

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所 別：工程技術研究所
學程別：資訊工程學程

組別：

科目：計算機概論

1. Solve the following recurrence exactly for n a power of two: (12%)

$$T(n) = 2T(n/2) + n \log_2 n \quad n \geq 2, \text{ subject to } T(1) = 1.$$

2. Trace the following function in C and explain your answer. (12%)

```
unsigned test1 (unsigned x, int p, int n, unsigned y)
{
    return x & ~((~0 << n) << (p+1-n)) | (y & ~((~0 << n) << (p+1-n)));
}
```

3. Given an input list (37, 65, 26, 81, 43, 79, 50, 8, 14, 92), write the status of the list at the end of each pass using the following merge sort method. (12%)

```
int merge2 (element list [], int lower, int upper)
{
    int middle;
    if (lower >= upper)
        return lower;
    else {
        middle = (lower + upper) / 2;
        return listmerge (list, merge2 (list, lower, middle), merge2 (list, middle+1, upper));
    }
}
```

4. Prove that the preorder traversal of a forest and the preorder traversal of the associated binary tree give the same result. (14%)
5. Find an all-NAND design for the function represented by the map of the following figure, subject to a fan-in limit of 3, assuming single-rail inputs. (20%)

AB \ CD	00	01	11	10
00	1	1	1	1
01	1	1		1
11		1		
10			1	

6. A data source produces 7-bit ASCII characters, to each of which is appended a parity bit. Derive an expression for the maximum effective data rate over an R-bps line for the following: (10%)
- (a) Asynchronous transmission, with a 1.5-unit stop bit.
- (b) Bit-synchronous transmission, with a frame consisting of 48 control bits and 128 information bits.

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7. A virtual memory uses two-level page tables. The format of a virtual address is (table number, page number, displacement within page) (20%)
The first four page tables are the follows:

Page Table 0	
page number	page frame #
0	on disk
1	12
2	9
3	5

Page Table 1	
page number	page frame #
0	15
1	7
2	on disk
3	0

Page Table 2	
page number	page frame #
0	6
1	13
2	0
3	on disk

Page Table 3	
page number	page frame #
page table not in main memory	

- (a) For each of the following accesses to virtual memory,
- If no page fault occurs, tell what physical address is computed. Give the answer in the form of (frame number, displacement).
 - Tell what access rights are needed to complete the access.

Access	Table number	Page number	Displacement within page	Physical address	Access right
Fetch data	1	2	50	<u>page fault</u>	<u>read</u>
Fetch data	0	1	12	_____	_____
Store data	2	3	2000	_____	_____
Jump to	3	3	100	_____	_____
Jump to	0	2	60	_____	_____

- (b) If all the above references are possible, how large is the virtual address space (at least)?
How large is the physical memory (at least)?