國立臺中教育大學 96 學年度研究所碩士班招生考試

計算機系統　科試題

資訊科學學系碩士班 用

一、(a) Why can't use the top-down parsing method to process the grammar listed as below?(4%)

(b) Please modify this grammar to avoid above problem. (4%)

<id-list> ::= **id** | <id-list> **id**

<exp> ::= <term> | <exp> + <term> | <exp> - <term>

<term> ::= <factor> | <term> * <factor> | <term> **DIV** <factor>

二、Please answer following questions briefly.(12%)

(a) What is a critical section?

(b) What three requirements must a solution to the critical-section problem satisfy?

(c) What is multiprogramming?

(d) What is swapping?

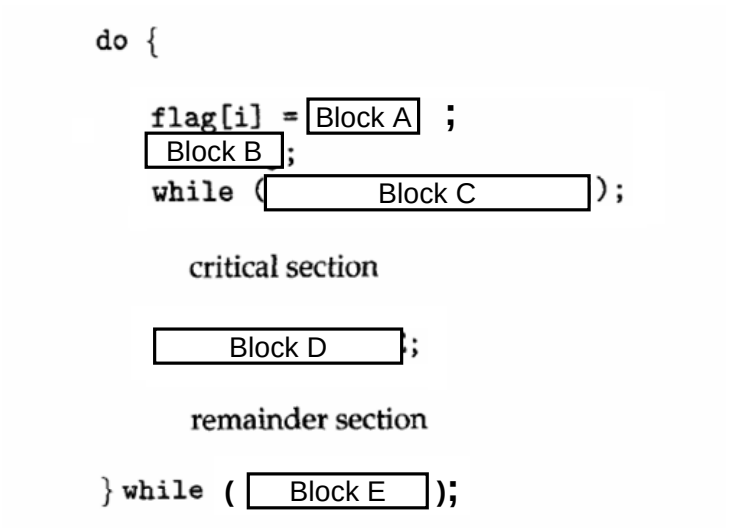
(e) What is a context switch?

(f) Define deadlock

三、Peterson's solution is a classic software-based solution to the critical-section problem.(10%)

(a)In regard to the Peterson's solution (described in the following picture) for process i and process j, please fill some code in the following blank-blocks (Block-A ~ Block-E).

(b)Please prove Peterson's solution satisfies the three requirements of critical-section.



The structure of process **Pi** in Peterson's solution

以下仍有試題

四、Consider the following segment table: (**1**st ~ **12**st bit for segment base address, **13**st ~ **22**st bit for segment length)(9%)

Segment No.	Content
0	0000110110111001011000
1	1000111111000000001110
2.	0000010110100001100100
3.	0101001011111001000100
4	0111101000000001100000

What are the physical addresses for the following logical addresses (**1**st ~ **3**st bit for segment number, **4**st ~ **12**st bit for offset)?

a.	000110101110
b.	011110010000
c.	010111110100

五、Assume that we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty frame is available or if the replaced page is not modified and 20 milliseconds if the replaced page is modified. Memory-access time is 100 nanoseconds. Assume that the page to be replaced is modified 70 percent of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 300 nanoseconds?(5%)

六、Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:(16%)

Process	**Burst Time**	**Priority**
A	10	3
B	1	1
C	2	3
D	1	4
E	5	2

The processes are assumed to have arrived in the order A, B, C, D, and E, all at time 0.

(a) What is the average turnaround time of each process for each of the scheduling algorithms including FCFS, SJF, a non-preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling?

(b) Which of the schedules in part a results in the minimal average waiting time (over all processes)?

以下仍有試題

七、For minimizing the number of page faults of a page replacement algorithm, we can associate with each page frame a counter of the number of pages that are associated with that frame. Then, to replace a page, we search for the page frame with the smallest counter. Use FIFO for breaking ties. Where, the initial value of the counters is 0. Counters are increased whenever a new page is associated with that frame. Counters are decreased whenever one of the pages associated with that frame is no longer required.(10%)

(a) How many page faults occur for the algorithm described above for the following reference string, for four page frames?

1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2

(b) What is the minimum number of page faults for an optimal page replacement strategy for the reference string in part **(a)** with four page frames?

八、Consider the following structure of the instruction register.

Op code	address-1	address-2
8 bits	16 bits	16 bits

(a) What is the maximum number of distinct operation codes that can be recognized and executed by the CPU? (5%)

(b) What is the maximum memory size on this machine? (5%)

九、Please explain the Hamming Code. If the original 8-bit data is 00111011, please write out the 12-bit Hamming code include 4 parity bits. (10%)

十、Derive the circuits for a three-bit parity generator and four-bit parity checker using odd parity bit. (10%)

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計算機數學　科試題

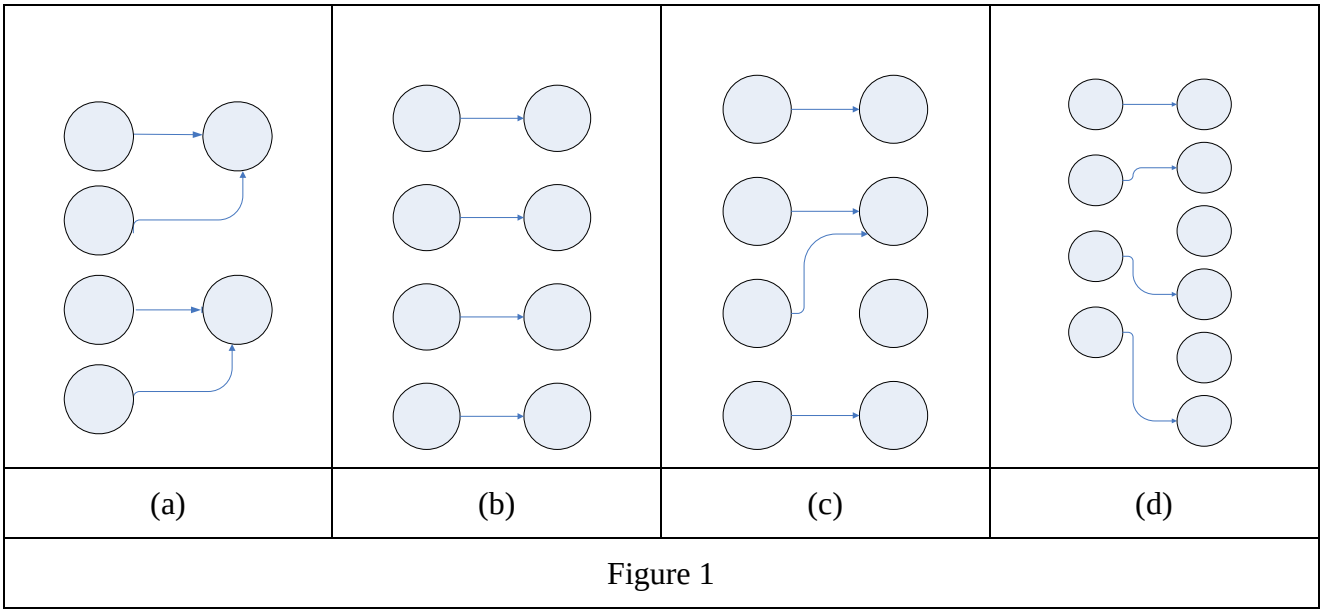
資訊科學學系碩士班 用

一、Solve the following recurrence relations together with the initial conditions given.(10%)

$a_n = 6a_{n-1} + 7a_{n-2}$ *for* $n \geq 2$, $a_0 = 0$, $a_1 = 1$

二、A positive integer is perfect if it equals to the sum of its positive divisors other than itself. Find **three** perfect integers and prove your answer. (10%)

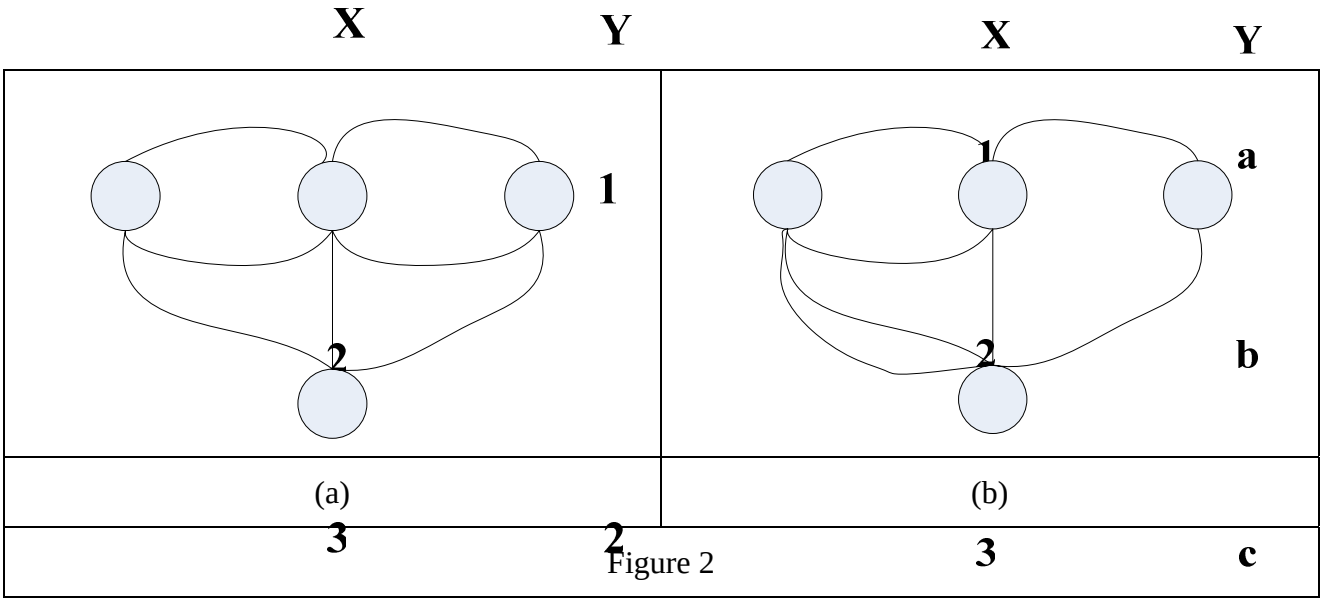
三、Let *f* be a total function from X to Y. Please determine which *f* of Figure 1 ((a), (b), (c), or (d)) is (1) *onto* function (2) *one-to-one* function (3) *one-to-one onto* function. (10%)



(a)　(b)　(c)　(d)

Figure 1

四、Two graphs are shown in Figure 2. Please determine which is Eular graph. Also construct Eular loops in the appropriate cases. (10%)



(a)　(b)

Figure 2

以下仍有試題

五、Let G be an undirected graph with two vertices connected by at most one edge. Which of the following statement is true? Also, please explain the reasons. (10%)

(a) Any two spanning tree of G should have a common edge.

(b) Minimal cost spanning tree of G is unique.

(c) All spanning trees of G have the same number of edges.

六、$x_1+x_2+x_3+x_4 \le 23$, $x_1 \ge 2$, $x_2 \ge 3$, $x_3 \ge 2$, $x_4 \ge 5$ 之整數解有多少組? (10%)

七、若方陣 $A^T=A$，試證(1)A 為對稱矩陣並且(2)$A^2=A$。(10%)

八、Find the inverse of the following matrix (if it exists): (10%)

$$\begin{bmatrix} 6 & 10 & -5 \\ -6 & -9 & 5 \\ -1 & -2 & 1 \end{bmatrix}$$

九、Use Cramer's rule to solve the following linear system: (10%)

$$\begin{aligned} 2x_1 + x_2 &= 7 \\ -3x_1 + 4x_2 &= 6 \end{aligned}$$

十、Let $A = \begin{bmatrix} 4 & -3 \\ 2 & -1 \end{bmatrix}$.

(a) Find the eigenvalues of A. (5%)

(b) Is $\begin{bmatrix} 6 \\ 4 \end{bmatrix}$ an eigenvector of A? Justify your answer. (5%)

國立臺中教育大學 96 學年度研究所碩士班招生考試

計算機導論　科試題

資訊科學學系碩士班 用

一、問答題(60%)

1. Please describe three characteristics of the Von Neumann architecture. (10%)

2. Let the operator "$" has higher priority than "#". (10%)
   (a) Please draw the tree representation for the expression (a#b) # c $(d#e)
   (b) Please convert the expression (a#b) # c $(d#e) to a prefix expression and a postfix expression.

3. Rewrite the following program segment using a **for** statement. In the body of your **for** statement, replace the conditional operator (**? :**) with a **if…else** statement. (6%)

```
while (--counter >= 1)
    System.out.println(counter % 2 == 0 ? "event" : "odd");
```

4. (9%)
   (a) Construct a Huffman tree and code for the following data:

character	**A**	**B**	**C**	**D**	**–**
Probability	**0.4**	**0.1**	**0.2**	**0.15**	**0.15**

   (b) Encode the text ABACABAD using the code from part (a).
   (c) Decode the text whose encoding is 100010111001010 using the code from part (a).

5. Given the recursive property $\binom{n}{k} = \begin{cases} \binom{n-1}{k} + \binom{n-1}{k-1} & 0 < k < n \\ 1 & k = 0 \text{ or } k = n \end{cases}$, please compute $\binom{4}{2}$ by using: (10%)
   (a) Divide-and-conquer technique
   (b) Dynamic-programming technique

6. Use the backtracking technique to find all combinations of the set of the numbers {6, 2, 3, 5, 4} that sum to W = 13 as efficient as possible. Please describe your promising function, and then show the pruned state space tree. (15%)

以下仍有試題

二、選擇題(20%，每題 2 分)

1. Which of the following is a functional programming language?
   (a) SQL
   (b) Prolog
   (c) Ada
   (d) LISP

2. Logic programming languages are also called _____ languages.
   (a) declarative
   (b) applicative
   (c) descriptive
   (d) imperative

3. programming has been used to write expert systems.
   (a) procedural
   (b) functional
   (c) applicative
   (d) logic

4. A _____ is a small text file that the Web server sends to the user’s browser and that gets stored on the user’s hard drive.
   (a) banner ad
   (b) cookie
   (c) portal
   (d) domain name

5.Computational models are also referred to as _____.
   (a) Turing models
   (b) simulation models
   (c) parity bits
   (d) alphabets

以下仍有試題

6-7 題請參考下列程式

A recursive algorithm is described below:

```
//-----------------------------------------------------
int fun(int x){
   if x=0
      return 0;
   else if x=1
      return 1;
   else
      return fun(x-1) +fun(x-2);
  }
//-----------------------------------------------------
```

6. In regard to the above recursive algorithm, please calculate the value of **fun(6**)?
   (a) 7
   (b) 8
   (c) 9
   (d) 10

7. In regard to the above recursive algorithm, how many times of the fun() will be called for running **fun(6)**?
   (a)15
   (b)20
   (c) 25
   (d) 30

8.Which of the following sorting technique is stable?
   (a) Quick sort
   (b) Selection sort
   (c) Insertion sort
   (d) Heap sort

9.What is the average time of merge sort algorithm to sort n elements ?
   (a) $O(n^2)$
   (b) O (n *log* n)
   (c) O(n)
   (d) O (*log* n)

10.Which of the following are true?
   (a)The time to delete a key from an AVL-tree with n keys is O (n*log*n)
   (b)The time to search a key from an AVL-tree with n keys is O (n)
   (c) The time to insert a key to an AVL-tree with n keys is O (*log*n)
   (d) In an AVL tree, the height of the left subtree and the height of the right subtree of a node R always equal

以下仍有試題

三、填充題(20%, 每格 2 分)

1-5 題請參考下列程式：
Please write down the outputs for the following program:

```
class Q1 {
   public static void main(String[] s) {
      System.out.println(m(10));   //本行輸出請在第 1 題作答
      System.out.println(m(20));   //本行輸出請在第 2 題作答
      System.out.println(m(30));   //本行輸出請在第 3 題作答
   }
   static int m(int x) {
      if (x > 15)
         if (x > 25)
            x += 1;
      else
         x += 2;
      return x;
   }
}
```

```
class Q2 {
   public static void main(String[] s) {
      System.out.println(m(10));   //本行輸出請在第 4 題作答
      System.out.println(m(20));   //本行輸出請在第 5 題作答
      System.out.println(m(30));
   }
   static int m(int x) {
      switch (x) {
         case 10: x += 1;
         case 20: x += 2;
      }
      return x;
   }
}
```

1.請寫輸出的內容_____

2.請寫輸出的內容_____

3.請寫輸出的內容_____

4.請寫輸出的內容_____

5.請寫輸出的內容_____

以下仍有試題

6-10 題請參考下列程式：

A QuickSort and swap C program are described below. Please fill some codes in the following Blank-Block (Block A ~ Block E) to complete the QuickSort C program.

```
//-------------------------------------------------------------
void swap(int *i, int *j)
{
      int temp;
      temp = *i;
      *i = *j;
      *j = temp;
}

void QuickSort(int *arr, int Lflag, int Rflag)
{
      int left, i, j, k, temp ;
      i = Lflag;
      j = Rflag + 1;
      if (i < j)
      {
            do {
                  do {
                        i++;
                  } while (  Block A          && i <= Rflag );
                  do {
                        j--;
                  } while (arr[j] >= arr[Lflag] &&  Block B          );
                  if (  Block C          )
                        swap(&arr[i], &arr[j]);
            } while( i < j );
            swap(  Block D          );
            QuickSort(  Block E          );
            QuickSort(arr, j+1, Rflag);
      }
}
//-------------------------------------------------------------
```

6. Block A: _____

7. Block B: _____

8. Block C: _____

9. Block D: _____

10. Block E: _____