

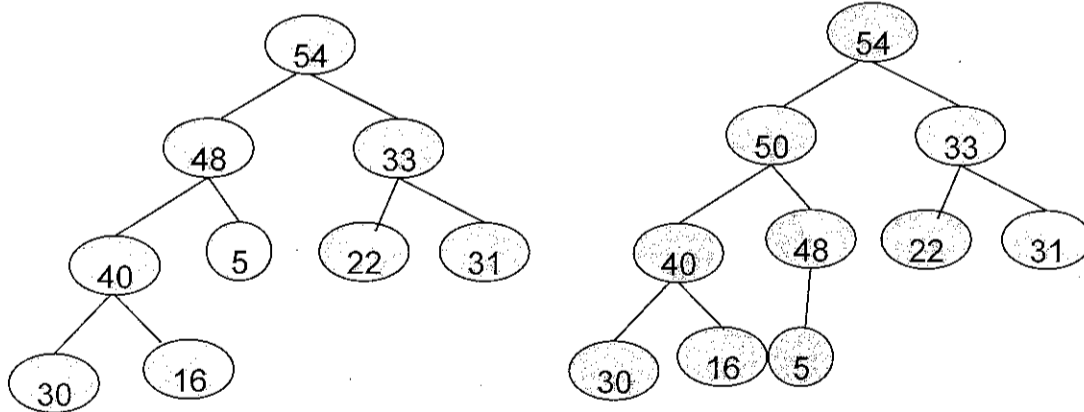
國立聯合大學 100 學年度碩士班考試招生

資訊管理研究所 入學考試試題

科目： 計算機概論 第 1 頁共 3 頁

本試卷共十題，每題十分。請依序標明題號作答。

1. Please answer the following questions.
 - a、 Convert 135_{10} in decimal representation into hexadecimal representation.
 - b、 Convert 101101_2 in binary representation into decimal representation.
 - c、 To represent a float point number in eight bits, we use a bit for sign, three bits for exponential part and four bits for mantissa. For example $1\ 010\ 1000$ is used to represent $-(1/2)*2^2 = -2$. What does 01101100 represent?
2. A binary tree has six nodes. The inorder traversal of the tree is DABFCE and preorder sequence is FDBAEC.
 - a、 Draw the binary tree.
 - b、 What is the postorder sequence of the tree?
3. Table normalization is a process of efficiently organizing data in a database. There are two goals of the normalization process: eliminating redundant data (for example, storing the same data in more than one table) and ensuring data dependencies make sense (only storing related data in a table). Both of these are worthy goals as they reduce the amount of space a database consumes and ensure that data is logically stored. The database community has developed a series of guidelines for ensuring that databases are normalized. These are referred to as normal forms and are numbered from 1NF through 5NF. Please discuss what are 1NF, 2NF and 3NF.?
4. A heap is a data structure in which the maximal or minimal value of a subtree is on the top. The following tree is an example of max-heap. When we insert a node, e.g. 50, then several parent-child switches are taken to maintain the heap.



Answer the following questions:

- a、 Please draw a max-heap for the sequence (11, 55, 33, 44, 66, 7, 22, 88).
 - b、 A new node with value 57 is inserted, what is the resulted heap?
5. Open Systems Interconnection (OSI) model is a reference model developed by ISO (International Organization for Standardization) in 1984. The seven layers of OSI model are Physical, Data link, Network, Transport, Session, Presentation and Application. What are the OSI's Layers of the followed network services mapped to? (e.g. Cable deployment \rightarrow Physical layer.)
 - a、 TCP(Transmission control protocol) \rightarrow
 - b、 IP(Internet protocol) \rightarrow
 - c、 Quality of service \rightarrow
 - d、 End-to-end transmission of Internet \rightarrow

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6. There are two representations can be used for multidimensional array declaration. For example, declaration `int arr[3][4][5]`; for column-major representation, `arr[1][1][1]` address is formulated as $\alpha + 3*4*1 + 3 * 1 + 1$. Now please answer the following questions.
- Obtain an addressing formula for the element `a[i1][i2...][in]` in an array declared as `a[u1][u2...][un]`. Assume a column-major representation of the array with one word per element and α the address of `a[0][0]...[0]`.
 - What the formula is when array is represented by row-major order?
7. Hash search is a data structure to quickly find out what we want. A hash function is used to calculate the address where data will be put to. For example, $f(x) = x \% 13$ can be used as a hash function, then data with value 15 will be put to the address 2. When the two values have same hash value, we need a collision handling to put one data to other address. Linear probe is a simple collision handling method by which the data will be put to the following first empty address. A data storage with 13 addresses and each address has two slots for storing data. If the hash function is $f(x) = x \% 13$, and collision handling is linear probe, what will the data be stored for the sequence (3, 6, 9, 12, 15, 2, 4, 19, 28) .
8. Trace the program listed below. Please output the results of `starting_pos[]`, `row_terms[]`, and `b[]`.

```
void fast_transpose(term a[ ], term b[ ])
{ int row_terms[MAX_COL], starting_pos[MAX_COL];
  int i, j, num_cols = a[0].col, num_terms = a[0].value;
  b[0].row = num_cols; b[0].col = a[0].row;
  b[0].value = num_terms;
  if (num_terms > 0){
    for (i = 0; i < num_cols; i++) row_terms[i] = 0;
    for (i = 1; i <= num_terms; i++) row_term [a[i].col]++;
    starting_pos[0] = 1;
    for (i = 1; i < num_cols; i++)
      starting_pos[i] = starting_pos[i-1] + row_terms [i-1];
    for (i = 1; i <= num_terms, i++) {
      j = starting_pos[a[i].col]++;
      b[j].row = a[i].col;
      b[j].col = a[i].row;
      b[j].value = a[i].value;
    }
  }
}
```

	a[]		
	row	col	value
a[0]	5	6	7
a[1]	0	0	15
a[2]	0	3	22
a[3]	0	5	-15
a[4]	1	1	11
a[5]	1	2	3
a[6]	2	3	-6
a[7]	4	2	2

9. Answer the following questions.

- What is the value of variable *counter* after the execution of the following program?

```
int counter = 0;
for( int i = 0; i < 10; i ++)
  for( int j = 5; j > 0; j --)
    counter ++;
```

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- b、 What is the value of variable *sum* after the execution of the following program?

```
int sum = 0;
for( int i = 1; i <= 100; i += 5)
    for( int j = 1; j < i; j++)
        sum += j;
```

10. QuickSort is a popular sorting algorithm.

- a、 Please implement the program to democat the algorithm. void QuickSort (int data[],int start, int end);
b、 Analysis the time complexity of your program in the worst case and average case.