

任课教师: _____

学号: _____

姓名: _____

班级: _____

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西 安 电 子 科 技 大 学

考试时间 120 分钟

试 题

题号	一	二	三	四	五	六	七	总分
分数								

1. 考试形式: 闭卷 ☒ 开卷 ☐
2. 考试日期: 年 月 日 (答题内容请写在装订线外)

Problem 1. Analysis of algorithms (15 points.)

Fill in the table to give the name and code framework of corresponding order-of-growth.

Order of growth	Name	Code framework
1	constant	<code>a = b + c;</code>
N	linear	<code>for (int i = 0; i < N; i++)</code> <code>{</code> ... <code>}</code>
logN		
NlogN		
N ²		

Problem 2. Union-Find. (14 points.)

Fill in the table below to give the contents of the `id[]` array and the number of connected components for each input pair when you use quick-find for the sequence 5-0 3-4 3-0 6-2 2-1 0-7 5-8.

input-pair	id[] array	number of connected components
5-0		
3-4		
3-0		
6-2		
2-1		
0-7		
5-8		

Problem 3. Sorting. (18 points.)

Fill in the table below to give the property of the sorting algorithms.

sorting algorithm	inplace ?	stable ?	time complexity in the worst case	optimal ?
selection sort	Yes	No	N^2	No
insertion sort	Yes	Yes	N^2	No
quick sort				
merge sort				
heap sort				

Problem 4. Binary search trees (BST). (8 points)

Fill in the blanks to complete the implementation of BST *Insert* operation.

```
public void put(Key key, Value val)
{
    root = put(root, key, val);
}

private Node put(Node x, Key key, Value val)
{
    if (x == null)
        _____;

    int cmp = key.compareTo(x.key);

    if (cmp < 0)
        _____;

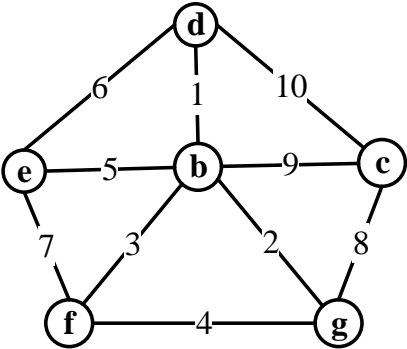
    else if (cmp > 0)
        _____;

    else
        _____;

    return x;
}
```

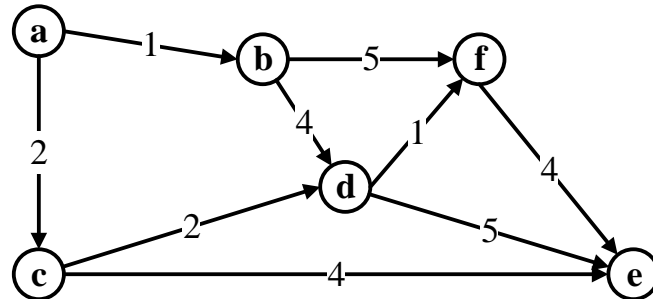
Problem 5. Minimum spanning trees (MST). (15 points.)

Consider the following edge-weighted graph G with 6 vertices and 10 edges. Give the process of computing the MST of G by using Kruskal's algorithm.



Problem 6. Shortest paths. (15 points)

Give an edge-weighted digraph shown below, write the process of computing the shortest paths from the vertex **a** to every other vertex by using Dijkstra's algorithm.



Problem 7. Algorithm design. (15 points.)

Given an array $a[]$ of N numbers, design an algorithm to find the k th smallest number in $a[]$. For example, if $a[] = \{5, 2, 1, 8, 1, 3\}$, then the fourth smallest number is 3. Your answer will be graded on correctness, efficiency and clarity.

附：单词释义表

题目	单词释义
1	order-of-growth 增长量级；
2	sequence 序列； connected components 连通分量；
3	property 性质；
4	implementation 实现；
5	vertex (vertices) 顶点；
6	digraph 有向图；
7	correctness, efficiency and clarity 正确性、效率和清晰度