九十一學年度 資訊系統與應用研究 (所) 甲 組碩士班研究生招生考試

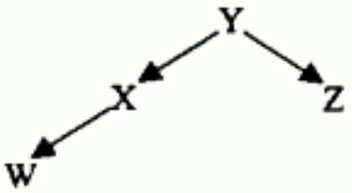
科目 計算機概論 科號 2801 共 4 頁第 1 頁 *請在試卷【答案卷】內作答

1. (3%) The life cycle of software consists of: development, use, and modification. Which two of these three form a **cycle** during the lifetime of software?
   (a) Development and use
   (b) Development and modification
   (c) Use and modification

2. (3%) Dataflow diagram and entity-relationship diagram are the two most popular methods frequently used in
   (a) Analysis phase
   (b) Design phase
   (c) Both

3. (5%) Suppose there are ***n*** stacks. Items A, B, C, D are read into these stacks in the order of A → B → C → D. What is the smallest ***n*** needed, if we like to have the output in the sequence of D → A → B → C.
   (a) One
   (b) Two
   (c) Three
   (d) Four

4. (5%) The sequence of **visiting** a binary tree is called "**inorder traversal,**" if the visiting sequence is (i) traversing the left subtree first, then (ii) visiting the root, and finally (iii) traversing the right subtree. The inorder traversal of the following tree is:



   (a) YXZW
   (b) WXZY
   (c) WXYZ

5. (5%) Suppose a hashed file is constructed using the division hash algorithm of "*key-value* ***mod*** *size*". Assume that indices of the hash table are labeled 0…6. The sequence of inserting the following key-values into the hash table is 24, 30, 3, 18, 15, 21, 9. To read the keys out from the table following the **order of** 0…6 of the hash table's indices, the key values are appearing in the sequence of
   (a) 24, 30, 3, 18, 15, 21, 9.
   (b) 3, 9, 15,18, 21, 24, 30.
   (c) 21, 15, 30, 9, 24, 3, 18.
   (d) 21, 15, 9, 30, 3, 24, 18.

6. (8%) Let the contents of Relation A and Relation B be as below:

Relation A

V	W
r	2
t	4
p	6

Relation B

X	Y	Z
5	g	p
4	d	e
2	m	q
4	t	f

After JOIN A and B, where A.W = B.X, has been done, the resultant Relation C has five columns, namely A.V, A.W, B.X, B.Y, and B.Z. Indicate two columns that have the same contents.

7. (13%) Consider a computer that has 16 general-purpose registers. Each register is 16 bits long. A word in the memory is 16 bits long, and is addressed by a 16-bit address. Each machine instruction also has 16 bits. The first 4 bits consist of the opcode; the last 12 bits make up the operand field. Instructions of interest are listed below, where R1, R2, R3 are registers, PC is the program counter, M[X] indicates the content of the memory at address X, Y is an 8-bit 2's complement number, and X is a 4-bit 2's complement number.

Opcode	Operand	Description
9_{16}	R1,R2,X	LOAD: R1 ← M[R2+X]
A_{16}	R1,R2,X	STORE: M[R2+X] ← R1
5_{16}	R1,R2,R3	ADD: R1 ← R2 + R3
1_{16}	R1,Y	JUMP: if R1≠0 then PC ← PC + Y

(a) (4%) Suppose at a particular instance, the contents of the memory are as follows: $M[5B32_{16}]=90BA_{16}$, $M[5B33_{16}]=5001_{16}$, $M[5B34_{16}]=A0BC_{16}$. If the content of the memory at location $5B32_{16}$ were interpreted as an instruction, what instruction it is? If it were interpreted as a 2's complement number, what it is?

(b) (5%) Suppose at the same instance, the contents of the registers are as follows: $PC=5B32_{16}$, $R1=0001_{16}$, $R11=5B38_{16}$. What is the content of $M[5B32_{16}]$, $M[5B33_{16}]$, $M[5B34_{16}]$, respectively after 3 cycles? Assume that each instruction takes one cycle to execute.

(c) (4%) Use (b) to explain the stored-program concept.

8. (13%) Answer the followings:

(a) (4%) Device drivers are usually put inside the operating system kernel. Explain what problems might occur if device drivers are not in the kernel but instead at the application level.

(b) (4%) Suppose a computer take 1 msec to handle an interrupt. However, if interrupts come too quickly, e.g. less than 1 msec, the CPU will be busy serving the interrupts and have no time to execute application processes. Give one example in which this situation may occur.

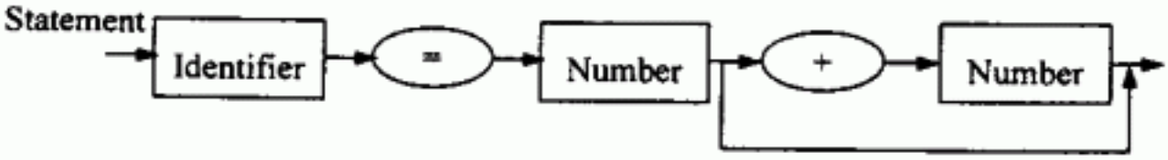
(c) (5%) Consider the four layers (application, transport, network, and link) of the Internet software in an Ethernet network. Which layer performs the operations of CSMA/CD? Which layer performs retransmission if a packet is lost?

9. (6%) Rewrite the following LISP statement, which uses the functional paradigm,

```
(Divide (Sum Numbers) (Count Numbers))
```

by using the object-oriented paradigm. Write your code using a pseudo code.

10. (6%) Consider the following syntax diagram:



(a) (3%) List all the tokens that the lexical analyser recognizes for the statement
`abc+3=x+579`

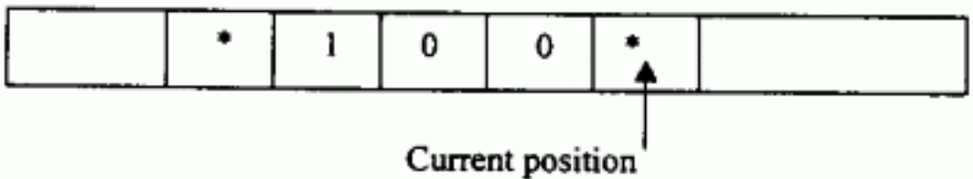
(b) (3%) Draw the parse tree for the satement `abc = 3 + 5`.

11. (8%) Hamming codes: Suppose the following symbols are encoded as

symbols	codes
A	000000
B	001111
C	010011
D	011100
E	100110
F	101001
G	110101
H	111010

What is the most likely actual message in terms of symbols if the receiver receives the following codes?
001110 100000 010100 101111 100100 000110 101000

12. (10%) Suppose the tape of a Turing Machine is initialized as:



Show the steps and actions of the Turing machine according to the table below. Assume that the machine is initially at the START state.

Current state	Current cell content	Value to write	Direction to move	New state to enter
START	*	*	Left	ADD
ADD	0	1	Left	NO CARRY
ADD	1	0	Left	CARRY
ADD	*	*	Right	HALT
CARRY	0	1	Left	NO CARRY
CARRY	1	0	Left	CARRY
CARRY	*	1	Left	OVERFLOW
NO CARRY	0	0	Left	NO CARRY
NO CARRY	1	1	Left	NO CARRY
NO CARRY	*	*	Right	RETURN
OVERFLOW	(ignored)	*	Right	RETURN
RETURN	0	0	Right	RETURN
RETURN	1	1	Right	RETURN
RETURN	*	*	No Move	HALT

13. (10%) Consider a floating-point encoding format using 1 sign bit, 3-bit exponent (in excess-4 notation), and 4-bit mantissa. Indicate the 8 bit code for the number –2.75.

14. (5%) What is the output of the following neural network when both inputs are 1;1 or 1;0 or 0;1 or 0;0?