

元智大學 101 學年度研究所 碩士班 招生試題卷

系(所)別： 資訊工程學系碩
士班

組別： 不分組

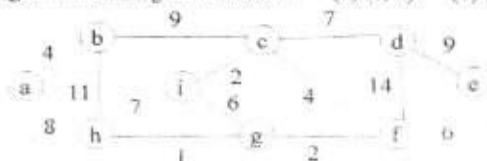
科目： 計算機概論

用紙第 1 頁共 2 頁

●不可使用電子計算機

一、單選題 (每題有四個選項，正確選項只有一個) (42% · 每題 3 分)

- Let T be a k -ary tree (i.e., a tree of degree k) with n nodes, each having a fixed size of k child fields. How many child fields are 0? (a) $n(k-1) - 1$ (b) $n(k-1)$ (c) $n(k-1) + 1$ (d) nk
- A binary tree A has the postorder traversal (2, 1, 3, 4, 7, 6, 5) and inorder traversal (2, 3, 1, 4, 5, 7, 6). What is its preorder traversal?
(a) 5, 4, 3, 2, 1, 6, 7 (b) 5, 4, 3, 2, 1, 7, 6 (c) 5, 6, 7, 4, 3, 2, 1 (d) 5, 6, 7, 4, 3, 1, 2
- The operation HEAP-DELETE (A, i) deletes the item in node i from heap A . After the operation of HEAP-DELETE ($A, 6$) on the heap $A = \langle 25, 20, 9, 16, 18, 8, 7, 10, 5, 12 \rangle$, give the result for heap A .
(a) $\langle 25, 20, 9, 16, 18, 7, 10, 5, 12 \rangle$ (b) $\langle 25, 20, 9, 16, 18, 12, 7, 10, 5 \rangle$
(c) $\langle 25, 20, 9, 16, 18, 5, 7, 10, 12 \rangle$ (d) $\langle 25, 20, 12, 16, 18, 9, 7, 10, 5 \rangle$
- How many different ways are there for multiplying 7 matrices?
(a) 429 (b) 132 (c) 42 (d) 14
- Consider the following graph. By performing minimum cost spanning tree algorithm, we can add a set of edges to form a minimum cost spanning tree of G . Which edge is the 7-th edge to be added by the Prim's algorithm starting from node a ? (a) (c, d) (b) (h, i) (c) (g, i) (d) (e, f)



- What is the main advantage by adding some complex instructions into the existed instructions sets?
(a) Reduced CPI (b) Less instruction count (c) Faster clock cycle (d) Increased MIPS
- Given a direct-mapped cache with 64 blocks and block size of 16 bytes, what block number does memory address $(256)_{10}$ map to? (a) 4 (b) 16 (c) 64 (d) 256
- Assume $R0 = 0$, which of the following instruction performs NOT operation?
(a) OR $R1, R0, R3$ (b) AND $R1, R0, R3$ (c) NOR $R1, R0, R3$ (d) ADD $R1, R0, R3$
- Which of the following feature is not typical for the RISC machine?
(a) Powerful instruction set (b) Small CPI (c) Limited addressing mode (d) Simple hardware architecture
- Given a MIPS assembly program, assume the program counter of "beq $\$4, \$8, 8$ " is 64. What is the new PC if the branch is taken?
(a) 72 (b) 68 (c) 96 (d) 100
- Which of the following statement is true?
(a) Pipelining reduces the instruction execution latency to one cycle.
(b) Pipelining not only improves the instruction throughput but also the instruction latency.
(c) Pipelining improves the instruction throughput rather than individual instruction execution time.
(d) Pipelining improves the instruction throughput other than individual instruction execution time.
- Which of the following statement is false?
(a) Dynamic power = Capacitive load \times Voltage² \times Frequency switched.
(b) Temporal locality means the tendency to use data items that are close in location.
(c) Static power is due to the small operating current in CMOS.
(d) Yield = the percentage of good dies from the total number of dies on the wafer.
- Which of the following operation is equivalent to division by 2 in two's complement notation, when there is no overflow or underflow?
(a) Arithmetic right rotate (b) Arithmetic right shift (c) Arithmetic left shift (d) Logic right shift
- Which of the following is false?
(a) C compiler compiles a C program into assembly language program for a target machine.
(b) Pseudo-instructions are instructions which are not implemented in hardware.
(c) A label is a pseudo-instruction.
(d) Pseudo-instructions are directives in an assembly language program.

- 二、(10%) Design an **optimal greedy algorithm** to determine an order of evaluating the matrix product $M_1 * M_2 * \dots * M_n$ so as to minimize the number of scalar multiplication, where each M is of dimension $l * 1, 1 * d, d * 1$, or $d * d$ for some fixed constant d . The proof and time complexity analysis are not required.
- 三、(10%) Assume that 3-CNF-SAT problem is already known to be NP-hard, prove that the clique problem is NP-hard.

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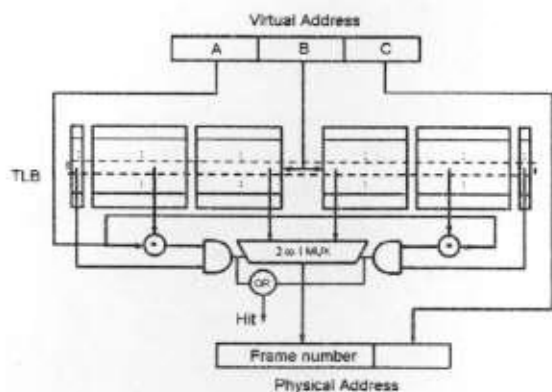


Figure 1

```

1 do {
2   waiting[i] = TRUE;
3   key = TRUE;
4   while ( _____ )
5     _____
6
7   // critical section
8   j = (i+1) % n;
9   while ((j!=i) && !waiting[j])
10    j = (j+1) % n;
11   if (j == i)
12     lock = FALSE;
13   else
14     waiting[j] = FALSE;
15   // remainder section
16 } while ( TRUE);
    
```

Figure 2

- 四、(2%) There are three major challenges in modern computing system design – power wall, memory wall, and ILP wall. Explain the ILP wall.
- 五、(6%) A virtual memory system with 32-bit virtual address, 128-entry 2-way set associative TLB, and 4KB page size. In Figure 1, what are the sizes of fields A, B, and C?
- 六、(6%) How can we know which process is the child process from the returned result of the fork() system call?
- 七、(6%) There are basically three methods used to pass parameters to the OS in system call design: passing parameters in registers, in a block, and in a stack. Discuss their advantages and disadvantages.
- 八、(6%) Figure 2 shows a version of a bounded-waiting mutual exclusion algorithm with TestAndSet(). However, line 4-6 are missing. Please write the line 4-6 to correctly execute this algorithm. (Each line has only one statement.)
- 九、(6%) Consider the following reference string in which there are 20 page references: 1, 2, 7, 1, 3, 0, 3, 2, 1, 4, 2, 0, 1, 2, 1, 2, 7, 0, 2, 1. There are 3 frames. Draw a figure to show the operation details for the LRU page replacement algorithm. The content changes of the frames should be demonstrated in your figure.
- 十、(6%) An important factor in the way frames are allocated to the various processes is page replacement. With multiple processes competing for frames, we can classify page-replacement algorithms into two broad categories: global replacement and local replacement.
 - (3%) What problem is with the global replacement algorithms?
 - (3%) In which situation will global replacement have greater system throughput than local replacement?