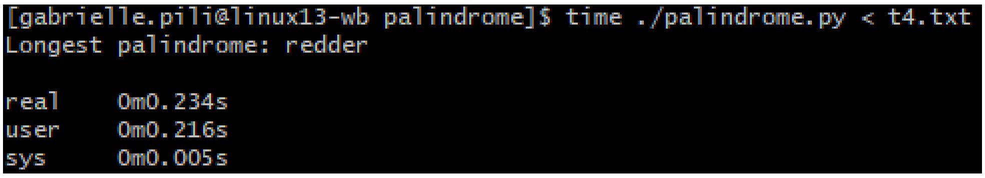
CPSC 457 - A1 Report

Question 1

Part (a)

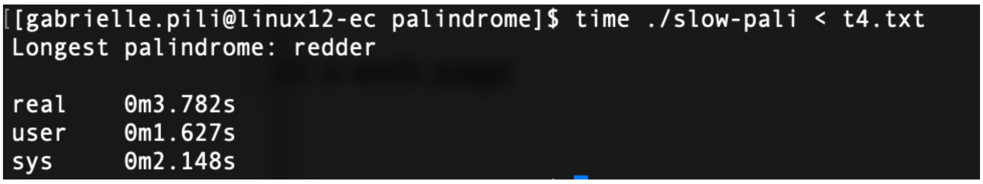
Running time with t4.txt

- **time for palindome.py with t4.txt**



```
[gabrielle.pili@linux13-wb palindrome]$ time ./palindrome.py < t4.txt
Longest palindrome: redder

real    0m0.234s
user    0m0.216s
sys     0m0.005s
```

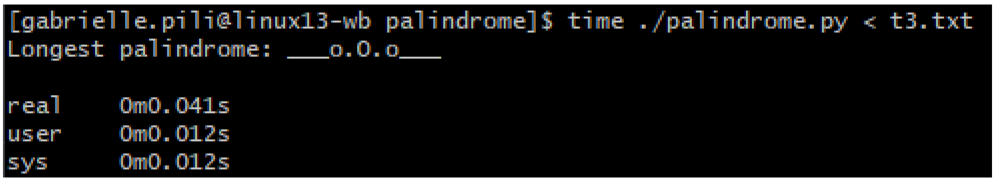
- **time for slow-pali with t4.txt**



```
[gabrielle.pili@linux12-ec palindrome]$ time ./slow-pali < t4.txt
Longest palindrome: redder

real    0m3.782s
user    0m1.627s
sys     0m2.148s
```

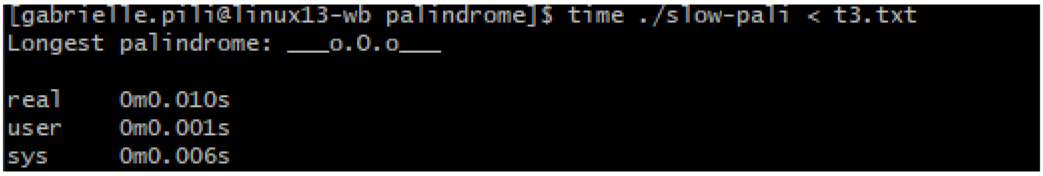
Running time with t3.txt

- **time for palindome.py with t3.txt**



```
[gabrielle.pili@linux13-wb palindrome]$ time ./palindrome.py < t3.txt
Longest palindrome: ___o.O.o___

real    0m0.041s
user    0m0.012s
sys     0m0.012s
```

- **time for slow-pali with t3.txt**



```
[gabrielle.pili@linux13-wb palindrome]$ time ./slow-pali < t3.txt
Longest palindrome: ___o.O.o___

real    0m0.010s
user    0m0.001s
sys     0m0.006s
```

Part (b)

t4.txt

	User mode	Kernel mode
palindrome.py	0.216 seconds	0.018 seconds
slow-pali.cpp	1.627 seconds	2.155 seconds

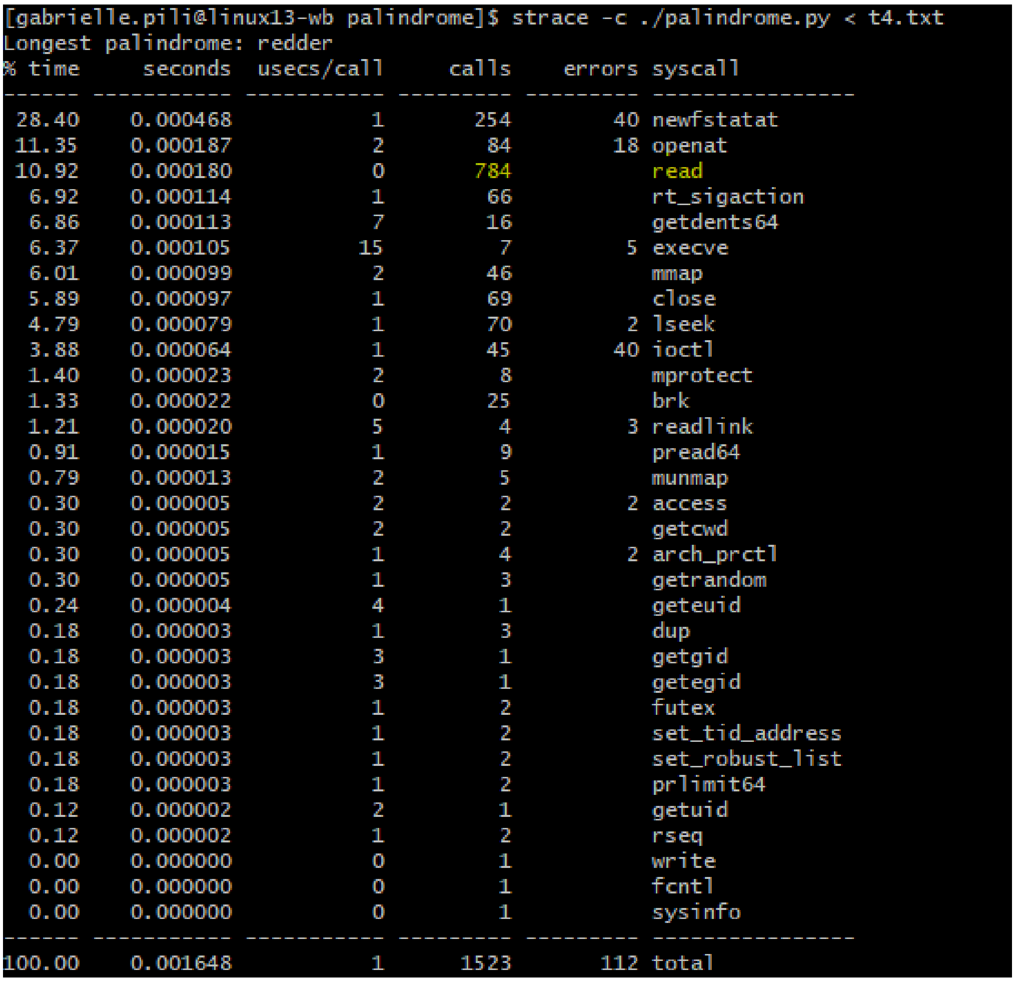
t3.txt

	User mode	Kernel mode
palindrome.py	0.012 seconds	0.029 seconds
slow-pali.cpp	0.010 seconds	0.009 seconds

Part (c)

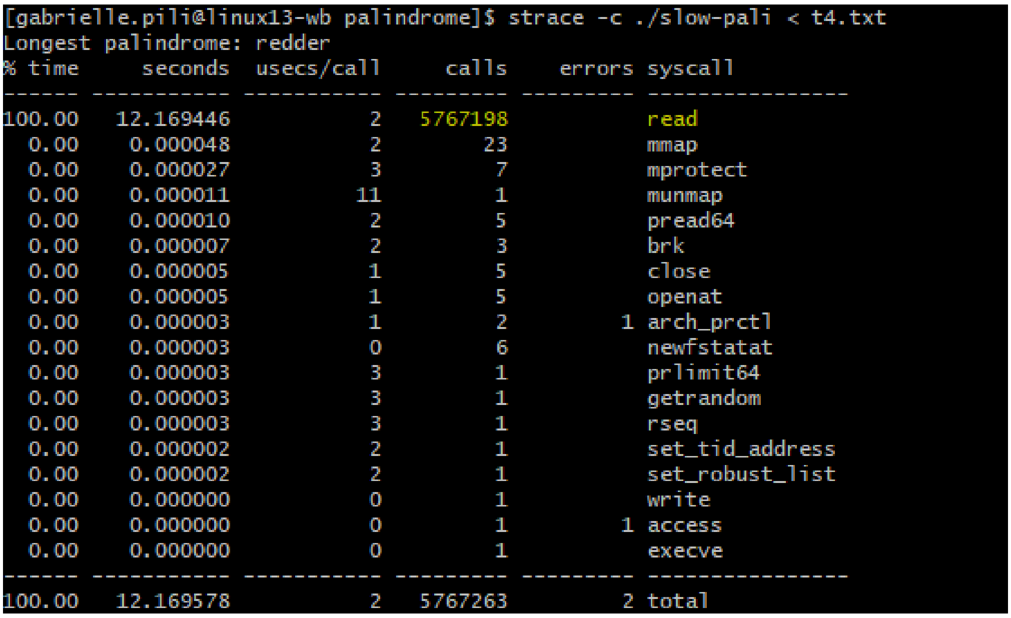
Running with t4.txt

- **strace for palindrome.py with t4.txt**



```
[gabrielle.pili@linux13-wb palindrome]$ strace -c ./palindrome.py < t4.txt
Longest palindrome: redder
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
 28.40    0.000468           1       254        40 newfstatat
 11.35    0.000187           2        84        18 openat
 10.92    0.000180           0       784           read
  6.92    0.000114           1        66           rt_sigaction
  6.86    0.000113           7        16           getdents64
  6.37    0.000105          15         7         5 execve
  6.01    0.000099           2        46           mmap
  5.89    0.000097           1        69           close
  4.79    0.000079           1        70         2 lseek
  3.88    0.000064           1        45        40 ioctl
  1.40    0.000023           2         8           mprotect
  1.33    0.000022           0        25           brk
  1.21    0.000020           5         4         3 readlink
  0.91    0.000015           1         9           pread64
  0.79    0.000013           2         5           munmap
  0.30    0.000005           2         2         2 access
  0.30    0.000005           2         2           getcwd
  0.30    0.000005           1         4         2 arch_prctl
  0.30    0.000005           1         3           getrandom
  0.24    0.000004           4         1           geteuid
  0.18    0.000003           1         3           dup
  0.18    0.000003           3         1           getgid
  0.18    0.000003           3         1           getegid
  0.18    0.000003           1         2           futex
  0.18    0.000003           1         2           set_tid_address
  0.18    0.000003           1         2           set_robust_list
  0.18    0.000003           1         2           prlimit64
  0.12    0.000002           2         1           getuid
  0.12    0.000002           1         2           rseq
  0.00    0.000000           0         1           write
  0.00    0.000000           0         1           fcntl
  0.00    0.000000           0         1           sysinfo
------ ----------- ----------- --------- --------- ----------------
100.00    0.001648           1      1523       112 total
```

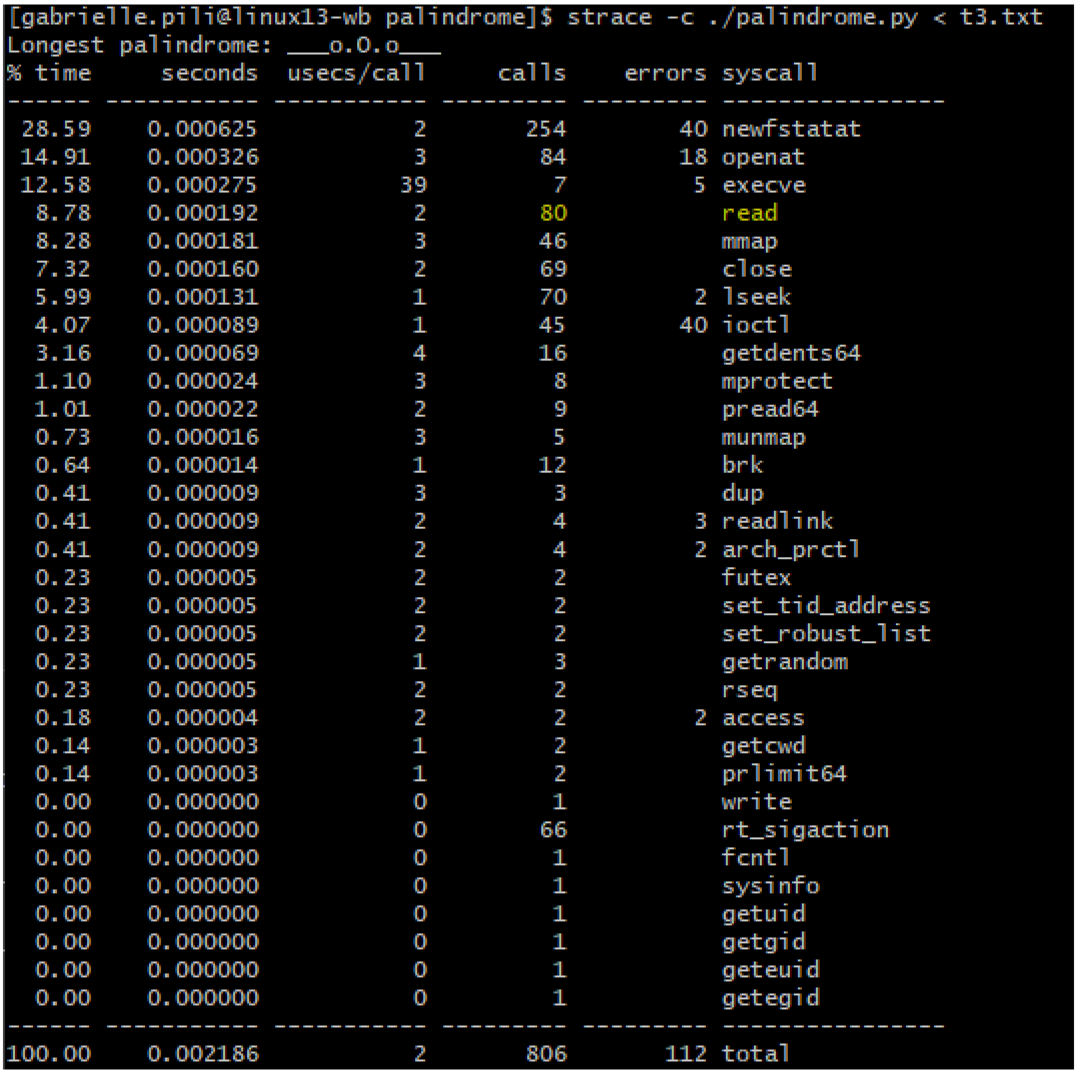
- **strace for slow-pali with t4.txt**



```
[gabrielle.pili@linux13-wb palindrome]$ strace -c ./slow-pali < t4.txt
Longest palindrome: redder
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
100.00   12.169446           2   5767198           read
  0.00    0.000048           2        23           mmap
  0.00    0.000027           3         7           mprotect
  0.00    0.000011          11         1           munmap
  0.00    0.000010           2         5           pread64
  0.00    0.000007           2         3           brk
  0.00    0.000005           1         5           close
  0.00    0.000005           1         5           openat
  0.00    0.000003           1         2         1 arch_prctl
  0.00    0.000003           0         6           newfstatat
  0.00    0.000003           3         1           prlimit64
  0.00    0.000003           3         1           getrandom
  0.00    0.000003           3         1           rseq
  0.00    0.000002           2         1           set_tid_address
  0.00    0.000002           2         1           set_robust_list
  0.00    0.000000           0         1           write
  0.00    0.000000           0         1         1 access
  0.00    0.000000           0         1           execve
------ ----------- ----------- --------- --------- ----------------
100.00   12.169578           2   5767263         2 total
```

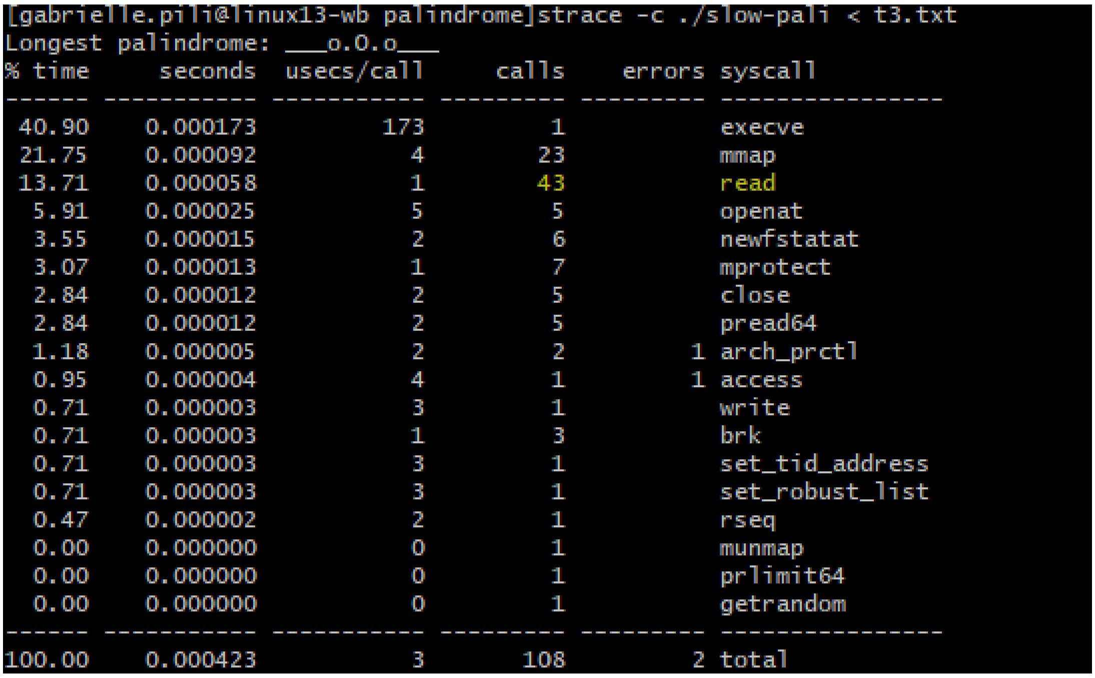
Running with t3.txt

- **strace for palindrome.py with t3.txt**



```
[gabrielle.pili@linux13-wb palindrome]$ strace -c ./palindrome.py < t3.txt
Longest palindrome: ___o.O.o___
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
 28.59    0.000625           2       254        40 newfstatat
 14.91    0.000326           3        84        18 openat
 12.58    0.000275          39         7         5 execve
  8.78    0.000192           2        80           read
  8.28    0.000181           3        46           mmap
  7.32    0.000160           2        69           close
  5.99    0.000131           1        70         2 lseek
  4.07    0.000089           1        45        40 ioctl
  3.16    0.000069           4        16           getdents64
  1.10    0.000024           3         8           mprotect
  1.01    0.000022           2         9           pread64
  0.73    0.000016           3         5           munmap
  0.64    0.000014           1        12           brk
  0.41    0.000009           3         3           dup
  0.41    0.000009           2         4         3 readlink
  0.41    0.000009           2         4         2 arch_prctl
  0.23    0.000005           2         2           futex
  0.23    0.000005           2         2           set_tid_address
  0.23    0.000005           2         2           set_robust_list
  0.23    0.000005           1         3           getrandom
  0.23    0.000005           2         2           rseq
  0.18    0.000004           2         2         2 access
  0.14    0.000003           1         2           getcwd
  0.14    0.000003           1         2           prlimit64
  0.00    0.000000           0         1           write
  0.00    0.000000           0        66           rt_sigaction
  0.00    0.000000           0         1           fcntl
  0.00    0.000000           0         1           sysinfo
  0.00    0.000000           0         1           getuid
  0.00    0.000000           0         1           getgid
  0.00    0.000000           0         1           geteuid
  0.00    0.000000           0         1           getegid
------ ----------- ----------- --------- --------- ----------------
100.00    0.002186           2       806       112 total
```

- **strace for slow-pali with t3.txt**



```
[gabrielle.pili@linux13-wb palindrome]strace -c ./slow-pali < t3.txt
Longest palindrome: ___o.O.o___
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
 40.90    0.000173         173         1           execve
 21.75    0.000092           4        23           mmap
 13.71    0.000058           1        43           read
  5.91    0.000025           5         5           openat
  3.55    0.000015           2         6           newfstatat
  3.07    0.000013           1         7           mprotect
  2.84    0.000012           2         5           close
  2.84    0.000012           2         5           pread64
  1.18    0.000005           2         2         1 arch_prctl
  0.95    0.000004           4         1         1 access
  0.71    0.000003           3         1           write
  0.71    0.000003           1         3           brk
  0.71    0.000003           3         1           set_tid_address
  0.71    0.000003           3         1           set_robust_list
  0.47    0.000002           2         1           rseq
  0.00    0.000000           0         1           munmap
  0.00    0.000000           0         1           prlimit64
  0.00    0.000000           0         1           getrandom
------ ----------- ----------- --------- --------- ----------------
100.00    0.000423           3       108         2 total
```

Part (d)

The Python program is faster on some inputs because it typically does a lot less system calls i.e. the system call read() is called much less than in the C++ program. Given the results in part (c).

- **With the t4.txt file:**
  - **palindrome.py** has *784 calls* to read() whereas **slow-pali.cpp** has *5767198 calls* to read()
  - In general, there are **less** system calls in **palindrome.py** with *1523 calls* than **slow-pali.cpp** with *5767263 calls*

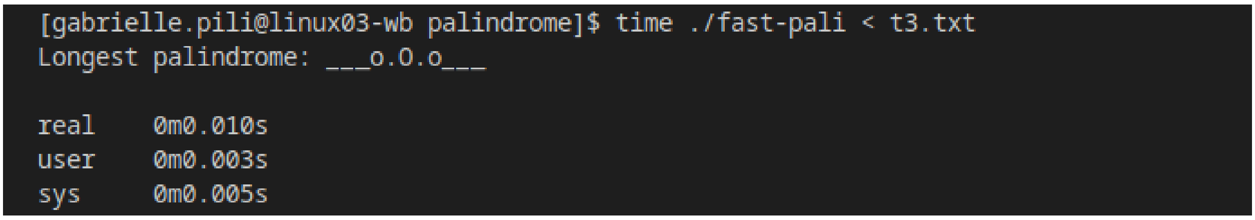
In the case the C++ program is faster than the Python program, **slow-pali.cpp** has less calls to read() than **palindrome.py**.

- **With the t3.txt file:**
  - **palindrome.py** has *80 calls* to read() whereas **slow-pali.cpp** has *43 calls* to read()
  - In general, there are ***more system calls*** in **palindrome.py** with *806 calls* than **slow-pali.cpp** with *108 calls*

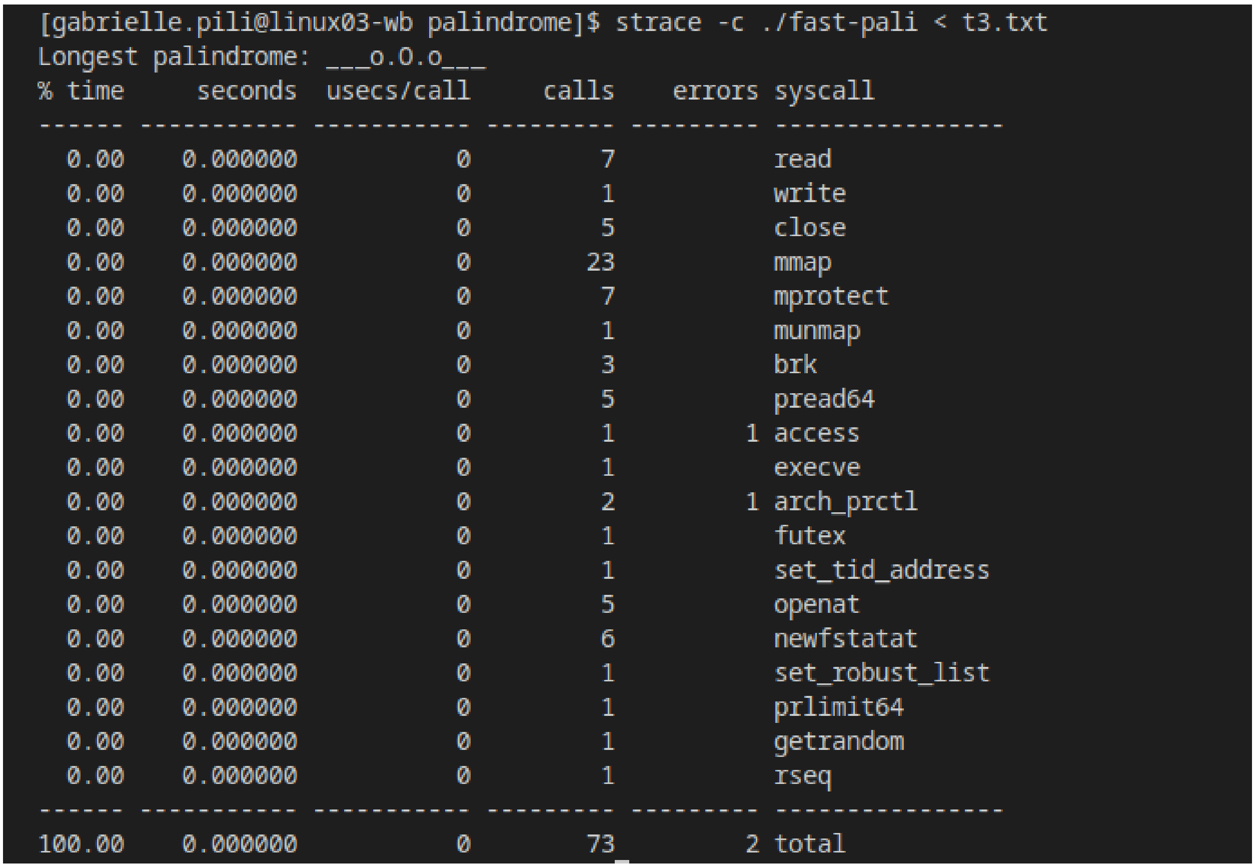
Question 3

Part (a)

`time` and `strace` with t3.txt

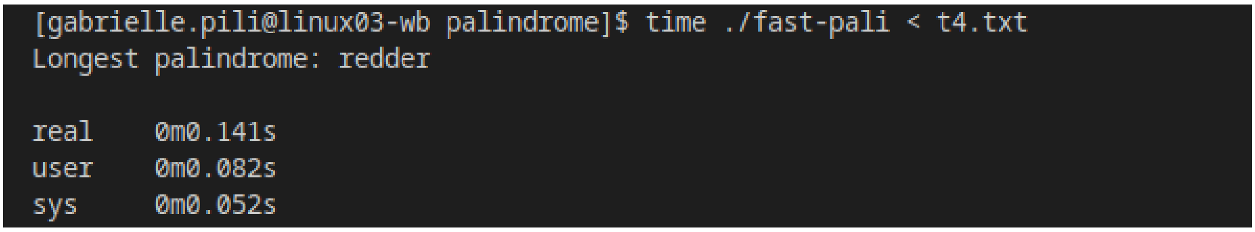


```
[gabrielle.pili@linux03-wb palindrome]$ time ./fast-pali < t3.txt
Longest palindrome: ___o.O.o___

real    0m0.010s
user    0m0.003s
sys     0m0.005s
```

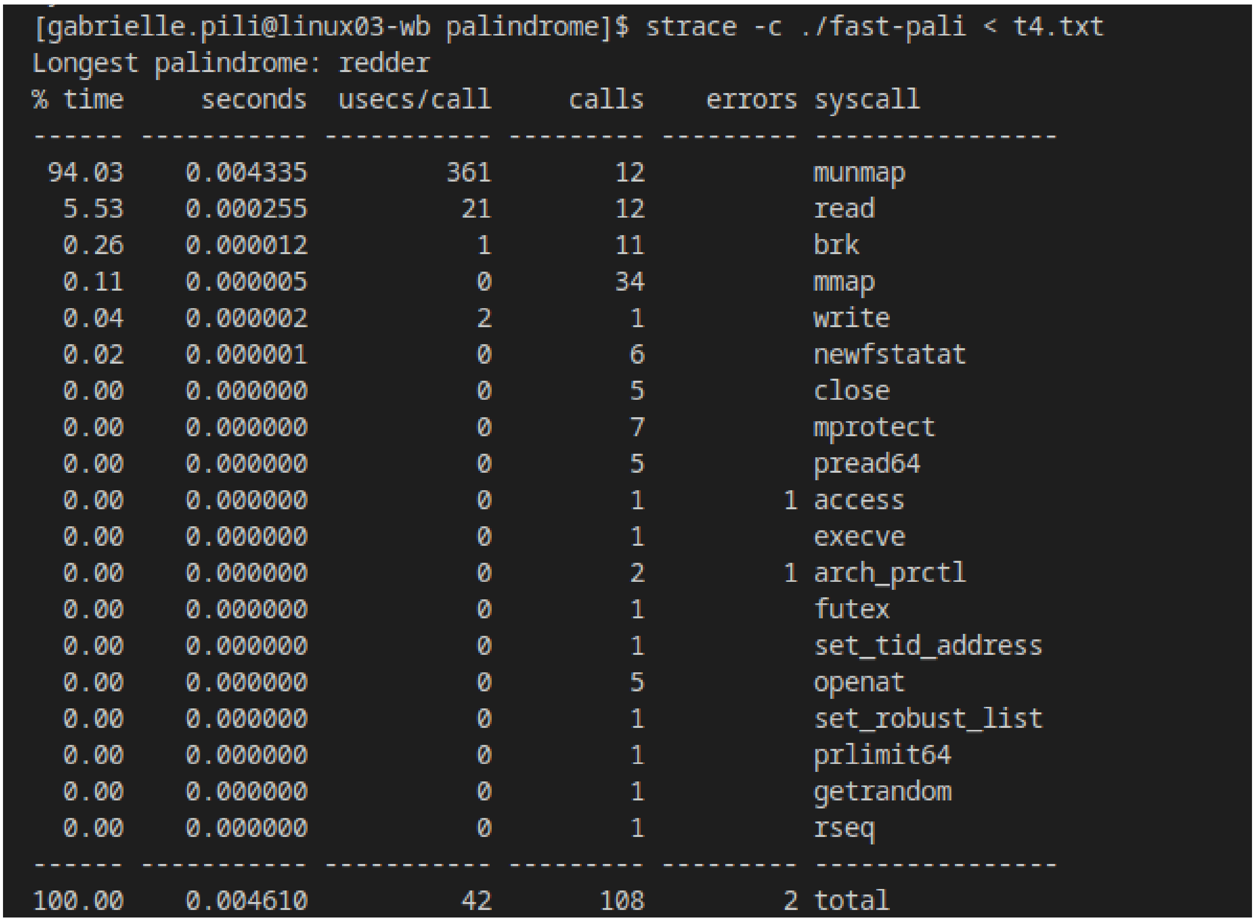


```
[gabrielle.pili@linux03-wb palindrome]$ strace -c ./fast-pali < t3.txt
Longest palindrome: ___o.O.o___
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
  0.00    0.000000           0         7           read
  0.00    0.000000           0         1           write
  0.00    0.000000           0         5           close
  0.00    0.000000           0        23           mmap
  0.00    0.000000           0         7           mprotect
  0.00    0.000000           0         1           munmap
  0.00    0.000000           0         3           brk
  0.00    0.000000           0         5           pread64
  0.00    0.000000           0         1         1 access
  0.00    0.000000           0         1           execve
  0.00    0.000000           0         2         1 arch_prctl
  0.00    0.000000           0         1           futex
  0.00    0.000000           0         1           set_tid_address
  0.00    0.000000           0         5           openat
  0.00    0.000000           0         6           newfstatat
  0.00    0.000000           0         1           set_robust_list
  0.00    0.000000           0         1           prlimit64
  0.00    0.000000           0         1           getrandom
  0.00    0.000000           0         1           rseq
------ ----------- ----------- --------- --------- ----------------
100.00    0.000000           0        73         2 total
```

`time` and `strace` with t4.txt



```
[gabrielle.pili@linux03-wb palindrome]$ time ./fast-pali < t4.txt
Longest palindrome: redder

real    0m0.141s
user    0m0.082s
sys     0m0.052s
```



```
[gabrielle.pili@linux03-wb palindrome]$ strace -c ./fast-pali < t4.txt
Longest palindrome: redder
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
 94.03    0.004335         361        12           munmap
  5.53    0.000255          21        12           read
  0.26    0.000012           1        11           brk
  0.11    0.000005           0        34           mmap
  0.04    0.000002           2         1           write
  0.02    0.000001           0         6           newfstatat
  0.00    0.000000           0         5           close
  0.00    0.000000           0         7           mprotect
  0.00    0.000000           0         5           pread64
  0.00    0.000000           0         1         1 access
  0.00    0.000000           0         1           execve
  0.00    0.000000           0         2         1 arch_prctl
  0.00    0.000000           0         1           futex
  0.00    0.000000           0         1           set_tid_address
  0.00    0.000000           0         5           openat
  0.00    0.000000           0         1           set_robust_list
  0.00    0.000000           0         1           prlimit64
  0.00    0.000000           0         1           getrandom
  0.00    0.000000           0         1           rseq
------ ----------- ----------- --------- --------- ----------------
100.00    0.004610          42       108         2 total
```

Part (b)

My **fast-pali.cpp** program is faster than **slow-pali.cpp**. The total system calls heavily decrease in **fast-pali.cpp**. For example, with t4.txt the calls go from *5767263* system calls to *108* calls.

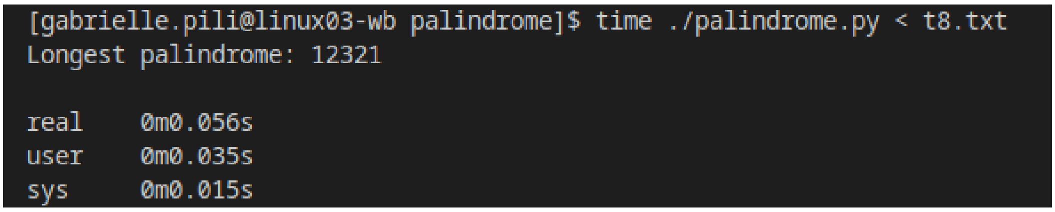
More specifically, the call to read() goes from *5767198* calls in `slow-pali.cpp` to *12* calls in `fast-pali.cpp` with t4.txt.

Part (c)

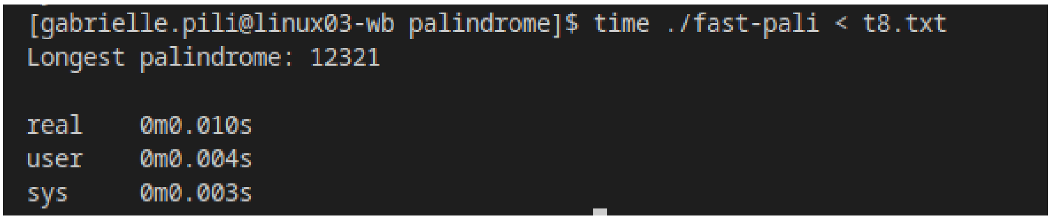
palindrome.py vs fast-pali.cpp

`fast-pali.cpp` is faster than `palindrome.py`

- `time` with t8.txt

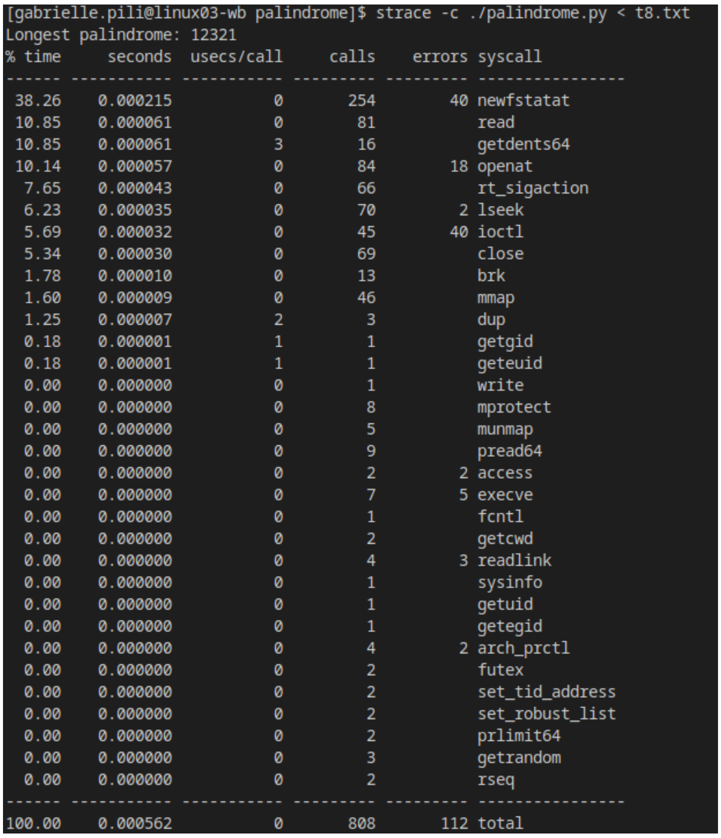


```
[gabrielle.pili@linux03-wb palindrome]$ time ./palindrome.py < t8.txt
Longest palindrome: 12321

real    0m0.056s
user    0m0.035s
sys     0m0.015s
```

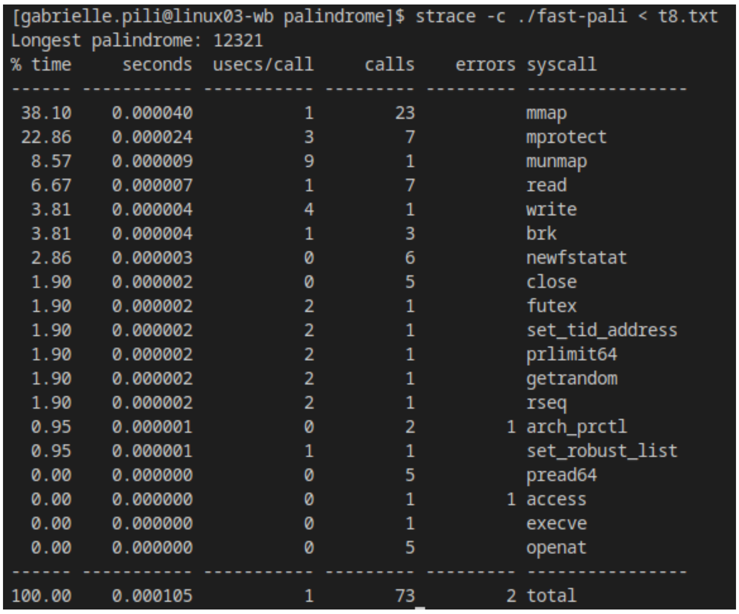


```
[gabrielle.pili@linux03-wb palindrome]$ time ./fast-pali < t8.txt
Longest palindrome: 12321

real    0m0.010s
user    0m0.004s
sys     0m0.003s
```

- `strace -c` with t8.txt
    - Here you can see that fast-pali does less system calls
        - **i.e.** palindrome.py has 808 system calls whereas fast-pali as 73 system calls
        - **i.e.** palindrome.py has 81 calls to read whereas fast-pali has 7 calls to read



```
[gabrielle.pili@linux03-wb palindrome]$ strace -c ./palindrome.py < t8.txt
Longest palindrome: 12321
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
 38.26    0.000215           0       254        40 newfstatat
 10.85    0.000061           0        81           read
 10.85    0.000061           3        16           getdents64
 10.14    0.000057           0        84        18 openat
  7.65    0.000043           0        66           rt_sigaction
  6.23    0.000035           0        70         2 lseek
  5.69    0.000032           0        45        40 ioctl
  5.34    0.000030           0        69           close
  1.78    0.000010           0        13           brk
  1.60    0.000009           0        46           mmap
  1.25    0.000007           2         3           dup
  0.18    0.000001           1         1           getgid
  0.18    0.000001           1         1           geteuid
  0.00    0.000000           0         1           write
  0.00    0.000000           0         8           mprotect
  0.00    0.000000           0         5           munmap
  0.00    0.000000           0         9           pread64
  0.00    0.000000           0         2         2 access
  0.00    0.000000           0         7         5 execve
  0.00    0.000000           0         1           fcntl
  0.00    0.000000           0         2           getcwd
  0.00    0.000000           0         4         3 readlink
  0.00    0.000000           0         1           sysinfo
  0.00    0.000000           0         1           getuid
  0.00    0.000000           0         1           getegid
  0.00    0.000000           0         4         2 arch_prctl
  0.00    0.000000           0         2           futex
  0.00    0.000000           0         2           set_tid_address
  0.00    0.000000           0         2           set_robust_list
  0.00    0.000000           0         2           prlimit64
  0.00    0.000000           0         3           getrandom
  0.00    0.000000           0         2           rseq
------ ----------- ----------- --------- --------- ----------------
100.00    0.000562           0       808       112 total
```



```
[gabrielle.pili@linux03-wb palindrome]$ strace -c ./fast-pali < t8.txt
Longest palindrome: 12321
% time     seconds  usecs/call     calls    errors syscall
------ ----------- ----------- --------- --------- ----------------
 38.10    0.000040           1        23           mmap
 22.86    0.000024           3         7           mprotect
  8.57    0.000009           9         1           munmap
  6.67    0.000007           1         7           read
  3.81    0.000004           4         1           write
  3.81    0.000004           1         3           brk
  2.86    0.000003           0         6           newfstatat
  1.90    0.000002           0         5           close
  1.90    0.000002           2         1           futex
  1.90    0.000002           2         1           set_tid_address
  1.90    0.000002           2         1           prlimit64
  1.90    0.000002           2         1           getrandom
  1.90    0.000002           2         1           rseq
  0.95    0.000001           0         2         1 arch_prctl
  0.95    0.000001           1         1           set_robust_list
  0.00    0.000000           0         5           pread64
  0.00    0.000000           0         1         1 access
  0.00    0.000000           0         1           execve
  0.00    0.000000           0         5           openat
------ ----------- ----------- --------- --------- ----------------
100.00    0.000105           1        73         2 total
```