For both programs I defined threadCount to hold the number of threads to be used, a data buffer to hold the contents of the file being read, and a struct threadInfo to be passed as the argument for each thread that has data fields start, end and count, all ints.

I create an array of these structs and use the size of the file being word counted to decide what to put in start and end. FirstStruct.start gets 0 and lastStruct.end get the file size then each struct.end gets the value of (fileSize / threadCount) * index shifted up until it is not on a word char and each struct.start gets the values of the previous structs .end.

When creating each thread I pass the function wordCount which takes as its argument one of the threadInfo structs. The structs start and end values are used to decide which parts of of the data buffer to read. It does this with a while loop that continues until start >= end. At the start of the loop it uses another loop to move start to the next word char, if start < end the word count is incremented, then another loop is used to increment start to the end of the word before starting the loop over again.

After the threads return their count values are summed into a sum variable which is printed out to display the word count.

For the windows version I use HeapAlloc to allocate memory for the threadInfo structs. I used CreateThread to make the threads then WaitForMulitpleObjects to wait for the threads to finish, and finally I use CloseHandle to close the threads.

For the posix version I needed a pthread_attr_t variable to create the threads and I used pthread_attr_init to initialize it. I then use pthread_create to make each thread and after they are made I use pthread_attr_destroy on the pthread_attr_t variable. Finally pthread_join is used to wait for each thread to finish.

Time and output for posix with 1,2,4,8 threads(4 cores)

```
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ gcc wordCount.c
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ time ./a.out test4
21334 words

real    0m0.013s
user    0m0.002s
sys 0m0.002s
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ gcc wordCount.c
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ time ./a.out test4
21334 words
```

```
real    0m0.015s
user    0m0.004s
sys 0m0.003s
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ gcc wordCount.c
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ time ./a.out test4
21334 words

real    0m0.013s
user    0m0.004s
sys 0m0.003s
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ gcc wordCount.c
ALEXANDERs-MacBook-Air:hw4 alexanderryner$ time ./a.out test4
21334 words

real    0m0.013s
user    0m0.003s
sys 0m0.003s
ALEXANDERs-MacBook-Air:hw4 alexanderryner$
```

Windows output for 1,2,4,8 threads followed by windows times for 1,2,4,8 threads(on my virtual machine)

C:\Users\Alan\Desktop\415\hw4>cl winWordCount.c
Microsoft (R) C/C++ Optimizing Compiler Version 18.00.21005.1 for x86
Copyright (C) Microsoft Corporation. All rights reserved.

winWordCount.c
Microsoft (R) Incremental Linker Version 12.00.21005.1
Copyright (C) Microsoft Corporation. All rights reserved.

/out:winWordCount.exe
winWordCount.obj

C:\Users\Alan\Desktop\415\hw4>winWordCount test
19591 words

C:\Users\Alan\Desktop\415\hw4>vim winWordCount.c

C:\Users\Alan\Desktop\415\hw4>cl winWordCount.c
Microsoft (R) C/C++ Optimizing Compiler Version 18.00.21005.1 for x86
Copyright (C) Microsoft Corporation. All rights reserved.

winWordCount.c
Microsoft (R) Incremental Linker Version 12.00.21005.1

```
Copyright (C) Microsoft Corporation.  All rights reserved.

/out:winWordCount.exe
winWordCount.obj

C:\Users\Alan\Desktop\415\hw4>winWordCount test
19591 words

C:\Users\Alan\Desktop\415\hw4>vim winWordCount.c

C:\Users\Alan\Desktop\415\hw4>winWordCount test
19591 words

C:\Users\Alan\Desktop\415\hw4>cl winWordCount.c
Microsoft (R) C/C++ Optimizing Compiler Version 18.00.21005.1 for x86
Copyright (C) Microsoft Corporation.  All rights reserved.

winWordCount.c
Microsoft (R) Incremental Linker Version 12.00.21005.1
Copyright (C) Microsoft Corporation.  All rights reserved.

/out:winWordCount.exe
winWordCount.obj

C:\Users\Alan\Desktop\415\hw4>winWordCount test
19591 words

C:\Users\Alan\Desktop\415\hw4>vim winWordCount.c

C:\Users\Alan\Desktop\415\hw4>cl winWordCount.c
Microsoft (R) C/C++ Optimizing Compiler Version 18.00.21005.1 for x86
Copyright (C) Microsoft Corporation.  All rights reserved.

winWordCount.c
Microsoft (R) Incremental Linker Version 12.00.21005.1
Copyright (C) Microsoft Corporation.  All rights reserved.

/out:winWordCount.exe
winWordCount.obj

C:\Users\Alan\Desktop\415\hw4>winWordCount test
19591 words

C:\Users\Alan\Desktop\415\hw4>
```

```
PS C:\Users\Alan\Desktop\415\hw4> Measure-Command{.\winWordCount .\test}

Days              : 0
Hours             : 0
Minutes           : 0
Seconds           : 0
Milliseconds      : 9
Ticks             : 97861
TotalDays         : 1.13265046296296E-07
TotalHours        : 2.71836111111111E-06
TotalMinutes      : 0.000163101666666667
TotalSeconds      : 0.0097861
TotalMilliseconds : 9.7861

PS C:\Users\Alan\Desktop\415\hw4> Measure-Command{.\winWordCount .\test}

Days              : 0
Hours             : 0
Minutes           : 0
Seconds           : 0
Milliseconds      : 8
Ticks             : 81507
TotalDays         : 9.43368055555556E-08
TotalHours        : 2.26408333333333E-06
TotalMinutes      : 0.000135845
TotalSeconds      : 0.0081507
TotalMilliseconds : 8.1507

PS C:\Users\Alan\Desktop\415\hw4> Measure-Command{.\winWordCount .\test}

Days              : 0
Hours             : 0
Minutes           : 0
Seconds           : 0
Milliseconds      : 7
Ticks             : 78575
TotalDays         : 9.0943287037037E-08
TotalHours        : 2.18263888888889E-06
TotalMinutes      : 0.000130958333333333
TotalSeconds      : 0.0078575
TotalMilliseconds : 7.8575

PS C:\Users\Alan\Desktop\415\hw4> Measure-Command{.\winWordCount .\test}
```

```
Days              : 0
Hours             : 0
Minutes           : 0
Seconds           : 0
Milliseconds      : 7
Ticks             : 71178
TotalDays         : 8.23819444444444E-08
TotalHours        : 1.97716666666667E-06
TotalMinutes      : 0.00011863
TotalSeconds      : 0.0071178
TotalMilliseconds : 7.1178

PS C:\Users\Alan\Desktop\415\hw4>
```