國立雲林科技大學
94 學年度碩士班入學招生考試試題

系所：資工所、電子系
科目：計算機概論

1. (5 points) Use the following BNF grammer
   <assignment statement> ::= <var> := <expr>
   <expr> ::= <var> | <expr> <operation> <var>
   <var> ::= X | Y
   <operation> ::= + | -
   to draw the parse three for the assignment: X:=X+X-Y

2. (10 points) Write a Turing machine and draw the corresponding state diagram that converts all the bits of a binary string from 0 to 1 and 1 to 0, but does not convert the last bit in a string, and stops when it hits the first blank. For example, **b0100100b** is converted to **b1011010b** and **b01101b** is converted to **b10011b.**

3. (10 pints)(a) Explain what a multiplexor circuit does. Be sure to state how many input and output lines it has.
   (b) If 11011111 is the input to a multiplexor, give the selector input that would give 0 as an output. (Assume that the input bits are numbered from right to left)

4. (15 points) A typical floppy disk on a PC has the following characteristics:
   Rotation speed=3600 rev/min, arm movement time=1 ms fixed startup time +0.1 ms for each track crossed (The 1 ms time is a constant no matter how far the arm moves.) Number of surfaces=2 (a double-sides floppy disk. A single read/write arm holds both read/write heads) Number of tracks per surface=100, Number of sectors per track=20, Number of characters per sector=512
   (a)Name and define the three components of access time to any individual sector on a hard disk.
   (b)How many characters can be stored on a single floppy disk?
   (c)What are the best-case, the worst-case, and the average-case (assume that on the average, the read/write head must move about 30 tracks) access times to any individual sector of this disk?

5. (10 points) What are the outputs of the following C programs?

(a)
```
#include < stdio.h >
#define f(x)(x*x+2*x+9)
void main()
{
    int i=2;
    printf("%d, %d \n", f(i), f(i+1));
}
```

(b)
```
#include < stdio.h >
void main (void)
{
    int i=2, s=0, *pi, *pj;
    int a[12]={4,5,6,1,2,3,7,8,9,7,8,9};
    pi=a;
    pj=pi+1;
    for (i=2 ; i<9; i+=2);
        s+=*(pj+i);
    printf("%d   %d   s=%d\n", *pi, *pj, s);
}
```

(c)
```
#include < stdio.h >
void p1(int *i, int *j)
    {
   *i=*j+5;
   *j=*j-1;
   printf("%d %d \n", *i, *j);
}
void p2(int *a, int b)
    {
   *a+=5;
   b*=2;
   printf("%d %d \n", *a, b);
   p1(a, &b);
}
main( )
    {
   int x=5, y=8;
   p2(&x, y);
   printf("%d %d \n", x,y);
}
```

(d)
```
#include < stdio.h >
main( )
{
   int i, j,cnt=0;
   for( i=1; i<=10; i++) {
        for( j=1; j<=10; j++) {
             if ( i==5) continue;
             if (j>5) break;
             cnt++;
        }
   }
   printf("%d\n",cnt);
}
```

(e)
```
#include <stdio.h>
main ( )
{
   int a=1, b=2, c=3;
   a+=b+=c+=7;
   printf("a=%d, b=%d, c=%d \n",a,b,c);
}
```

6. (10 points) Show the printouts after executing the following C++ statements.

(a)
```
char quiz = 'E';
char * pq = &quiz;
std::cout << *pq;
*pq = 'Q';
std::cout << quiz << std::endl;
```

(b)
```
std::string name = "Gery";
int   i = name.size();
name += "Smith";
std::cout << name[i] << std::endl;
```

7. (10 points) Describe the idea of stored program concept.

8. (10 points) Determine the total time it would take to transmit a complete gray-scale image (with 8bits/pixel) from a screen with a resolution of 1,000x1,000 pixels using the following media: (a) A V.90 modem (b) A dedicated T1 phone line (c) A dedicated T3 phone line (d) A fiber-optic OC-3 line (e) An OC-48 gigabit line.

9. (10 points) Develop an algorithm that, when given an arrangement of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, will rearrange the digits so that the new arrangement represents the next larger value that can be represented by these digits--otherwise reports that no such rearrangement exists if no rearrangement produces a larger value. Thus, 4317859602 would produce 4317859620.

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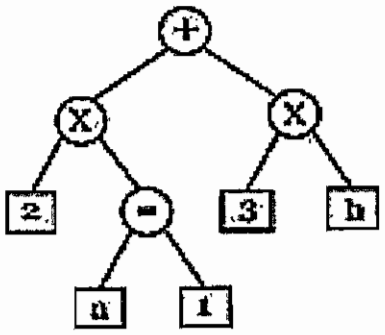
系所：資工所、電子系
科目：計算機概論

10. (10 pints) Write a pseudo code to printout an arithmetic expression that is stored in an arithmetic expression tree. The diagram below shows an example of the arithmetic expression tree with the arithmetic expression (2 x (a -1) + (3 x b)).



國立雲林科技大學
94學年度碩士班入學招生考試試題

系所：資工所
科目：作業系統

題目1至題目10爲多選題，每題5分。每題需全部答對才給分，答錯倒扣1分。

1. What main advantages do multiprocessor systems have?
   (A) increased throughput
   (B) real time
   (C) economy of scale
   (D) increased reliability

2. Which are volatile storage?
   (A) cache
   (B) magnetic disk
   (C) optical disk
   (D) main memory

3. Which activities is the OS responsible for in connection with memory management?
   (A) keeping track of which parts of memory are currently being used
   (B) deciding which processes are to be loaded into memory when memory space becomes available
   (C) blocking and de-blocking I/O data
   (D) allocating and deallocating memory space

4. Which state transitions are possible for a process?
   (A) new → ready
   (B) running → ready
   (C) running → waiting
   (D) waiting → ready

5. What scheduling algorithms are time-sharing systems primarily based on?
   (A) the FCFS scheduling algorithm
   (B) the round-robin scheduling algorithm
   (C) the SJF scheduling algorithm
   (D) the priority scheduling algorithm

6. Which hardware instructions are usually used to solve mutual-exclusion problems?
   (A) Wait
   (B) Lock
   (C) TestAndSet
   (D) Swap

7. For deadlock prevention that a process requests all needed resources prior to commencement of execution, what main disadvantages shall be incurred?
   (A) Mutual exclusion problems are still not solved.
   (B) Resource utilization may be low.
   (C) Starvation is possible.
   (D) Preempting processes would be frequent.

8. Which memory-management scheme would cause external fragmentation?
   (A) dynamic storage allocation (e.g., first-fit, best-fit, or worst-fit)
   (B) paging
   (C) pure segmentation
   (D) virtual memory

9. Which page-replacement algorithms can be called stack algorithms?
   (A) FIFO
   (B) optimal page-replacement algorithm
   (C) LRU
   (D) LFU

10. Which are correct for disk space linked allocations?
   (A) There is no external fragmentation with linked allocation.
   (B) It is inefficient to support a direct-access capability for linked allocation files.
   (C) Linked allocation has reliability problems.
   (D) Linked allocation is to determine how much space is needed for a file.

11. Use a text editor to read your Linux system's password file, /etc/passwd. You should be able to find a single-line entry in the ASCII file for your own login. Speculate how your password is saved in /etc/passwd. What user is the owner of /etc/passwd? Do you have write permission for /etc/passwd? Explain your answer. (15%)

12. A system is composed of four processes, {P1, P2, P3, P4}, and three types of serially reusable resources, {R1, R2, R3}. The number of units of the resources are <3, 2, 2>.
    - P1 hold 1 unit of R1 and requests 1 unit of R2.
    - P2 hold 2 unit of R2 and requests 1 unit each of R1 and R3.
    - P3 hold 1 unit of R1 and requests 1 unit of R2.
    - P4 hold 2 unit of R3 and requests 1 unit of R1.

    Show the resource-allocation graph to represent this system state. Can deadlock occur? If so, what processes are deadlocked in this state? If not, give a safe sequence for this state. (15%)

13. What are the difference between user-level threads and kernel-supported threads? (10%)

14. Give an example to explain the meaning of the term busy waiting. Can busy waiting be avoided altogether? Explain your answer. (10%)

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系所：資工所、電子系
科目：線性代數

1. (10%) Find A^{120} where A is given by

$$A=\begin{bmatrix}1 & 1\\ 1 & 0\end{bmatrix}$$

2. (15%) Find the minimum value of

$$C(x_1,x_2)=\frac{x_1^2-x_1x_2+x_2^2}{2x_1^2+x_2^2}$$

where x_1 and x_2 are both real numbers.

3. (10%) Prove the following statement: If A and B are diagonalizable, they share the same eigenvector matrix S if and only if $AB=BA$.

4. (15%) Find the singular value decomposition of

$$A=\begin{bmatrix}2 & 2\\ -1 & 1\end{bmatrix}$$

5. (15%) Show that the set R^+ of positive reals is a linear space when '$x+y$' is interpreted to mean the product of x and y (so that 2+3 is 6), and '$r\cdot x$' is interpreted as the r-th power of x.

6. (20%) For each of (a), (b) and (c), you must justify your answer with a proof or counter examples:
(a) If A, B are subspaces of a vector space, must $A\cap B$ be a subspace? Always? Sometimes? Never?
(b) Must $A\cup B$ be a subspace?
(c) If A is a subspace, must its complement be a subspace?

7. (15%) Consider the vectors $\vec{v},\vec{s}_1,\vec{s}_2,..\vec{s}_m$ in R^n. Prove
span($\vec{s}_1,\vec{s}_2,..\vec{s}_m$)=span($\vec{v},\vec{s}_1,\vec{s}_2,..\vec{s}_m$) if and only if $\vec{v}\in$ span($\vec{v},\vec{s}_1,\vec{s}_2,..\vec{s}_m$).

國立雲林科技大學
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系所：資工所、資管系
科目：離散數學

1. (15%) Show that we cannot construct a finite state machine that recognizes precisely in the language $A = \{0^i 1^j \mid i, j \in Z^+, i < j\}$. (The alphabet for A is $\Sigma = \{0,1\}$.)

2. (10%) Let G=(V,E) be a loop-free connected undirected graph, and let {a,b} be an edge of G. Prove that {a,b} is part of a cycle if and only if its removal (the vertices a and b are left) does not disconnect G.

3. (10%) Let $f : Z \to N$ be defined by $f(x) = \begin{cases} 2x-1, & if\ x > 0 \\ -2x, & for\ x \le 0. \end{cases}$

   (*a*) Prove that f is one-to-one and onto.
   (*b*) Determine f^{-1}.

4. (15%) For each of the following statements about relations on a set A, where |A|=n, determine, whether the statement is true or false. If it is false, give a counterexample.
   (*a*) If R is reflexive relation on A, then |R| >= n.
   (*b*) If R is a relation on A and |R| >= n, then R is reflexive.
   (*c*) If R1, R2, are relations on A and R2 is a superset of R1, then R1 reflexive => R2 reflexive.
   (*d*) If R1, R2, are relations on A and R2 is a superset of R1, then R1 symmetric => R2 symmetric.
   (*e*) If R1, R2, are relations on A and R2 is a superset of R1, then R1 transitive => R2 transitive.
   (*f*) If R is an equivalence relation on A, then $n \le |R| \le n^2$.

5. (10%) (*a*) In how many ways can a particle move in the *xy*-plane from the origin to the point (7,4) if the moves that are allowed are of the form: (4%)
   (R): $(x,y) \to (x+1,y)$; (U): $(x,y) \to (x,y+1)$
   (*b*) Answer part (*a*) if a third type of move
   (D): $(x,y) \to (x+1,y+1)$
   is also allowed. (6%)

6. (10%) Consider the open statement
   $p(x,y)$: $y - x = y + x^2$
   where the universe for each of the variables x, y comprises all integers. Determine the true value for each of the following statements:
   (*a*) $p(0,1)$ (*b*) $\forall y\, p(0,y)$ (*c*) $\exists y\, p(1,y)$
   (*d*) $\forall x\, \exists y\, p(x,y)$ (*e*) $\exists y\, \forall x\, p(x,y)$

7. (5%) Let $m = p_1^{e_1} p_2^{e_2} p_3^{e_3} p_4^{e_4}$ and $n = p_1^{f_1} p_2^{f_2} p_3^{f_3} p_5^{f_5}$, where p_1, p_2, p_3, p_4, p_5 are

distinct primes, and $e_1, e_2, e_3, e_4, f_1, f_2, f_3, f_5 \in \mathbf{Z}^+$. How many common divisors are there for m, n?

8. (5%) Write a Turing machine that, when run on the tape

   ... b 1 1 1 0 b ...

   will produce an output tape of

   ... b 1 1 1 0 1 b ...

9. (10%) (*a*) Let $S = \{2, 16, 128, 1024, 8192, 65536\}$. If four numbers are selected from S, prove that two of them must have the product 131072.
   (*b*) Generalize the result in part (*a*).

10. (10%) Apply the minimization process to the following finite state machine.

	v		ω	
	0	1	0	1
S_1	S_6	S_3	0	0
S_2	S_3	S_1	0	0
S_3	S_2	S_4	0	0
S_4	S_7	S_4	0	0
S_5	S_6	S_7	0	0
S_6	S_5	S_2	1	0
S_7	S_4	S_1	0	0