大同大學 105 學年度 研究所碩士班入學考試試題

考試科目:計算機概論　　所別:資訊工程研究所　　

註:本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器

Part I (資料結構)

1. (20 points) Choose the correct or best answer for each of the following questions (2 points each).

(a). ___ For a **balanced binary search tree** with n nodes, its **worst-case insertion efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(b). ___ For an **extremely unbalanced binary search tree** with n nodes, its **worst-case insertion efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(c). ___ If **binary search** is used to find an entry in an **unsorted array** of n items, its **worst-case search efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(d). ___ If **binary search** is used to find an entry in a **sorted array** of n items, its **worst-case search efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(e). ___ If **binary search** is used to find an entry in an **array** of n items, its **best-case search efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(f). ___ If **sequential search** is used to find an entry in an **unsorted array** of n items, its **worst-case search efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(g). ___ If **sequential search** is used to find an entry in a **sorted array** of n items, its **worst-case search efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(h). ___ If **sequential search** is used to find an entry in an **array** of n items, its **best-case search efficiency** will be (1) O(1) (2) O(log n) (3) O(n) (4) O(n log n) (5) O(n^2)

(i). ___ A binary tree in which the key in any node is **larger than** the keys in all nodes of that node's **left subtree** and **smaller than** the keys in all nodes of that node's **right subtree** is called a/an (1) AVL-tree (2) max heap (3) red-black tree (4) binary search tree (5) spanning tree.

(j). ___ A binary tree in which every level, except possibly the **last**, is **completely filled**, and all nodes are as **far left** as possible is called a (1) heap (2) full tree (3) complete tree (4) binary search tree (5) spanning tree.

2. (10 points) State the differences between (a) (3 points) **stacks** and **queues**, (b) (3 points) **queues** and **priority queues**, (c) (4 points) **trees** and **graphs**.

3. (10 points) (a) (2 points) What is a **hash table**? (b) (2 points) What is a **hash function**? (c) (2 points) What is **hash collision**? (d) (4 points) State **two methods** used for **collision resolution**.

4. (10 points) Suppose A**[0..**n**-1]** is an array containing n integers.

(a) (4 points) Write an **iterative** function ***printBackwardsI***(int A**[]**, int ***size***) that prints the integers in reverse order (i.e., A**[**n**-1]**, …, A**[0]**). The first call to the function is ***printBackwardsI***(A, n).

(b) (6 points) Write a **recursive** program ***printBackwardsR***(int A**[]**, int ***size***) that prints the integers in reverse order. The first call to the function is ***printBackwardsR***(A, n).

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Part 2: 基本數位邏輯

1 (10 points) According to the number and coding system answer the following questions.
(a) Convert a decimal value 43 into a 8-bit binary representation.
(b) Convert a decimal value −43 into a 8-bit 2's complement binary representation.
(c) Convert a hexadecimal value 318 into a octal representation.
(d) (4 points) What are the ASCII codes for TTU105. (6 bytes)
(**Hint**: 'A' is 1000001, 'a' is 1100001, and '0' is 0110000)

2 (10 points) According to the Boolean Algebra answer the following questions.
(a) Prove the Boolean equation $A+B\cdot C=(A+B)\cdot(A+C)$.
(b) Replace the NOT gate with NAND, NOR, XOR, and XNOR gates, respectively.

3 (15 points) Given a logic function, $F(A,B,C,D)=(A+\overline{B}+C)(A+\overline{C}+\overline{D})(\overline{B}+\overline{C}+D)(\overline{A}+\overline{C}+\overline{D})$
(a) (5 points) Rewrite the given function in the form $F(A,B,C,D)=\sum(\cdots)$.
(b) (5 points) Find the **minimal** expression in sum-of-production form.
(c) (5 points) Draw the **minimal** circuit (using all NAND without NOT gates.)

4 (15 points) Design a single-input (clock) and single-output Moore-type synchronous FSM to generate the sequence {0, 1, 1, 0, 1, 1, . . .} continuously. The output of your design must connect to Flip-Flop's output directly, that is **no gates between them**. Answer the following questions in given order.
(a) (5 points) What is the minimal state diagram?
(b) (3 points) What is the minimal state table?
(c) (2 points) What is the state-assigned table?
(d) (5 points) What is the circuit implemented with D flip-flops?