CI01

國立臺北科技大學108學年度碩士班招生考試

系所組別：2300 資訊工程系碩士班

第一節　計算機概論　試題

注意事項：

1. 本試題共壹拾參題，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (15 pts) Please answer the following questions concisely.
   (1) (3 pts) Suppose that we have the list of integers 100 to 500. What is the least number of integers that must be chosen so that at least one number has distinct digits?
   (2) (3 pts) Define a relation R on the set $\mathbb{Z}\times\mathbb{Z}$ by $(m, t)R(n, s)$ if and only if $m=n$ and $t\text{-}s\geq 0$. Is R antisymmetric?
   (3) (3 pts) Please write the following postfix expression in infix form:
   $$f\ a\times b\ b\times +\ c\ d+/\ e+$$
   (4) (3 pts) How quickly can you multiply a $kn \times n$ matrix by an $n \times kn$ matrix, using Strassen's matrix multiplication algorithm as a subroutine?
   (5) (3 pts) Let A and B be two problems and we were able to establish the following fact: "if we could solve A in time $O(T(n))$, then we could solve B in time $O(n \log n + T(n))$." Suppose that B now has a $\Omega(n \log n)$ time lower bound. Can we conclude that A also has a $\Omega(n \log n)$ time lower bound?

2. (6 pts) It is assumed that $T(1) = d$ for some constant d. State, using the "Big-Oh" notation, the solution to each of the following two recurrences. Just state the answer - you do NOT need to justify them.
   (1) (3 pts) $T(n) = 16T(\frac{n}{2}) + n^4$
   (2) (3 pts) $T(n) = 7T(\frac{n}{2}) + 18n^2\sqrt{n}$

3. (8 pts) Indicate whether the following statements are TRUE or FALSE:
   (1) (2 pts) If e is a minimum-weight edge in a connected weighted graph, it must be among edges of each minimum spanning tree of the graph.
   (2) (2 pts) If edge weights of a connected weighted graph are not all distinct, the graph must have more than one minimum spanning tree.
   (3) (2 pts) There is a unique (2, 4) tree associated with a given red-black tree.
   (4) (2 pts) In red-black trees, the sibling of an external node is either external or it is red.

4. (6 pts) Let A_1, ..., A_5 be matrices with dimension 2×1, 1×3, 3×2, 2×4, 4×1, respectively. Let $C_{i,j}$ be the smallest number of scalar multiplications needed for computing the matrix product $A_iA_{i+1}\ldots A_j$, assuming that multiplying an $r \times s$ matrix and an $s \times t$ matrix takes rst scalar multiplications. Mark by TRUE or FALSE each of the following statements:
   (1) (2 pts) $C_{3,4}$ is computed before $C_{2,5}$.
   (2) (2 pts) $C_{1,4} = 22$.
   (3) (2 pts) $C_{1,5}$ is derived from $C_{1,2}$ and $C_{3,5}$.

5. (10 pts)
   (1) (3 pts) Plot the encoded waveform of Return-to-Zero (RZ) encoding for the data string "1001011011".
   (2) (4 pts) What is the difference between "routing protocol" and "routed protocol?" Please give two protocol examples for both of them.
   (3) (3 pts) What is the meaning of "GetNext Request" service in SNMP? What situation can this service be applied?

6. (10 pts)
   (1) (4 pts) What is the security protocol utilized by HTTPS? Numerates at least three functionalities provided by the protocol.
   (2) (3 pts) For a CRC system: given CRC generator is "110101" and data string is "1010001101." What is the transmitted codeword?
   (3) (3 pts) What is the meaning of VPN? Also, give three implementation methods for VPN (the most common ways).

7. (4 pts) For the following questions regarding *process management*, please indicate whether each statement is true or false. If a statement is incorrect, please explain the reasons. (not just correcting the errors)
   (1) (2 pts) Multithreaded programs can always provide better performance than a single-threaded solution.
   (2) (2 pts) Interprocess communication using shared memory is usually faster than message passing.

注意：背面尚有試題

8. (6 pts) Among the following statements about *memory and file management*, please indicate whether each statement is true or false. If a statement is incorrect, please explain the reasons. (not just correcting the errors)
   (1) (2 pts) Pure paging requires less memory overhead than pure segmentation to maintain the address translation structures.
   (2) (2 pts) Pure paging has the problem of external fragmentation, since free memory space is broken into little pieces that are not contiguous.
   (3) (2 pts) The contiguous allocation algorithm for file management suffers from the problem of internal fragmentation.

9. (5 pts) Answer the following questions regarding *interrupts*:
   (1) (3 pts) Please explain the idea of interrupts. What is the purpose of interrupts?
   (2) (2 pts) Explain why interrupts are not appropriate for implementing synchronization primitives in multiprocessor systems.

10. (6 pts) Regarding the following questions about *information security*, please indicate whether each statement is true or false. In the case of false statement, you must explain the reason why it's not correct. (not just correcting the errors)
    (1) (2 pts) Public-key encryption is more secure than symmetric encryption.
    (2) (2 pts) Key distribution is trivial when using public-key encryption, compared to the handshaking involved with key distribution centers for symmetric encryption.
    (3) (2 pts) Key distribution is trivial when using public-key encryption, compared to the handshaking involved with key distribution centers for symmetric encryption.

11. (4 pts) What is the idea of *nonrepudiation* in information security? Describe possible mechanisms to provide this security service.

12. (10 pts) Given the following MIPS assembly code segments in **Figure 1**, which contain a function **int func(int a, int b)** that calls another function **foo(a, b)**. Please answer the following problems.
    (1) (2 pts) This code contains some mistakes that violates some MIPS calling conventions. Please indicate this code violate which MIPS calling conventions? (callee's responsibility, caller's responsibility, or both?)
    (2) (4 pts) Following the previous problem, please re-write the fixed code that can be correctly executed according to the MIPS calling conventions.
    (3) (4 pts) What is the **equivalent C code** of the above fixed MIPS assembly code of the function **func** in **Figure 1**? Please disassemble the MIPS code into the **equivalent C code**. Assume that the function **func**'s and **foo**'s arguments **a, b** are held in the registers **$a0 - $a1**, respectively.

MIPS Code	**func**: addi $sp,$sp,-4
	sw $ra, 0($sp)
	addi $a0, $a0, 1
	addi $a1, $a1, 2
	jal **foo**
	addi $a0, $v0, 4
	add $v0, $a0, $a1
	lw $ra, 0($sp)
	addi $sp,$sp, 4
	jr $ra

Figure 1. MIPS assembly code segment

13. (10 pts) A typical MIPS processor with a five-stage pipeline(**Figure 2**), including: **IF**-Instruction fetch; **ID**-Instruction decode and register fetch; **EX**-Execution or calculate effective address; **MEM**-Access data memory; **WB**-Write back to registers

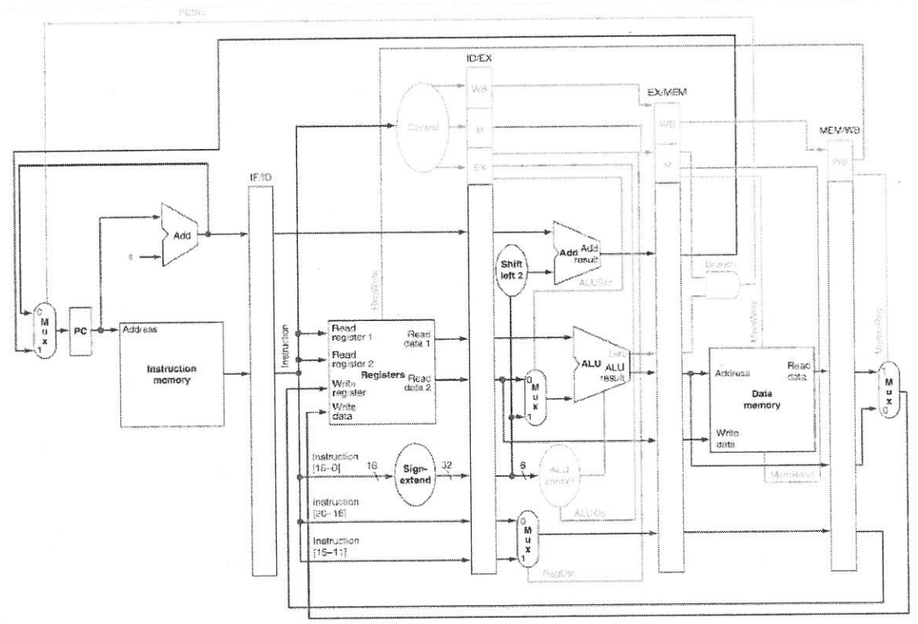

Figure 2. Pipelined datapath and control signals

The control portions of the pipeline registers are connected for the pipelined datapath with the **control signals** (e.g.: ALUSrc, ALUOp, RegWrite, …), as shown in **Figure 2**. Please use following datapath illustration to **complete the control signals** in **Table 1**. Please draw and fill the table on your answer. (2 pts per signal, five signals in total)

Instruction	Execution/address calculation stage control lines			Memory access stage control lines			Write-back stage control lines	
	RegDst	ALUOp	ALUSrc	Branch	MemRead	MemWrite	RegWrite	MemtoReg
add	1	10	0	0	0	0	1	0
lw	0	00		0	1		1	
beq	X		0	1	0	0		X

Table 1(1:asserted of control line, 0:deasserted of control line, x:don't care)