功能测试报告

1.用户界面初始化

```
reading blocks...
Time taken by reading blocks: 11991 microseconds
reading transactions...
Time taken by reading transactions: 14067964 microseconds
getting graph...
Time taken by getting graph: 10150811 microseconds
now, please choose type:
input: 2:data search /3:data analysis /4:input data. /5:quit
```

初始化部分总用时约为24秒，其中读入交易14秒，完成图的构建10秒。

2.输入鲁棒性检查

2.1初始界面

根据提示应该输入2，3，4，5中的一个数字。

```
input: 2:data search /3:data analysis /4:input data. /5:quit
abcd
invalid input, please try again
input: 2:data search /3:data analysis /4:input data /5:quit.
13
please input the right type:
input: 2:data search /3:data analysis /4:input data /5:quit.
```

测试输入样例：

`13`:非要求的数字。

`abcd`:字符串。

二者都能被正确处理。

2.1 细分功能界面

以数据选择类型2为例子

```
input: 2:data search /3:data analysis /4:input data. /5:quit
2
please input the type you want to search:
1:search a user's top k transactions
2:search a user's balance at a time
3:search the richest people at a time
5
invalid, please try again
Time taken by this operation: 2371440 microseconds(including the time you choose options)
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
2
please input the type you want to search:
1:search a user's top k transactions
2:search a user's balance at a time
3:search the richest people at a time
asdv
invalid input, please try again!
2
please input the user and time you want to search:
```

进入2级别菜单后，可以看见也做了同样的处理。

对所有的此部分都进行了相同的提高鲁棒性处理，能够解决输入类型不匹配，输入不按要求的问题。

就不一一展示了

3.功能检测

3.2 数据搜索功能

3.2.1账户转入转出记录

测试输入：

`2` `1` `0` `100000000000` `10` `1VayNert3x1KzbpzMGt2qdqrAThiRovi8`

显示用户数额最大的前十笔交易。

```
Enter 'start_time': 0
Enter 'end_time': 1000000000000
Enter 'k'(k>0): 10
Enter 'name': 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
Username:1VayNert3x1KzbpzMGt2qdqrAThiRovi8
The top10transactions:
rank: 1 time: 1344059131 amount: 991.153
from: 1LURx4Z8Ch4rqRT84fDvEqPfLGw7gudWqR to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 2 time: 1344139397 amount: 945.379
from: 17KpM7knQGHbdPQ4ByHEbPiL2h4VcRDmiE to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 3 time: 1344252459 amount: 875.604
from: 1CvXrKy24249UuyuyVCpdKmA8fiu6x9ofD to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 4 time: 1344265273 amount: 867.381
from: 14vBa2zCm4Nj1KBFgtdKzc6EAFSridHrWA to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 5 time: 1344272785 amount: 863.601
from: 1L2tnrRDP36zwRFzF1Ym95UAqgf4Y2TaRf to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 6 time: 1344276160 amount: 863.571
from: 15k1QLFU5CtjNjPmdCEEm89wib3e7hpBLM to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 7 time: 1344341603 amount: 848.237
from: 1KAzqnX8fDHTAfx38Cvwip1Knq4A39qbRB to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 8 time: 1344373792 amount: 841.13
from: 1DYR5mNSkZmbapdFqxBsvYHdmeogPBzQ5N to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 9 time: 1344430970 amount: 809.82
from: 191Ndhqrgu4HazeaXBzKdsgfsvZeTazymh to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
rank: 10 time: 1344454223 amount: 794.732
from: 12NhPrqAzrZRdL93pn2xDUiha1h8YRjn7k to 1VayNert3x1KzbpzMGt2qdqrAThiRovi8
total transaction number:9017
Time taken by this operation: 12263582 microseconds(including the time you choose options)
```

3.2.2 余额查询

测试输入：

`2` `2` `1VayNert3x1KzbpzMGt2qdqrAThiRovi8` `1000000000000`

查询该用户在1000000000时刻的账户资金

```
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
2
please input the type you want to search:
1:search a user's top k transactions
2:search a user's balance at a time
3:search the richest people at a time
2
please input the user and time you want to search:
please input name:
1VayNert3x1KzbpzMGt2qdqrAThiRovi8
please input time:
1000000000000
balance now:434322
Time taken by this operation: 10797061 microseconds(including the time you choose options)
```

3.2.3 福布斯榜单

测试输入：

`2` `3` `100000000000` `10`

显示输出在100000000000时间时的`top10`

```
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
2
please input the type you want to search:
1:search a user's top k transactions
2:search a user's balance at a time
3:search the richest people at a time
3
please input time:
100000000000
please input k:
10
rank:1 name: 1VayNert3x1KzbpzMGt2qdqrAThiRovi8 money: 434322
rank:2 name: 122semdHkeMzS1naK83wVxW2DgpM2CvUfX money: 135140
rank:3 name: 1Q7L195hFoiEARiAyNu8XntJbFXDLMxyB9 money: 60000
rank:4 name: 13TUWDE7foufgGNMsMqXHf9xpPUhoeMzNJ money: 58333.5
rank:5 name: 1K6xtaY8VqfEYQqnWHpFJnhdcbAj4Tw4uu money: 58309.6
rank:6 name: 1JLreuLdmkNjp5c8ssXr8MZPxigPpSLNSq money: 57997.1
rank:7 name: 1LAKupP8bN882Uy6oaGuiKYu6gkJBVZUZu money: 57979.4
rank:8 name: 1BpPKrzXqbyHSt9uJRmzjfAHoPCHuX72zG money: 57900.7
rank:9 name: 1JYUy1j9GXW4LAPg3yV6EbfhbctmgKQSLq money: 57771.2
rank:10 name: 1ESAwctdKc3z44wGpUG3GcPBLNSFZCGQfz money: 57644.4
Time taken by this operation: 3599488 microseconds(including the time you choose options)
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
```

3.2 数据分析

3.3.1 建图，初始化阶段已经完成

3.3.2出入度统计

测试输入：

`3` `2` `10`

输出前十的出入度，以及平均的入度和出度。

```
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
3
please input the type you want to analysis:
2:count the average out_degree/in_degree and output the top k nodes
3:judge whether there is a circle in the graph
4:use Dijkstra algorithm to find the shortest path from a node to other nodes
2
please input k:
10
The average out_count:1.19496
The average in_count:1.19496
rank:1 name: 14LBBe1WXT9Guvjxjx17h7xtfivqEaaEy9 money: 675
rank:2 name: 1B8LUcw6kTMafvyFHqBsF9PFwWgTDLteS1 money: 144
rank:3 name: 1LhPD3nQy7YJkrqNGyWMTjvWKGNVaHuhCq money: 128
rank:4 name: 186xHyf4F85YCzuP6JKwgg1kef63uvDkHM money: 118
rank:5 name: 14XP4yH5i11gfewSziHjb6iEzSy5wcW7Zi money: 112
rank:6 name: 1AEVYDvLExdgUY3FwY2BzUH2LR3Ecdvdpp money: 101
rank:7 name: 1Lw58CM9rrrwqR4tSYfboSJkZjSxqzfzmK money: 90
rank:8 name: 16pDMLwmqmh5Lawuft4speRNHUCaXQS5rQ money: 86
rank:9 name: 1EeCrLkfx2oTmAxneZFaTvGWjVaNb8aEbL money: 80
rank:10 name: 1K566E1VvhH2vhufZS3RCakLJSuwQDesYu money: 80
Time taken by this operation: 10860346 microseconds(including the time you choose options)
```

3.3.3判断环

测试输入：

`3` `3`

输出判断结果。

```
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
3
please input the type you want to analysis:
2:count the average out_degree/in_degree and output the top k nodes
3:judge whether there is a circle in the graph
4:use Dijkstra algorithm to find the shortest path from a node to other nodes
3
NO
Time taken by this operation: 251340 microseconds(including the time you choose options)
```

3.3.4 dijkstra算法查找最短路径

测试输入：

`3` `4` `1EeCrLkfx2oTmAxneZFaTvGWjVaNb8aEbL`

寻找点的所有可达到顶点以及最短路径（本例共约80个结点）

```
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
3
please input the type you want to analysis:
2:count the average out_degree/in_degree and output the top k nodes
3:judge whether there is a circle in the graph
4:use Dijkstra algorithm to find the shortest path from a node to other nodes
4
please input the name you want to search:
1EeCrLkfx2oTmAxneZFaTvGWjVaNb8aEbL
nodename: 129iC9YmhF9vQKFuUeRnRiqaBSGakBZkid node_dist: 0.02
nodename: 12BT2PpRuNtVJMo4NmPZEigV8VkfiJCbLu node_dist: 0.01
nodename: 12biVCVXsm9hoL25rqE6Dpyb3jJdwbT5Aw node_dist: 0.02
nodename: 131vwRkwbsGejL2NqeYnH4DssLeujFwckw node_dist: 0.01
nodename: 13Hc3BdTsuBk3rb9x55LW2PponkXaY1f4y node_dist: 0.02
nodename: 13ewo5aSye57TDYfA5bPuvq8nic7Nm5mcd node_dist: 0.02
nodename: 13roSuwtMbCX8HZMGJ6j8sXLr7GnPYmREk node_dist: 1
nodename: 144E2sZwbZrtK7N3xj5q3dcsmis5RR6J6p node_dist: 1
nodename: 14fCdHpWfX2a63ikbwmW9jDApHKAcWz855 node_dist: 0.02
nodename: 14kLVsSz6g8JD736iesWzLzW3FS36EjXrG node_dist: 0.02
nodename: 15CrBRzgFio8RarEcRRvKDLX9ciehzptEH node_dist: 0.02
nodename: 15KzjPFFMa7o515fpsdgcdtPF8nfqtMLC8 node_dist: 0.1
nodename: 15j2cmRuWUgNiXgimwQAJ588SV4V9HoVWM node_dist: 1.01
nodename: 15w9fcWgkHF7Gz79RCYE5VmSwPG5pGWv71 node_dist: 5.03
nodename: 15y5KtJ87taJUywRMHpVDfcDe2VfhGkE3A node_dist: 0.01
nodename: 16mknJcKR9QBMMe6UqxJMesYPVJsidnobC node_dist: 0.03
nodename: 16qatygnwU7mt4iyPMu1JGd6rM1KdHHC7i node_dist: 0.5
nodename: 16rRZEey8RuN6ttFE6Hwo6gnKkxRq5sTbv node_dist: 0.01
nodename: 176umQcueELRQzRLG51UPNRJVPmUiuVS3S node_dist: 0.02
nodename: 17RhPB82C4cCVeai6hUH1N5TLxE6wHQVaD node_dist: 0.32
nodename: 1875VmSc8CtBA1rT75tJVcPrsPZWdN7dRG node_dist: 0.01
```

```
nodename: 18FarTATpLGqZPEGE7gCNeRirLMnnbrqbe node_dist: 0.31
nodename: 18K126va1WmAPhzetyT9CkzB8Z796VDoVG node_dist: 1
nodename: 18XtbfT6BWmc2t1CKXnCNYLdvxk5AuMB76 node_dist: 0.01
nodename: 19JmF9oRbxShpTw5qMQUepUBQMLkYh5LvD node_dist: 0.05
nodename: 19MySHeKH3yBfZFy6wJoaHvqxVrhQbSQK9 node_dist: 0.04
nodename: 19jZ3BPomj6c86AfC1Lv5YhkcLm2yGDEYQ node_dist: 0.02
nodename: 19zvzY4b7xq93SmNSNL3SLVuXp8DsWXuCE node_dist: 0.03
nodename: 1A3YzojxaAW54TuUwxwMsQkVV64g46S3ND node_dist: 0.02
nodename: 1A4rsAR8KVbp3DVYxBMYKi72ZAGWXq6PtA node_dist: 0.01
nodename: 1A8h7nGspMK7byTfk8VGRT2zRZVko46vF3 node_dist: 1
nodename: 1ALyo9ugsn9Jg19wYyf3XqaS5gEuuVaSqj node_dist: 0.09
nodename: 1BkJY6nfZSz2aY5eajRrXrKuPL71WxzTJg node_dist: 0.02
nodename: 1Bs9pnYxX4rytEwbmEEYTDkYF3GMBYgGaj node_dist: 0.11
nodename: 1CBsrLjQHgAB9T6i3qVfXWph3gpWXSjagY node_dist: 0.02
nodename: 1CJBdrNHkMES8XrjncAf3YK7VtyyFf3UQZ node_dist: 0.5
nodename: 1CNGeYba9DA2sekFwDLsTC559F6Nbqe7WD node_dist: 0.02
nodename: 1CSTjq32JsmzKuaKEs3x4XNuxZBJJXEoSd node_dist: 0.02
nodename: 1CcufsdKZbMiDVovHhBEZJCFtvr8tKSJ8P node_dist: 0.02
nodename: 1Cz5sY4TVj3kX5W18RPTNouwVdVPPHuxte node_dist: 0.02
nodename: 1CzxMgUet2T1uLKo74EmPzCa8FhwxarR9A node_dist: 1.03
nodename: 1DAZsMEVcfR6dApThP1FcnZaCt8zTDRgM node_dist: 0.1
nodename: 1DC4RJVctb7V6HAJWRuBfMHi5BJ5Prrjpo node_dist: 1
nodename: 1DFV51U789wUXKzBxG5UVyTfb5ah8BqHPK node_dist: 0.01
nodename: 1DJp2fLXPAY8H8Sg8KHjZkwMqhnrXnELVQ node_dist: 0.02
nodename: 1Dke3WCzGJBfLis14eYY6pqj6zJHZKsu5X node_dist: 0.02
nodename: 1EAFdEsvU8GKHVaVStFARPV4GZ5dzBhaTU node_dist: 0.01
nodename: 1EDeAgQ5732jSfUDYNSbShVsZAyi1riD8M node_dist: 0.02
nodename: 1EYFb5oJtrxf7BG4yvyfv5gW1b5S5P8EkW node_dist: 0.01
nodename: 1FaGv7ASRBfiekHuzi3gtNxuvWv5pAmaRJ node_dist: 0.11
nodename: 1G3Xy9K7768oax4UVT7fR1P1bGDQfNnhFW node_dist: 1
nodename: 1G5kvbP33mMwgtSTHpwAJe86xWKBwUHSV4 node_dist: 0.03
```

```
nodename: 1MrsCEQQKsHzrECwA9TckgchWhQRjSYnAf node_dist: 0.01
nodename: 1N3RzrjuN9ebfmSKyqnpLXBRb3A8hDha5L node_dist: 1.02
nodename: 1Nc4DAWh5YtR8kvhYZDr5hwqZPz4pU4aPA node_dist: 0.01
nodename: 1PTn57Ka9kL3cm6JpQJSRmB73vYPxkaZPA node_dist: 1.01
nodename: 1PfSnNKTdKVCb4n4NLJLUN7Fip79KvotZW node_dist: 0.03
nodename: 1PkV6r3i3PNJyHL6w7YSH7jHaxDqZtgRFc node_dist: 0.04
nodename: 1PyeymUht8vb92WDAUfvTNi2X8ZRgsQj4Q node_dist: 0.78
nodename: 1QKv2b5EzrtHqNAE9dBy4mcd2Wtr3A2Nh node_dist: 0.01
nodename: 1n5AcV4gmuMHGDsMKLoTvw4UUAzmFwKKw node_dist: 1.01
nodename: 1ww1cghV1zq8y31HdJwg8Tr7oPoRPNmvB node_dist: 0.25
```

3.4插入新数据

```
please choose your next option: input: 2:data search /3:data analysis /4:input data /5:quit.
4
please input the data you want to input:
please input the file path
data\tx_data_part2.csv
is there the headline?1yes 2 no
1
input data successfully!
Time taken by this operation: 62016215 microseconds(including the time you choose options)
```