Test case 1:

```
./simpsh --rdonly a0.txt \
        --wronly err.txt \
        --pipe --wronly out.txt \
        --profile \
        --command 0 3 1 cat \
        --command 2 4 1 sort \
        – 0 4 1 sed ‘s/hello/hi/g’ \
        --close 0 \
        --wait


 1
user time is 0.000000, system time is 0.000008 s
user time is 0.000000, system time is 0.000071 s
user time is 0.001253, system time is 0.037796 s
user time is 5.662395, system time is 0.352749 s
user time is 0.000000, system time is 0.000161 s
 2
user time is 0.000000, system time is 0.000009 s
user time is 0.000000, system time is 0.000070 s
user time is 0.000000, system time is 0.034963 s
user time is 5.586349, system time is 0.352983 s
user time is 0.000000, system time is 0.000213 s
 3
user time is 0.000000, system time is 0.000007 s
user time is 0.000000, system time is 0.000079 s
user time is 0.000000, system time is 0.036410 s
user time is 5.880713, system time is 0.382275 s
user time is 0.000000, system time is 0.000193 s
 4
user time is 0.000000, system time is 0.000008 s
user time is 0.000000, system time is 0.000075 s
user time is 0.000000, system time is 0.037025 s
user time is 5.831753, system time is 0.355229 s
user time is 0.000000, system time is 0.000211 s
 5
user time is 0.000000, system time is 0.000008 s
user time is 0.000000, system time is 0.000071 s
user time is 0.000000, system time is 0.035908 s
user time is 5.590928, system time is 0.361369 s
user time is 0.000000, system time is 0.000217 s

avg usr = 5.710427 s
avg sys = 0.390785 s

bash: time (cat a0.txt | sort > out.txt; sed ‘s/hello/hi/g’ a0.txt > out.txt) 2> err.txt
 1

real    0m7.790s
user    0m5.774s
sys     0m0.359s
 2

real    0m7.836s
user    0m5.739s
sys     0m0.424s
 3

real    0m7.838s
user    0m5.751s
sys     0m0.421s
 4

real    0m7.765s
user    0m5.793s
sys     0m0.428s
```

5

real 0m7.518s
user 0m5.759s
sys 0m0.383s

avg usr = 5.75 s
avg sys = 0.355

dash:
$ time cat a0.txt | sort > out.txt
0.00user 0.04system 0:04.99elapsed 0%CPU (0avgtext+0avgdata 712maxresident)k
0inputs+0outputs (0major+223minor)pagefaults 0swaps
$ time cat a0.txt | sort > out.txt
0.00user 0.03system 0:05.02elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+224minor)pagefaults 0swaps
$ time cat a0.txt | sort > out.txt
0.00user 0.03system 0:05.04elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+223minor)pagefaults 0swaps
$ time cat a0.txt | sort > out.txt
0.00user 0.03system 0:05.05elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+223minor)pagefaults 0swaps
time cat a0.txt | sort > out.txt $
0.00user 0.03system 0:04.98elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+223minor)pagefaults 0swaps

avg usr = 0 s
avg sys = 0.3 s

	simpsh	bash	dash
user	5.71	5.75	0
System	0.39	0.355	0.0325

Test case 2:

```
./simpsh \
  --rdonly a0.txt \
  --pipe \
  --trunc \
  --wronly err.txt \
  --wronly out.txt \
  --profile \
  --command 0 2 3 sort \
  --command 1 4 3 tr A-Z a-z \
  --command 0 4 3 grep 1234 \
  --wait | grep 'user'
```

1
user time is 0.000001, system time is 0.000009 s
user time is 0.000005, system time is 0.000057 s
user time is 0.000006, system time is 0.000068 s
user time is -0.001067, system time is 0.008480 s
user time is 7.470527, system time is 0.168155 s
user time is 7.555543, system time is 0.316634 s
user time is 0.000013, system time is 0.000147 s
2
user time is 0.000001, system time is 0.000010 s
user time is 0.000006, system time is 0.000085 s
user time is 0.000005, system time is 0.000057 s

user time is 0.000103, system time is 0.022618 s
user time is 7.490230, system time is 0.170621 s
user time is 7.580800, system time is 0.322298 s
user time is 0.000000, system time is 0.000243 s
 3
user time is 0.000000, system time is 0.000009 s
user time is 0.000000, system time is 0.000073 s
user time is 0.000000, system time is 0.000083 s
user time is 0.000000, system time is 0.020262 s
user time is 7.462774, system time is 0.178215 s
user time is 7.568067, system time is 0.304133 s
user time is 0.000000, system time is 0.000186 s
 4
user time is 0.000001, system time is 0.000009 s
user time is 0.000006, system time is 0.000068 s
user time is 0.000006, system time is 0.000059 s
user time is -0.001045, system time is 0.021555 s
user time is 7.359420, system time is 0.171748 s
user time is 7.447429, system time is 0.306017 s
user time is 0.000015, system time is 0.000165 s
 5
user time is 0.000000, system time is 0.000009 s
user time is 0.000977, system time is 0.000000 s
user time is 0.000000, system time is 0.000000 s
user time is -0.000977, system time is 0.020177 s
user time is 7.371696, system time is 0.154280 s
user time is 7.462935, system time is 0.288390 s
user time is 0.000000, system time is 0.000000 s

avg usr = 7.5075
avg sys = 0.4628

bash: time (sort a0.txt | tr A-Z a-z > out.txt; grep 1234 < a0.txt > out.txt)2>err.txt
 1

real	0m3.153s
user	0m7.476s
sys	0m0.296s
 2

real	0m3.469s
user	0m7.480s
sys	0m0.326s
 3

real	0m3.316s
user	0m7.431s
sys	0m0.324s
 4

real	0m3.238s
user	0m7.484s
sys	0m0.276s
 5

real	0m3.117s
user	0m7.499s
sys	0m0.304s

avg usr = 7.45
avg sys = 0.3
dash:
 [haoranz@lnxsrv09 ~/cs111/lab1/1c_test]$ dash
$ time sort a0.txt | tr A-Z a-z > out.txt; grep 1234 < a0.txt > out.txt
7.39user 0.13system 0:01.66elapsed 452%CPU (0avgtext+0avgdata 286508maxresident)k
0inputs+0outputs (0major+1707minor)pagefaults 0swaps

```
$ time sort a0.txt | tr A-Z a-z > out.txt; grep 1234 < a0.txt > out.txt
7.43user 0.16system 0:02.02elapsed 375%CPU (0avgtext+0avgdata 288496maxresident)k
0inputs+0outputs (0major+892minor)pagefaults 0swaps


$ time sort a0.txt | tr A-Z a-z > out.txt; grep 1234 < a0.txt > out.txt
7.44user 0.13system 0:01.67elapsed 451%CPU (0avgtext+0avgdata 288492maxresident)k
0inputs+0outputs (0major+821minor)pagefaults 0swaps

$ time sort a0.txt | tr A-Z a-z > out.txt; grep 1234 < a0.txt > out.txt
$ 7.48user 0.14system 0:01.77elapsed 429%CPU (0avgtext+0avgdata 286516maxresident)k
0inputs+0outputs (0major+877minor)pagefaults 0swaps

$ time sort a0.txt | tr A-Z a-z > out.txt; grep 1234 < a0.txt > out.txt
7.37user 0.15system 0:01.69elapsed 444%CPU (0avgtext+0avgdata 288488maxresident)k
0inputs+0outputs (0major+774minor)pagefaults 0swaps
```

avg usr = 7.42
avg sys = 0.142

	simpsh	bash	dash
user	7.5075	7.45	7.42
System	0.4628	0.3	0.142

test case 3:

```
./simpsh \
    --rdonly a0.txt \
    --pipe \
    --trunc --wronly new \
    --wronly err.txt \
    --wronly out.txt \
    --profile \
    --command 0 2 4 cat \
    --command 1 3 4 sort \
    --command 0 5 4 sleep 5 \
    --wait | grep 'user'


 1
user time is 0.000000, system time is 0.000022 s
user time is 0.000000, system time is 0.000080 s
user time is 0.000000, system time is 0.000058 s
user time is 0.000764, system time is -0.009388 s
user time is 0.002073, system time is 0.025960 s
user time is 5.707646, system time is 0.346048 s
user time is 0.000000, system time is 0.000260 s
 2
user time is 0.000000, system time is 0.000000 s
user time is 0.000000, system time is 0.000198 s
user time is 0.000000, system time is 0.000000 s
user time is -0.000988, system time is -0.009301 s
user time is -0.000988, system time is 0.032142 s
user time is 5.712139, system time is 0.387959 s
user time is 0.000000, system time is 0.000319 s
 3
user time is 0.000000, system time is 0.000010 s
user time is 0.000000, system time is 0.000067 s
user time is 0.000000, system time is 0.000057 s
user time is 0.000771, system time is -0.010238 s
user time is 0.001865, system time is 0.024775 s
user time is 5.785441, system time is 0.370809 s
```

user time is 0.000000, system time is 0.000224 s
4
user time is 0.000000, system time is 0.000009 s
user time is 0.000000, system time is 0.000065 s
user time is 0.000000, system time is 0.000045 s
user time is 0.000000, system time is 0.025000 s
user time is 0.000739, system time is 0.025000 s
user time is 5.646131, system time is 0.329236 s
user time is 0.000000, system time is 0.000234 s
5
user time is 0.000000, system time is 0.000010 s
user time is 0.000000, system time is 0.000071 s
user time is 0.000000, system time is 0.000078 s
user time is 0.001038, system time is 0.027728 s
user time is 0.001748, system time is 0.027728 s
user time is 5.596903, system time is 0.358856 s
user time is 0.000000, system time is 0.000252 s

avg usr = 5.69
avg sys = 0.374

1

real 0m12.500s
user 0m5.798s
sys 0m0.396s
2

real 0m12.272s
user 0m5.666s
sys 0m0.397s
3

real 0m12.543s
user 0m5.581s
sys 0m0.352s
4

real 0m12.597s
user 0m5.805s
sys 0m0.406s
5

real 0m13.512s
user 0m5.827s
sys 0m0.347s

avg usr = 5.735
avg sys = 0.3796

dash:
$ time cat a0.txt | sort > new; sleep 5 < a0.txt > out.txt
0.00user 0.03system 0:05.07elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+224minor)pagefaults 0swaps
$ time cat a0.txt | sort > new; sleep 5 < a0.txt > out.txt
0.00user 0.03system 0:05.02elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+223minor)pagefaults 0swaps
time cat a0.txt | sort > new; sleep 5 < a0.txt > out.txt
$ 0.00user 0.03system 0:05.09elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+223minor)pagefaults 0swaps
$ time cat a0.txt | sort > new; sleep 5 < a0.txt > out.txt
0.00user 0.03system 0:04.94elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k
0inputs+0outputs (0major+224minor)pagefaults 0swaps
$ time cat a0.txt | sort > new; sleep 5 < a0.txt > out.txt
0.00user 0.04system 0:05.08elapsed 0%CPU (0avgtext+0avgdata 716maxresident)k

0inputs+0outputs (0major+223minor)pagefaults 0swaps

avg usr = 0
avg sys = 0.032

	simpsh	bash	dash
user	5.69	5.735	0
System	0.374	0.3796	0.032

Whole table:

	simpsh	bash	dash
user1	5.71	5.75	0
System1	0.39	0.355	0.0325
user2	7.5075	7.45	7.42
System2	0.4628	0.3	0.142
user3	5.69	5.735	0
System3	0.374	0.3796	0.032

Conclusion:
It seems dash runs pretty fast except for test case 2, and I think that is because in test case 2, we have to write all the grep lines into file, and that is done in user mode, that's probably why the time is counted as user. And also dash may be running under multithreading, so it can read fast but write slowly since it is hard for a program to write correctly into a file simultaneously. As for Bash and simpsh, their running time are very close except for some cases simpsh runs faster and some slower.