

数据结构与算法实验报告

实验三



学 生：

学 号：

年 级：2023

专 业：软件工程

重庆大学大数据与软件学院

2024 年 11 月 9 日

1. 实验目的：

- 练习各种排序算法的实现。
- 掌握调试程序的方法，跟踪程序的执行过程。

2. 实验要求

- 完成实验中要求的内容，**实验报告书写格式尽量美观整洁**。
- 所有程序需经过上机调试通过。
- 注意程序编写规范，如：必要的注释行，缩进排列等。
- 提交项目压缩包和实验报告。

3. 实验内容：

实现插入排序、选择排序、冒泡排序、希尔排序、归并排序、快速排序算法，并编写程序进行测试。

选做：

- (1) 使用上述排序算法对长度为 n 的数组进行排序，比较 n 值不同时算法的执行时间。
- (2) 设计程序对上述排序算法执行过程中的比较次数、交换次数进行统计。
- (3) 实现堆排序，并与上述排序算法进行比较。

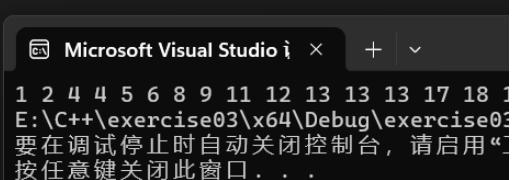
4. 核心代码和实验结果

代码见压缩包

```
using namespace std;
int main()

    mt19937 rng(std::random_device{}());
    uniform_int_distribution<int> dist(1, 1000);
    vector<int> data;
    const int numElements = 1000;
    for (int i = 0; i < numElements; ++i) {
        data.push_back(dist(rng));
    }
    inssort<int, IntLess>(data.data(), 1000);
    for (int i = 0; i < 20; i++)
    {
        cout << data[i] << " ";
    }

    return 0;
```



The screenshot shows the Microsoft Visual Studio interface with the title bar "Microsoft Visual Studio". In the center, there is a terminal-like window displaying the sorted sequence of integers from 1 to 18. The text in the window is as follows:

```
1 2 4 4 5 6 8 9 11 12 13 13 13 17 18 19  
E:\C++\exercise03\x64\Debug\exercise03.exe  
要在调试停止时自动关闭控制台，请启用“按任意键关闭此窗口...”
```

实验三

The screenshot shows three separate code editors within Microsoft Visual Studio, each displaying a different sorting algorithm. The top editor contains selection sort code, the middle editor contains bubble sort code, and the bottom editor contains shell sort code. Each editor has its own status bar showing the file path and process ID.

Top Editor (Selection Sort):

```
mt19937 rng(std::random_device{}());
uniform_int_distribution<int> dist(1, 1000);
vector<int> data;
const int numElements = 1000;
for (int i = 0; i < numElements;
| data.push_back(dist(rng));
}
selsort<int, IntLess>(data, data
for (int i = 20; i < 40; i++)
{
    cout << data[i] << " ";
}

return 0;
```

Middle Editor (Bubble Sort):

```
mt19937 rng(std::random_device{}());
uniform_int_distribution<int> dist(1, 1000);
vector<int> data;
const int numElements = 1000;
for (int i = 0; i < numElement
| data.push_back(dist(rng));
}
bubsort<int, IntLess>(data, dat
for (int i = 40; i < 60; i++)
{
    cout << data[i] << " ";
}

return 0;
```

Bottom Editor (Shell Sort):

```
mt19937 rng(std::random_device{}());
uniform_int_distribution<int> dist(1, 1000);
vector<int> data;
const int numElements = 1000;
for (int i = 0; i < numEleme
| data.push_back(dist(rng));
}
shellsort<int, IntLess>(data, da
for (int i = 60; i < 80; i++)
{
    cout << data[i] << " ";
}

return 0;
```

实验三

The screenshot shows two instances of Microsoft Visual Studio. The left instance displays a C++ code editor with the following content:

```
int main()
{
    mt19937 rng(std::random_device{}());
    uniform_int_distribution<int> dist(1, 1000);
    vector<int> data;
    const int numElements = 1000;
    for (int i = 0; i < numElements; ++i) {
        data.push_back(dist(rng));
    }
    int a[1000] = { 0 };
    mergesort<int, IntLess>(data.data(), a, 0, 999);
    for (int i = 60; i < 80; i++)
    {
        cout << data[i] << " ";
    }

    return 0;
}
```

The right side of the interface shows the Solution Explorer with files: inssort.cpp, merg...cpp (selected), selsort.cpp, shsort.cpp, book.h, and com.h. The bottom window shows the output of the program execution:

```
77 77 79 80 81 82 83 83 84 87 89 89 90 90 92 93 94 99 100 101
E:\C++\exercise03\x64\Debug\exercise03.exe (进程 20348)已退出, 你要在调试停止时自动关闭控制台, 请启用“工具”->“选项”->“调试”->“调试按任意键关闭此窗口. . .
```

The second instance of Visual Studio shows a similar setup with a different code editor content:

```
mt19937 rng(std::random_device{}());
uniform_int_distribution<int> dist(1, 1000);
vector<int> data;
const int numElements = 1000;
for (int i = 0; i < numElements; ++i) {
    data.push_back(dist(rng));
}
int a[1000] = { 0 };
qsort<int, IntLess>(data.data(), 0, 999);
for (int i = 60; i < 80; i++)
{
    cout << data[i] << " ";
}

return 0;
```

The right side shows the Solution Explorer with files: book.h, bubs..t.cpp, compare.h, inssort.cpp, merg...cpp, qsort.cpp (selected), and selsort.cpp. The bottom window shows the output of the program execution:

```
56 57 58 58 60 60 61 62 65 65 66 69 70 73 73 74 74 76 76 80
E:\C++\exercise03\x64\Debug\exercise03.exe (进程 10300)已退出, 你要在调试停止时自动关闭控制台, 请启用“工具”->“选项”->“调试”->“调试按任意键关闭此窗口. . .
```