國立臺中教育大學九十七學年度研究所碩士班

(含在職進修專班)招生考試

作業系統試題

適用學系:資訊科學學系

※ 共 **10** 題，每題 **10** 分

1. Describe the purpose of the command interpreter. Why is it usually separate from the kernel?

2. Describe the meaning of swapping.

3. What is the definition of a socket? What's its representation? Show the figure of communication using sockets.

4. In a computer system, a physical memory reference takes 200 nanoseconds. The paging system has its page table stored in memory. We add **translation look-aside buffer (TLB)** to reduce the overhead of page-table access. If **TLB** access takes 10 nanoseconds and 80 percent of all page-table references are found in the **TLB**, what is the effective paged memory reference time?

5. How many page faults would occur for the following page reference string if the virtual memory management system uses the **LRU** replacement algorithm? Assume there are four page frames and all frames are initially empty.

   Page reference string: 1,3,4,2,6,5,1,2,1,3,6,3,7,2,1,2,6,3,4,6,5,4,2

6. A disk drive has 200 cylinders, numbered from 0 to 199. Suppose that it is currently serving a request at cylinder 150 and the previous request was at cylinder 130. The queue of pending requests, in FIFO order, is 82, 113, 25, 48, 140, 189, 29, 77. What is the total distance (in cylinders) that the disk arm moves to serve all the pending requests if adopting the **SCAN** disk scheduling algorithm?

7. Consider the following processes:

Process	Arrival Time	Burst Time	Priority Value
P1	0	6	2
P2	1	4	1
P3	4	2	3
P4	7	3	4

(a) Suppose we are using a preemptive priority scheduler (high priority value for high priority).

(a.1)Write the execution order of these processes.

(a.2)What is the average waiting time?

(b) Now suppose we are using a preemptive Shortest-Job-First scheduler. (Please ignore the priority value).

(b.1)Write the execution order of these processes.

(b.2)What is the average waiting time?

8. The Readers-Writers Problem with semaphore

The readers-writers problem has several solutions. The simplest one requires that no reader will be kept waiting unless a writer has already obtained permission to use the shared data. In other words, no reader should wait for other readers to finish simply because a writer is waiting. In this solution, the reader processes share the following data structures:

semaphore **mutex, wrt;**

int **readcount;**

The semaphores **mutex** and **wrt** are initialized to **1**; **readcount** is initialized to **0**. The semaphore **wrt** is common to both **reader** and **writer** processes.

The code for a writer process is shown in Figure 1; the code for a reader process is shown in Figure 2. Please fill code in the Block-A, Block-B, Block-C, Block-D and Block-E. (2 points for each Block)

```
                            do {
                                wait(mutex);
                                [ Black-B ] ;
                                if (readcount == 1)
                                    [ Black-C ] ;
                                signal(mutex);
                                 . . .
                                // reading is performed
                                 . . .
                                wait(mutex);
do {                            readcount--;
    [ Black-A ] ;               if ( [ Black-D ] )
     . . .                          signal(wrt);
    // writing is performed     [ Black-E ] ;
     . . .                  }while (TRUE);
    signal(wrt);
}while (TRUE);
```

Figure 1 The structure of a writer process   Figure 2 The structure of a reader process

9. Please describe the Necessary Conditions of occurring process deadlock?

10. There are 4 types of resources (A, B, C and D resource) with many instances respectively in a system. Consider the following snapshot of a system:

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	6	2	0	3	6	2	0	5	5	0	1	2
P1	0	4	0	1	6	6	0	5				
P2	0	2	0	1	0	2	0	1				
P3	3	4	1	5	3	6	2	5				
P4	0	0	1	0	7	0	1	5				

Answer the following questions using the banker's algorithm:
(a) What is the content of the matrix Need? (3 points)
(b) Is the system in a safe state? Please describe the reason. (3 points)
(c) If a request from process P1 arrives for (3, 0, 0, 1), can the request be granted immediately? Please describe the reason. (4 points)

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(含在職進修專班)招生考試

計算機導論試題

適用學系：資訊科學學系

一、單選題 **(10%)**

1. Which one is not a basic construct for structured programming?
   (a) Sequential Construct (b) Combinational Construct
   (c) Conditional Construct (d) Iterative Construct

2. What would the following fragment code output?
   int sum = 7;
   sum = sum + sum*5/4;
   System.out.println(sum);
   (a) 15.75 (b) 35 (c) 15 (d) 61

3. Which of the following sort technique is *not* a stable sort?
   (a) Bubble sort (b) Insertion sort (c) Quicksort (d) Mergesort

4. What is the output of cout << (45&59) in C++?
   (a) 45&59 (b) 49 (c) 45 (d) 41

5. What would be the output of executing the following code?
   enum direction{forward, backward, upward, downward, left, right};
   direction My_Direction = downward;
   cout << My_Direction;
   (a) downward (b) 0 (c) null (d) 3

二、問答題

1. (10%) Complete the following table for 6-bit representations (including the sign bits) indicated below. Show your answers as signed based 10 integers.

	6-bit signed magnitude	6-bit excess 32
Largest number	+31	
Most negative number		
No. of distinct numbers		

2. (10%) Represent $(107.15)_{10}$ in a floating-point representation with a sign bit, a seven-bit excess 64 exponent, and a normalized 24-bit fraction in based 2. There is no hidden 1. Truncate the fraction by chopping bits as necessary (round toward zero).

3. (10%) Please draw the circuit by the Truth Table step by step. How many transistors are there in your circuit?

Input			Output
a	b	c	d
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

4. (10%) Using the following program to sort the sequence of number listed below. Please also show numbers which have been selected as pivots.

26   5   37   1   61   11   59   15   48   19

```
void Sort (Element *list, const int left, const int right)
{
    if (left < right) {
        int i = left, j = right+1, pivot = list[left];
        do {
            do i++; while (list[i] < pivot);
            do j--; while (list[j] > pivot);
            if (i < j)   swap (list[i], list[j]);
```

```
        } while (i < j)
        swap (list[left], list[j]);
        Sort (list, left, j–1);
        Sort(list, j+1, right);
    }
  }
```

5. (5%) Show the results of inserting 10, 3, 5, 16, 8, 15, 4, 19 into an initial empty binary search tree.

6. (5%) Please order the following function by growth rate in increasing order: N, N^2, $N^{1.5}$, 2^N, NlogN, $Nlog^2N$, Nlog(logN), $NlogN^2$.

7. (10%) Among *n* persons, a celebrity is defined as someone who is known by everyone but not know anyone. The problem is to identify the celebrity, if one exists, by asking questions only of the form, "Excuse me, do you now the person over there?" The assumption is that all the answers are correct. Can this problem be done in O(*n*) time? If yes, state the algorithm briefly. If no, state your reason and the best possible algorithm.

8. (10%) Please fill in the blank parts (A B C) in the following program fragment, which outputs a sequence of numbers, Fibonacci numbers, and rewrite it using while-loop.

```
int fn_1=0;
int fn=1;
cout << fn_1 << " " << fn << " ";
for (int count=2;count<=20;count++)   {
   fn += | Blank A | ;
   fn_1 = | Blank B |  - | Blank C |  ;
   cout << fn << " ";
}
```

9. (10%) Given a sorted array (int[] a) an an arbitrary number (int target), write a recursive function (int search(int target, int first, int last)) using binary search to determine if that number is a member of the array. Return -1 if the number is not found in the aray.
Assume you have made the following code, try to finish it with a recursive function and the body of function public int find(int target).

```
public class BinarySearch   {
   int[] a;
   public BinarySearch(int[] theArray)   {
```

```
        a = theArray;
    }

    public int find(int target)   {
      ...
    }
}
```

10. (10%) Consider the following Java program code:
==
```
public void swap(Dimension a1, Dimension a2)   {
    a1.width = 20;
    a1.height = 20;
    Dimension tmp = a1;
    a1 = a2;
    a2 = tmp;
    a1.width = 50;
    a1.height = 50;
}

public static void main (String[] args)   {
    Dimension d1 = new Dimension(30,40);
    Dimension d2 = new Dimension(0,0);
    System.out.println("Width: " + d1.width + " Height: " + d1.height);     //(I)
    System.out.println("Width: " + d2.width + " Height: " + d2.height);     //(II)
    swap(d1, d2);
    System.out.println("Width: " + d1.width + " Height: " + d1.height);     //(III)
    System.out.println("Width: " + d2.width + " Height: " + d2.height);     //(IV)
}
```
==
Please answer the following questions:
    (1) Please execute the the code manually and write down the output of the above code.
    (2) How does Java pass objects to functions?
        (a) Pass by address (b) Pass by name (c) Pass by reference (d) No such facility to pass
an object to a function

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離散數學試題

適用學系：資訊科學學系

※ 共 **10** 題。

1. (10%) Suppose that the password of a computer system must satisfy the following requirements: (*i*) each password must be *two* to *four* characters long; (*ii*) each character in the password must be a letter within the set {*a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *j*} or a digit (0-9); and (*iii*) each password must contain at least one digit (0-9). How many possible passwords are there for such a computer system?

2. (10%) Given the relation $R = \{(a, b) \mid a$ divides $b\}$, where a and b are positive integers, answer the following questions:

   (1) Prove that R is a partial order relation.　(6%)

   (2) Draw the Hasse diagram for R restricted to the set $\{1, 2, 3, 4, 5, 6, 7, 8, 9\}$. (4%)

3. (10%) Please answer the following questions for trees:

   (1) How many leaves does a full binary tree with 51 vertices have?　(4%)

   (2) How many vertices does a full 4-ary tree with 50 internal vertices have? (3%)

   (3) How many leaves does a complete 3-ary tree of height 5 have?　(3%)

4. (10%) Prove that $\displaystyle\sum_{0 \le k \le n} k(k-1)\binom{n}{k} = n(n-1)2^{n-2}$, where $n \ge 0$.

5. (5%) How many different strings can be made by reordering the letters of the words RESEARCH?

6.(10%) Solve the following equations.

(a) $\sum_{k=0}^{n} 2^k \binom{n}{k}$

(b) $\sum_{k=0}^{n} 3^k \binom{n}{k}$

7. (10%) Answer the following questions.

(a) Find a recurrence relation and give initial conditions for the number of bit strings of length n that do not contain two consecutive 1s.

(b) How many such bit strings are there of length seven?

8.(10%) (a) Use Kruskal's method to obtain a minimum cost spanning tree of the weighted graph of Figure 2. (b) What is the cost of the spanning tree of (a).
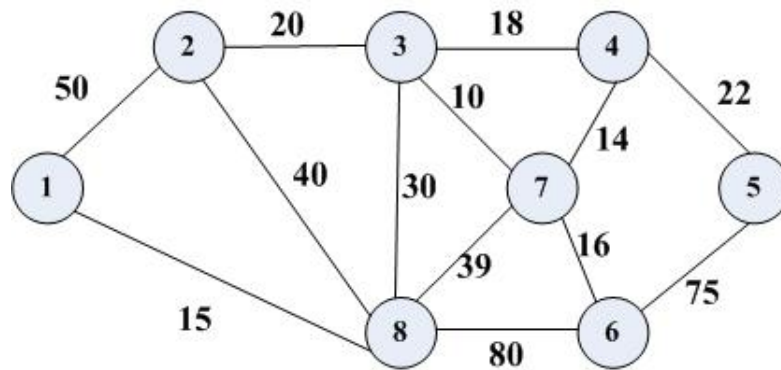

Figure 2

9. (10%) Compute a minimum coloring for the graphs given in Figure 3.

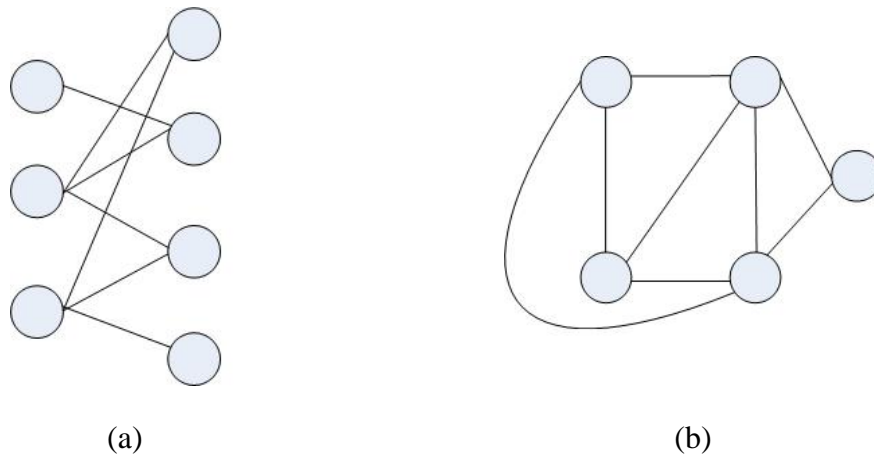(a)   (b)

Figure 3

10. (15%) For the graphs of Figure 4, do the following. (a) Obtain a BFS starting at vertex 1. (b) Obtain the cycle basis relative to the spanning tree of (a). (c) What is the cycle rank of the cycle basis obtained?
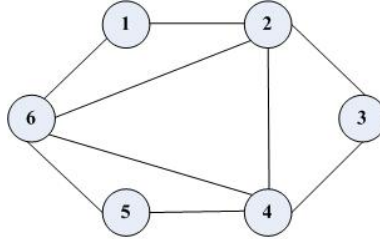

Figure 4