实验二实验报告

221275023 朱奕冰

任务一：每日资金流入流出统计

根据 user_balance_table 表中的数据，编写MapReduce程序，统计所有用户每日的资金流入与流出情况。资金流入意味着申购行为，资金流出为赎回行为 。

程序设计思路如下：

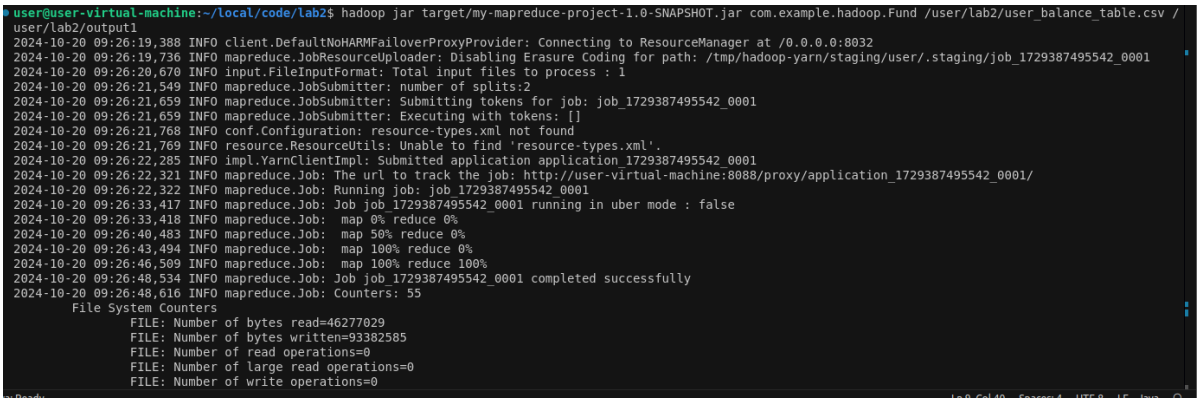
map任务：在map任务中，利用spilt函数对每行进行分割，随后取出相应的日期以及资金流入流出列，将流入与流出的资金拼接为字符串作为Text对象，利用context.write进行传输即可

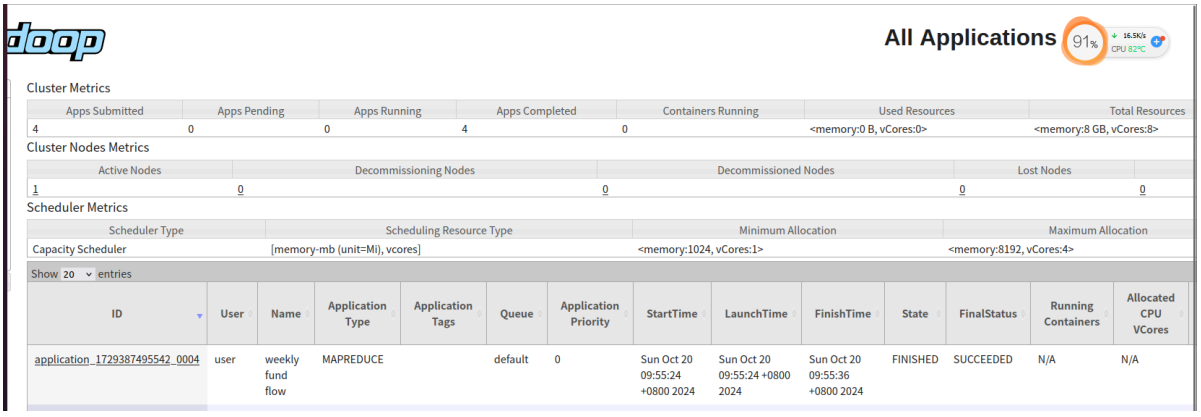
```
public void map(Object key, Text value, Context context) throws IOException,
InterruptedException {
            String line = value.toString();
            String[] fields = line.split(",");  // 假设字段是用逗号分隔的
            if (fields.length < 6) { // 确保有足够的字段
                return; // 忽略无效行
            }
            String mfd_date = fields[1].trim();  // 日期
            String total_purchase_amt = fields[4].trim();  // 资金流入
            String total_redeem_amt = fields[5].trim();  // 资金流出
            // 如果字段缺失，视为零
            if (total_purchase_amt.isEmpty()) {
                total_purchase_amt = "0";
            }
            if (total_redeem_amt.isEmpty()) {
                total_redeem_amt = "0";
            }
            // 输出格式：<日期>    <资金流入量,资金流出量>
            dateKey.set(mfd_date);
            flowValues.set(total_purchase_amt + "," + total_redeem_amt);
            context.write(dateKey, flowValues);
        }
    }
```

在reduce任务中，只需获取资金流入/流出值，进行累加求和即可。最终利用context.write作为最终输出。

```
try {
                    // 尝试解析资金流入和流出的值
                    double inflow = Double.parseDouble(flowAmounts[0]);
                    double outflow = Double.parseDouble(flowAmounts[1]);

                    // 仅在解析成功后累加
                    totalInflow += inflow;
                    totalOutflow += outflow;
                } catch (NumberFormatException e) {
                    System.err.println("Skipping invalid numbers: " +
val.toString());
                    continue; // 跳过无法解析的值
                }
```

```
            }

            // 输出最终的资金流入和流出总额
            result.set(totalInflow + "," + totalOutflow);
            context.write(key, result);
        }
```





c0a66d397247a83042c8e0a7b503ed7

任务二：星期交易量统计

基于任务一的结果，编写MapReduce程序，统计一周七天中每天的平均资金流入与流出情况，并按照资金流入量从大到小排序。

程序设计思路如下：

定义由日期向星期的转换函数，将其作为map的辅助方法。Java的包time.format.DateTimeFormatter可以实现日期的解析。

```
private String getWeekday(String dateStr) {
            DateTimeFormatter formatter =
DateTimeFormatter.ofPattern("yyyyMMdd");
            LocalDate date = LocalDate.parse(dateStr, formatter);
            return date.getDayOfWeek().name(); // 获取星期几的名称
        }
```

由于利用的是任务1的输出文件，所以将输入类型确定为KeyValueTextInputFormat.class，有利于后续处理。

`job.setInputFormatClass(KeyValueTextInputFormat.class);`

在map任务中，需要调用该函数，将日期转换为相应的星期，进行传输

```
public void map(Text key, Text value, Context context) throws IOException,
InterruptedException {
            String dateStr = key.toString().trim(); // 日期 (key)
            String[] flowAmounts = value.toString().split(","); // 输入格式 v,v

            if (flowAmounts.length < 2) {
                return; // 忽略无效行
            }
            String total_purchase_amt = flowAmounts[0].trim(); // 资金流入
            String total_redeem_amt = flowAmounts[1].trim(); // 资金流出
            try {
                String weekday = getWeekday(dateStr);
                weekdayKey.set(weekday);
                flowValues.set(total_purchase_amt + "," + total_redeem_amt);
                context.write(weekdayKey, flowValues);
            } catch (DateTimeParseException e) {
                // 记录异常，但不使任务失败
                System.err.println("Invalid date format for input: " + dateStr);
            }
        }
```

为了实现输出的排序，定义辅助类以便后续处理，包含星期以及平均资金流入/流出。并且定义列表，用于存储reduce时统计的数据信息

```
public static class WeekData {
            String week;
            double avgInflow;
            double avgOutflow;

            WeekData(String week, double avgInflow, double avgOutflow) {
                this.week = week;
                this.avgInflow = avgInflow;
                this.avgOutflow = avgOutflow;
            }
        }
```

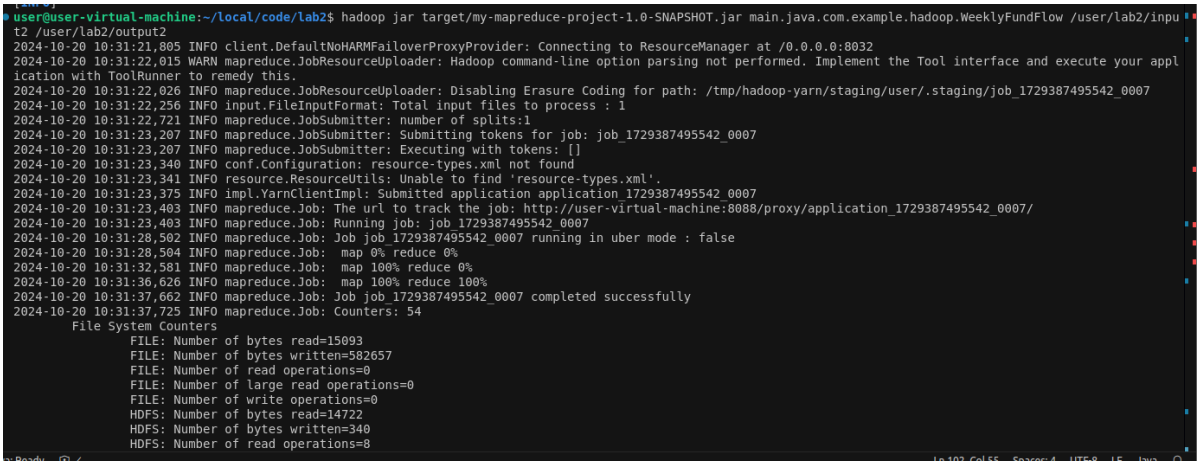
在reduce任务中进行统计求和，并且求平均，将结果存入list当中

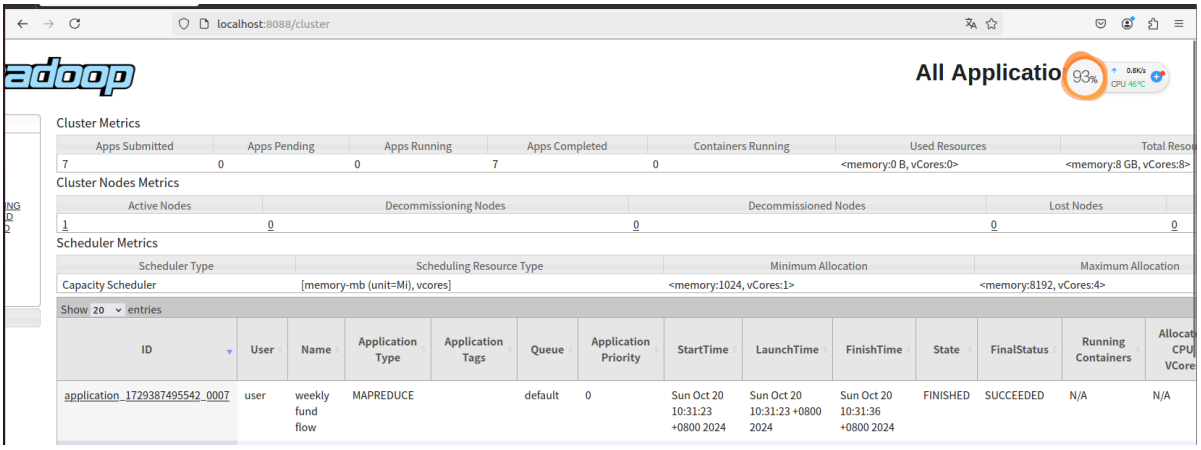
```
public void reduce(Text key, Iterable<Text> values, Context context) throws
IOException, InterruptedException {
            double totalInflow = 0.0;
            int count = 0;
            double totalOut = 0.0;
            for (Text val : values) {
                String[] flowAmounts = val.toString().split(",");
                double inflow = Double.parseDouble(flowAmounts[0]); // 获取资金流入
量
                double outflow = Double.parseDouble(flowAmounts[1]);
                totalInflow += inflow;
                totalOut += outflow;
                count++;
            }

            // 计算平均值
```

```
            double avgInflow = totalInflow / count;
            double avgOut = totalOut / count;

            // 将平均值和星期添加到列表中
            weekDataList.add(new WeekData(key.toString(), avgInflow, avgOut));
        }
```

由于总共7个数据，排序开销小，因此直接在cleanup阶段，调用sort函数利用数组实现排序即可。

```
@Override
        protected void cleanup(Context context) throws IOException,
InterruptedException {
            // 对列表进行排序，按 avgInflow 从大到小排序
            Collections.sort(weekDataList, new Comparator<WeekData>() {
                public int compare(WeekData w1, WeekData w2) {
                    return Double.compare(w2.avgInflow, w1.avgInflow); // 降序排序
                }
            });

            // 输出排序后的结果
            for (WeekData weekData : weekDataList) {
                result.set(weekData.avgInflow + "," + weekData.avgOutflow);
                context.write(new Text(weekData.week), result);
            }
```





278074c0e9430be7a6dc07f2f406849

任务三：用户活跃度分析

根据 user_balance_table 表中的数据，编写MapReduce程序，统计每个用户的活跃天数，并按照活跃天数降序排列。

该任务与任务一类似，根据map阶段读取的数据，判断当天用户是否活跃，若活跃将key=userid，value=1，进行写出即可。

```
            userKey.set(user);
            if (directPurchaseAmt > 0 || totalRedeemAmt > 0) {
                context.write(userKey, new Text("1"));  // 活跃用户输出 "1"
            }
```

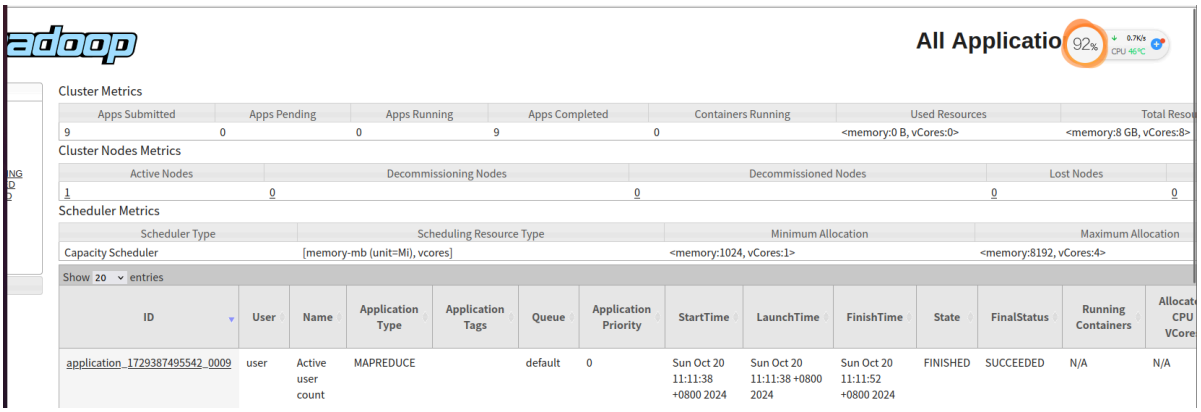
reduce阶段，进行求和与计数

```
public void reduce(Text key, Iterable<Text> values, Context context) throws
IOException, InterruptedException {
            int sum = 0;
            for (Text val : values) {
                sum += Integer.parseInt(val.toString()); // 将 Text 转换为 String，
再解析为 int
            }
            userActivityList.add(new UserActivity(key.toString(), sum));
        }
```

在最终输入的排序上，可以再编写一个mapreduce任务，利用key-value反转进行排序，也可以在cleanup时原地排序，这里采用直接原地排序的方法

```
@Override
        protected void cleanup(Context context) throws IOException,
InterruptedException {
            // 对用户按活跃天数进行降序排序
            Collections.sort(userActivityList, new Comparator<UserActivity>() {
                @Override
                public int compare(UserActivity u1, UserActivity u2) {
                    return Integer.compare(u2.activeDays, u1.activeDays); // 降序
                }
            });
             // 输出排序后的结果
            for (UserActivity userActivity : userActivityList) {
                context.write(new Text(userActivity.userId), new
Text(String.valueOf(userActivity.activeDays)));
            }
        }
```

```
user@user-virtual-machine:~/local/code/lab2$ hadoop jar target/my-mapreduce-project-1.0-SNAPSHOT.jar main.java.com.example.hadoop.Active /user/lab2/user_balance
_table.csv /user/lab2/output3
2024-10-20 11:11:36,542 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at /0.0.0.0:8032
2024-10-20 11:11:36,748 INFO mapreduce.JobResourceUploader: Disabling Erasure Coding for path: /tmp/hadoop-yarn/staging/user/.staging/job_1729387495542_0009
2024-10-20 11:11:36,949 INFO input.FileInputFormat: Total input files to process : 1
2024-10-20 11:11:37,831 INFO mapreduce.JobSubmitter: number of splits:2
2024-10-20 11:11:38,330 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1729387495542_0009
2024-10-20 11:11:38,330 INFO mapreduce.JobSubmitter: Executing with tokens: []
2024-10-20 11:11:38,476 INFO conf.Configuration: resource-types.xml not found
2024-10-20 11:11:38,476 INFO resource.ResourceUtils: Unable to find 'resource-types.xml'.
2024-10-20 11:11:38,513 INFO impl.YarnClientImpl: Submitted application application_1729387495542_0009
2024-10-20 11:11:38,539 INFO mapreduce.Job: The url to track the job: http://user-virtual-machine:8088/proxy/application_1729387495542_0009/
2024-10-20 11:11:38,539 INFO mapreduce.Job: Running job: job_1729387495542_0009
2024-10-20 11:11:43,653 INFO mapreduce.Job: Job job_1729387495542_0009 running in uber mode : false
2024-10-20 11:11:43,655 INFO mapreduce.Job:  map 0% reduce 0%
2024-10-20 11:11:47,725 INFO mapreduce.Job:  map 50% reduce 0%
2024-10-20 11:11:49,745 INFO mapreduce.Job:  map 100% reduce 0%
2024-10-20 11:11:52,785 INFO mapreduce.Job:  map 100% reduce 100%
2024-10-20 11:11:53,822 INFO mapreduce.Job: Job job_1729387495542_0009 completed successfully
2024-10-20 11:11:53,894 INFO mapreduce.Job: Counters: 54
        File System Counters
                FILE: Number of bytes read=3363569
                FILE: Number of bytes written=7555755
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
```



a3917a1f76f8064edd4e875c18090b0

任务四：交易行为影响因素分析

在本任务中尝试基于任务三的结果与user_profile进行结合分析，探究星座对用户活跃程度的影响，即统计每个星座用户的平均活跃天数。

为了实现由用户id到星座的映射，将user_profile文件存到hdfs中，并构建用用户id到用户星座的映射表

此操作在setup阶段进行

```
        @Override
        protected void setup(Context context) throws IOException,
InterruptedException {
            Configuration conf = context.getConfiguration();
            Path path = new Path(conf.get("zodiac.file.path"));
            FileSystem fs = FileSystem.get(conf);
            FSDataInputStream inputStream = fs.open(path);
            BufferedReader reader = new BufferedReader(new
InputStreamReader(inputStream));
            String line;
            while ((line = reader.readLine()) != null) {
                String[] fields = line.split(",");
                if (fields.length >= 4) { // 确保有足够的字段
                    String userId = fields[0];
                    String zodiacSign = fields[3]; // 假设星座在第四列
                    zodiacMap.put(userId, zodiacSign);
                } else {
                    System.err.println("Invalid line format: " + line);
                }
            }

            reader.close();
            inputStream.close();
```

```
        }
```

在map阶段，将key从用户id映射至其星座

```
@Override
        protected void map(Text key, Text value, Context context) throws
IOException, InterruptedException { // 修改 LongWritable 为 Text
            String userId = key.toString();
            long activeDays = Long.parseLong(value.toString()); // 将 Text 转换为
long

            String zodiacSign = zodiacMap.get(userId);

            if (zodiacSign != null) {
                context.write(new Text(zodiacSign), new
LongWritable(activeDays));
            }
        }
    }
```

reduce阶段只需求均值即可

```
public static class AvgActiveDaysReducer extends Reducer<Text, LongWritable,
Text, Text> {
        @Override
        protected void reduce(Text key, Iterable<LongWritable> values, Context
context) throws IOException, InterruptedException {
            long totalActiveDays = 0;
            int count = 0;

            for (LongWritable value : values) {
                totalActiveDays += value.get();
                count++;
            }

            double averageActiveDays = count > 0 ? (double) totalActiveDays /
count : 0;
            context.write(key, new Text(String.format("%.2f",
averageActiveDays)));
        }
    }
```

为了实现全局路径参数传递，需要在main类中设置user_profile的路径参数

```
conf.set("zodiac.file.path", args[2]); // 从命令行获取星座文件路径

        Job job = Job.getInstance(conf, "Zodiac Average Active Days");
```

最终执行结果为f56b5e00b2b0c0013a3a7b51a7f62b4

c65090c9d0623ae80cd480305832e01

由此可见星座对用户的活跃水平影响并不显著，所有星座的用户活跃天数均值都在（20，24）天内。