.
()	(o) The task of the linker is to read instructions from the object file and store them into memory for execution..
()	(p) FORTRAN does not have iteration mechanism.
()	(q) Binding is the process of associating a symbolic name with a memory address.
()	(r) WAN generally uses Ethernet protocol.
()	(s) Compare to T1, modem is a high speed device used in computer network connections.
()	(t) Neural networks can be used to simulate the connectionist architecture of the human brain.

備 考 試 題 隨 卷 繳 交

命 題 委 員 :

-64-

(簽章) 92年4月7日

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2. (10%)	Write (in the table provided) the worst-case and the average-case time complexity of the following algorithms on n input elements. (For Radix sort, each element has at most d -digits.)		
		Worst-case time complexity	Average-case time complexity
	(a) Sequential search		
	(b) Binary search		
	(c) Merge sort		
	(d) Quicksort		
	(e) Radix sort		

3. (10%)	(a) (6%) The concept of divide and conquer can be used in designing algorithms. Explain the three phases of the divide and conquer process.
	(b) The recurrence equation, as described below, can be used to analyze the complexity of divide and conquer method. $T(n) = aT(n/b) + f(n)$ Explain the following: (1) (2%) the role of the function $f(n)$, and (2) (2%) the restriction on b , and, why we need such a restriction.

4. (10%)	The algorithm for insertion sort is given below
	<pre> 1 for $j \leftarrow 2$ to length[A] 2 do $key \leftarrow A[j]$ 3 *Insert $A[j]$ into the sorted sequence $A[1..j-1]$ 4 $i \leftarrow j-1$ 5 while $i > 0$ and $A[i] > key$ 6 do $A[i+1] \leftarrow A[i]$ 7 $i \leftarrow i-1$ 8 $A[i+1] \leftarrow key$ </pre> <p>The running time of the above algorithm can be described by the following equation: $T(n) = c_1n + c_2(n-1) + c_4(n-1) + c_5 \sum_{j=2}^n t_j + c_6 \sum_{j=2}^n (t_j - 1) + c_7 \sum_{j=2}^n (t_j - 1) + c_8(n-1)$ where n is the input size, c_i is the steps required for the i^{th} statement, and t_j is the number of times the while loop test in line 5 is executed for that value of j.</p> <p>Using this equation, explain</p> <p>(a) (3%) the best-case, (b) (4%) the worst-case, and (c) (3%) the average-case running time of the insertion sort.</p>

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5. (a) (2%) What shall an OS do in order to initiate the execution of a program?
(4%) (b) (2%) Which program of the OS will do this process, in general?
6. (3% each) Explain the following four terms that are used in compiler or programming
(12%) language design: (1) BNF, (2) grammar, (3) language, and (4) semantic record.
7. If a RAM is using a 24-bit address mechanism, answer the following:
(6%) (a) (2%) What is the maximal possible memory size of it? (using the unit K, M or G)
(b) (2%) What are the input and output size of the memory address decoder if it is a one-dimensional memory?
(c) (2%) What are the input and output size of the memory address decoder if it is a two-dimensional memory?
8. The XOR (exclusive OR) takes 2 binary inputs (X and Y) and produces 1 binary output
(10%) (O). The output goes ON only when the two inputs are different.
(a) (4%) Construct the truth table of a XOR.
(b) (3%) Write the Boolean expression for its output O.
(c) (3%) Draw a simple circuit for this Boolean expression using only AND, OR, and NOT gates.
9. The single-precision floating point number is represented in the following format:
(8%)
- | | | |
|------|--------|----------|
| 1bit | 8 bits | 23 bits |
| s | exp | mantissa |
- The 8-bit exponent is represented using excess 127 mechanism so that the bit pattern represents:
- $$(-1)^s \times 2^{\text{exp}-127} \times 0.\text{mantissa}_2 \text{ (i.e. } 0.\text{mantissa} < 1)$$
- Using this representation, convert the following binary number to decimal number:
- 11000000111010000000000000000000
- (a) (5%) Using exactly the above definition.
(b) (3%) Using a similar format such that the exponent part has 9 bits (with excess 255 mechanism) and mantissa part has 22 bits.

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10. (10%)	Answer only one of the following three subproblems (only one from (a), (b), or (c))
	(a) (1) (4%) What is "deadlock"?
	(2) (6%) Give a deadlock recovery algorithm (in communication) and a deadlock prevention algorithm (in resource sharing). (3% each)
	or
	(b) (1) (2%) What is the function of the routing table used in computer networks.
	(2) (3%) Explain how does the Ethernet protocol work?
	(3) (3%) What will you do in case of a collision in implementing the Ethernet protocol?
	(4) (2%) Explain the differences between packet-switching and circuit-switching.
	or
	(c) (1) (4%) What is the Turing test?
	(2) (3%) The information retrieved on the internet usually contains irrelevant answers, suggests some mechanism that could improve this situation.
	(3) (3%) Best-first search is widely used in various applications, describes briefly how the idea of best-first search can be applied to game playing.

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