| 考試科目 | 計算机概論 | 所別 | 資訊科學系 碩士在職專班 | 考試時間 | 2月26日(六) 第4節 |
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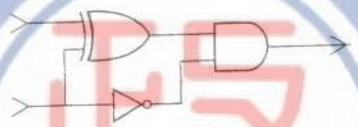
Basic Computer Concepts (BCC) Master Entrance Examination
for Gradudate School of Computer Science Professional Program

Date: Feb.-26-2011, Time: 15:20-17:00

There are 10 problems in this examination. The weights for each (sub)problem are indicated at the beginning of each problem. Please do all of them.

1. Data Storage

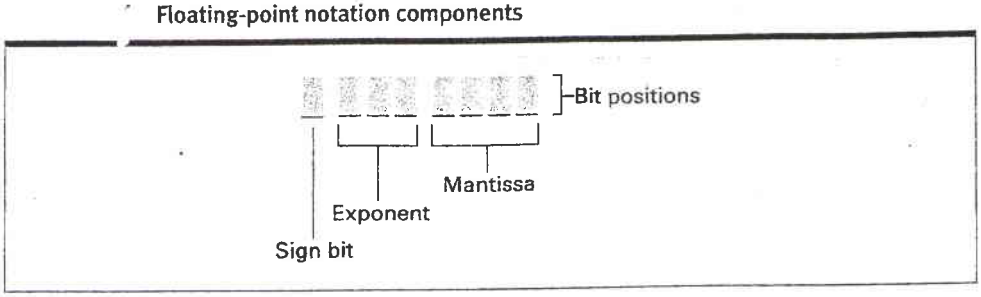
(a) (2%)For the following circuit, identify the input combinations that produce an output of 1.



(b) (2%)Convert the two's complement representation 10011 to its equivalent base ten representation.

(c) (2%)Solve the problem of $5 - 11$ by translating the values into two's complement notion (using patterns of five bits), converting this subtraction problem to an equivalent addition problem, and performing that addition. Check your work by converting your answer to base ten notation.

(d) (4%)What answer would be given to $2\frac{1}{4} + 1\frac{1}{8}$ by a machine using the eight-bit floating-point format described as the following?

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2. **Data Manipulation**

(a) (2%)In what way do general-purpose registers and main memory cells differ?

(b) (4%)Translate the following instructions from English into the machine language described in Appendix.

i. LOAD register 7 with the contents of memory cell 66.

ii. ROTATE register 4 three bits to the right.

(c) (4%)Suppose the following program, written in the machine language of Appendix, is stored in main memory beginning at address 30(hexadecimal). What task will the program perform when executed from left to right, top to down until C000?

```
2003 2101 2200 2310 1400 3410
5221 5331 3239 333B B248 B038 C000
```

3. **Operating Systems**

(a) (2%)What information is contained in the state of a process?

(b) (2%)What complications could arise in a time-sharing/multitasking system if two processes require access to the same file at the same time?

(c) (2%)What is the difference between virtual memory and main memory?

(d) (4%)Suppose a multiprogramming operating system is allotting time slices of 50 milliseconds. If it normally takes 8 milliseconds to position a disk's read/write head over the desired track and another 17 milliseconds for the desired data to rotate around to the read/write head, how much of a program's time slice can be spent waiting for a read operation from a disk to take place? If the machine is capable of executing ten instructions each microsecond, how many instructions can be executed during this waiting period?

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4. **Networking and the Internet**

   (a) (2%)Why is the CSMA/CD protocol not applicable in a wireless network?

   (b) (2%)In what sense does the global nature of the Internet limit legal solutions to Internet problems?

   (c) (2%)Why does the transport layer chop large messages into small packets?

   (d) (4%)Suppose the address of an end system on the Internet is quoted as 135.48.4.123. What is the 32-bit address in hexadecimal notation?

5. **Algorithms**

   (a) (4%)Rewrite the following program segment using a `while` structure rather than a `repeat` structure. Be sure the new version prints the same values as the original.

```
Count <- 1;
repeat
 (print the value assigned to Count and
  Count <- Count + 1)
until (Count=5)
```

   (b) (6%)The factorial of 0 is defined to be 1. The factorial of a positive integer is defined to be the product of that integer times the factorial of the next smaller nonnegative integer. We use the notation n! to express the factorial of the integer n. Design a recursive algorithm that computes the factorial of a give value n.

6. **Programming Languages**

   (a) (2%)What is an advantage of passing parameters by value as opposed to passing them by reference?

   (b) (8%)Translate the following pesudocode program into the machine language described in Appendix.

```
x <- 0;
while (x<3) do
 (x <- x + 1)
```

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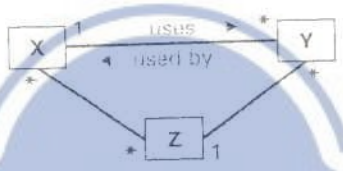
7. **Software Engineering**

(a) (2%)Is open-source development a top-down or bottom-up methodology?Explain your answer.

(b) (4%)What is the difference between coupling and cohesion? Which should be minimized and which should be maximized?Why?

(c) (4%)Answer the following questions based on the class diagram below that represents the associations between tools, their users, and their manufacturers.




i. Which classes (X, Y, and Z) represent tools, users, and manufacturers? Justify your answer.

ii. Can a tool be used by more than one user?

iii. Can a tool be manufactured by more than one manufacturer?

iv. Does each user use use tools manufactured by only one manufacturer?

8. **Database Systems**

(a) (2%)What is the role of a DBMS in the layered approach to a database implementation?

(b) (3%)Which of the following tasks are handled by a DBMS?

i. Ensure that a user's access to the database is restricted to the appropriate subschema.

ii. Translate commands stated in terms of the database model into actions compatible with the actual data storage system.

iii. Disguise the fact that the data in the database is actually scattered among many computers in a network.

(c) Using SQL to answer each of the following questions about parts and their manufacturers in terms of the following database:

PART relation

| PartName | Weight |
|---|---|
| Bolt 2X | 1 |
| Bolt 2Z | 1.5 |
| Nut V5 | 0.5 |

MANUFACTURER relation

| CompanyName | PartName | Cost |
|---|---|---|
| Company X | Bolt 2Z | .03 |
| Company X | Nut V5 | .01 |
| Company Y | Bolt 2X | .02 |
| Company Y | Nut V5 | .01 |
| Company Y | Bolt 2Z | .04 |
| Company Z | Nut V5 | .01 |

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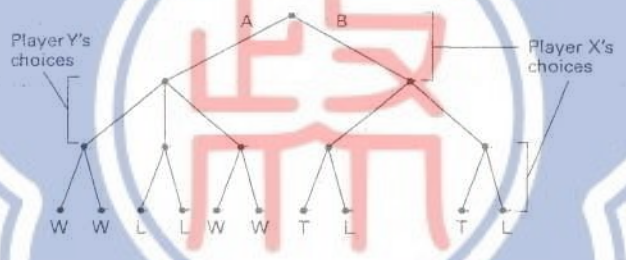
i. (2%)Which companies make Bolt 2Z?

ii. (3%)Which companies make a part with weight 1?

9. **Artificial Intelligence**

(a) (5%)What is the Turing Test? If a machine passes the Turing test, would you agree that it is intelligent? If not, would you agree that it appears to be intelligent? Please justify your answer.

(b) (5%)The tree below represents possible moves in a competitive game, showing that player X currently has a choice between move A and move B. Following the move of player X, player Y is allowed to select a move, and then player X is allowed to select the last move of the game. The leaf nodes of the tree are labeled W, L, or T, depending on whether that ending represents a win, loss, or tie for player X. Should player X select move A or move B? Why? How does selecting a "production" in a competitive atmosphere differ from a one-person game, such as the eight-puzzle?




10. **Theory of Computation**

(a) (2%)Suppose a problem can be solved by an algorithm in $\Theta(n^2)$ as well as another algorithm in $\Theta(2^n)$. Will one algorithm always outperform the other?

(b) (3%)Which of the following problems are in the class P?

i. A problem with complexity $n^2$

ii. A problem with complexity $2^n$

iii. A problem with with $n!$

(c) (5%)What is a P problem? What is an NP-complete problem? Whether all of the NP problems are also in P?

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Appendix

| Op-code | Operand | Description |
|---|---|---|
| 1 | RXY | LOAD the register R with the bit pattern found in the memory cell whose address is XY.<br>*Example:* 14A3 would cause the contents of the memory cell located at address A3 to be placed in register 4. |
| 2 | RXY | LOAD the register R with the bit pattern XY.<br>*Example:* 20A3 would cause the value A3 to be placed in register 0. |
| 3 | RXY | STORE the bit pattern found in register R in the memory cell whose address is XY.<br>*Example:* 35B1 would cause the contents of register 5 to be placed in the memory cell whose address is B1. |
| 4 | 0RS | MOVE the bit pattern found in register R to register S.<br>*Example:* 40A4 would cause the contents of register A to be copied into register 4. |
| 5 | RST | ADD the bit patterns in registers S and T as though they were two's complement representations and leave the result in register R.<br>*Example:* 5726 would cause the binary values in registers 2 and 6 to be added and the sum placed in register 7. |
| 6 | RST | ADD the bit patterns in registers S and T as though they represented values in floating-point notation and leave the floating-point result in register R.<br>*Example:* 634E would cause the values in registers 4 and E to be added as floating-point values and the result to be placed in register 3. |
| 7 | RST | OR the bit patterns in registers S and T and place the result in register R.<br>*Example:* 7CB4 would cause the result of ORing the contents of registers B and 4 to be placed in register C. |
| 8 | RST | AND the bit patterns in registers S and T and place the result in register R.<br>*Example:* 8045 would cause the result of ANDing the contents of registers 4 and 5 to be placed in register 0. |
| 9 | RST | EXCLUSIVE OR the bit patterns in registers S and T and place the result in register R.<br>*Example:* 95F3 would cause the result of EXCLUSIVE ORing the contents of registers F and 3 to be placed in register 5. |
| A | R0X | ROTATE the bit pattern in register R one bit to the right X times. Each time place the bit that started at the low-order end at the high-order end.<br>*Example:* A403 would cause the contents of register 4 to be rotated 3 bits to the right in a circular fashion. |

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| B | RXY | JUMP to the instruction located in the memory cell at address XY if the bit pattern in register R is equal to the bit pattern in register number 0. Otherwise, continue with the normal sequence of execution. (The jump is implemented by copying XY into the program counter during the execute phase.)<br>*Example:* B43C would first compare the contents of register 4 with the contents of register 0. If the two were equal, the pattern 3C would be placed in the program counter so that the next instruction executed would be the one located at that memory address. Otherwise, nothing would be done and program execution would continue in its normal sequence. |
| C | 000 | HALT execution.<br>*Example:* C000 would cause program execution to stop. |

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