

# CSE 344

## HOMEWORK #5

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I used conditional variables in my HW4 assignment, and in this assignment, I added a barrier.

- **Starting the Threads:** In the code, a specified number of worker threads (num\_workers) are created and started in the main function. These threads run the workerThreadStart function to perform file copying operations.
- **File Copying Operations:** Each thread performs file copying operations. These operations are carried out in the workerThreadStart function. The threads retrieve file information from the file\_buffer and use the copy\_file function to copy the files.
- **Waiting at the Barrier:** When the threads complete the file copying operations, they wait at the barrier in the workerThreadStart function:

```
154 void *workerThreadStart(void *arg) {
155     while (1) {
156         pthread_mutex_lock(&file_buffer.mutex);
157         while (file_buffer.start == file_buffer.end && !file_buffer.done) {
158             pthread_cond_wait(&file_buffer.not_empty, &file_buffer.mutex);
159         }
160         if (file_buffer.start == file_buffer.end && file_buffer.done) {
161             pthread_mutex_unlock(&file_buffer.mutex);
162             break;
163         }
164         file_info_t file = file_buffer.buffer[file_buffer.start];
165         file_buffer.start = (file_buffer.start + 1) % buffer_size;
166         pthread_cond_signal(&file_buffer.not_full);
167         pthread_mutex_unlock(&file_buffer.mutex);
168
169         printf("Copying file from %s to -->>> %s\n", file.src_path, file.dest_path);
170         copy_file(file.src_path, file.dest_path);
171     }
172
173     // Wait at the barrier after copying files
174     pthread_barrier_wait(&barrier);
```

At this line, each thread waits at the barrier and waits for the other threads to reach this point. When all threads reach this point, the barrier allows them to continue.

The barrier is initialized with the number of worker threads (`num_workers`). This ensures that all threads synchronize when they reach a certain point. The initialized barrier ensures that the threads meet at a specific point and continue together.

```
int main(int argc, char *argv[]) {  
    if (argc != 5) {  
        fprintf(stderr, "Usage: %s <buffer_size> <num_workers> <src_dir> <dest_dir>\n", argv[0]);  
        exit(EXIT_FAILURE);  
    }  
  
    struct sigaction sa;  
    sa.sa_handler = signal_handler;  
    sa.sa_flags = 0;  
    sigemptyset(&sa.sa_mask);  
    sigaction(SIGINT, &sa, NULL);  
  
    buffer_size = atoi(argv[1]);  
    num_workers = atoi(argv[2]);  
    src_dir = argv[3];  
    dest_dir = argv[4];  
  
    file_buffer.start = 0;  
    file_buffer.end = 0;  
    file_buffer.done = 0;  
    pthread_mutex_init(&file_buffer.mutex, NULL);  
    pthread_cond_init(&file_buffer.not_empty, NULL);  
    pthread_cond_init(&file_buffer.not_full, NULL);  
    pthread_barrier_init(&barrier, NULL, num_workers);  
    workers = (pthread_t *)malloc(num_workers * sizeof(pthread_t));  
}
```

## Example Scenario

In the code, worker threads wait at the barrier after completing the file copying operations. This ensures that all worker threads have finished their file copying tasks. Thus, after all worker threads have completed the file copying operations, they can proceed together. This happens as follows:

1. Thread A finishes the file copying operations and waits at the barrier.
2. Thread B finishes the file copying operations and waits at the barrier.
3. All worker threads (e.g., A, B, C, ...) wait at the barrier.
4. When all worker threads reach the barrier, the barrier allows them to continue, and they all proceed to the next tasks together.

## Output: test1

```
arife@LAPTOP-SRROEDP3:~/hw4/hw4test/put_your_codes_here$ make
gcc -pthread -Wall -c main.c
gcc -pthread -Wall -o MWcp main.o
arife@LAPTOP-SRROEDP3:~/hw4/hw4test/put_your_codes_here$ ./MWcp 10 10 ../testdir/src/libvterm ../tocopy
Copying file from ../testdir/src/libvterm/src/gui_at_sb.c to -->>> ../tocopy/src/gui_at_sb.c
Copying file from ../testdir/src/libvterm/src/gui_xmewb.h to -->>> ../tocopy/src/gui_xmewb.h
Copying file from ../testdir/src/libvterm/src/installml.sh to -->>> ../tocopy/src/installml.sh
Copying file from ../testdir/src/libvterm/src/globals.h to -->>> ../tocopy/src/globals.h
Copying file from ../testdir/src/libvterm/src/iid_ole.c to -->>> ../tocopy/src/iid_ole.c
Copying file from ../testdir/src/libvterm/src/dosinst.h to -->>> ../tocopy/src/dosinst.h
Copying file from ../testdir/src/libvterm/src/evalfunc.c to -->>> ../tocopy/src/evalfunc.c
Copying file from ../testdir/src/libvterm/src/digraph.c to -->>> ../tocopy/src/digraph.c
Copying file from ../testdir/src/libvterm/src/if_python3.c to -->>> ../tocopy/src/if_python3.c
Copying file from ../testdir/src/libvterm/src/crypt.c to -->>> ../tocopy/src/crypt.c
Copying file from ../testdir/src/libvterm/src/MRT10.pdf to -->>> ../tocopy/src/MRT10.pdf
Copying file from ../testdir/src/libvterm/src/gui_dwrite.cpp to -->>> ../tocopy/src/gui_dwrite.cpp
Copying file from ../testdir/src/libvterm/src/termScreen.c to -->>> ../tocopy/src/termScreen.c
Copying file from ../testdir/src/libvterm/src/parser.c to -->>> ../tocopy/src/parser.c
Copying file from ../testdir/src/libvterm/src/config.mk.in to -->>> ../tocopy/src/config.mk.in
Copying file from ../testdir/src/libvterm/src/gui_w32.c to -->>> ../tocopy/src/gui_w32.c
Copying file from ../testdir/src/libvterm/src/hangulin.c to -->>> ../tocopy/src/hangulin.c
Copying file from ../testdir/src/libvterm/src/keyboard.c to -->>> ../tocopy/src/keyboard.c
Copying file from ../testdir/src/libvterm/src/gvimtutor to -->>> ../tocopy/src/gvimtutor
Copying file from ../testdir/src/libvterm/src/dict.c to -->>> ../tocopy/src/dict.c
Copying file from ../testdir/src/libvterm/src/INSTALLpc.txt to -->>> ../tocopy/src/INSTALLpc.txt
Copying file from ../testdir/src/libvterm/src/gui_x11.c to -->>> ../tocopy/src/gui_x11.c
Copying file from ../testdir/src/libvterm/src/bigvim64.bat to -->>> ../tocopy/src/bigvim64.bat
Copying file from ../testdir/src/libvterm/src/create_cmdidxs.vim to -->>> ../tocopy/src/create_cmdidxs.vim
Copying file from ../testdir/src/libvterm/src/if_cscope.h to -->>> ../tocopy/src/if_cscope.h
Copying file from ../testdir/src/libvterm/src/gui_gtk_x11.c to -->>> ../tocopy/src/gui_gtk_x11.c
Copying file from ../testdir/src/libvterm/src/if_perlsfio.c to -->>> ../tocopy/src/fold.c
Copying file from ../testdir/src/libvterm/src/if_mzsch.h to -->>> ../tocopy/src/if_mzsch.h
Copying file from ../testdir/src/libvterm/src/mouse.c to -->>> ../tocopy/src/mouse.c
Copying file from ../testdir/src/libvterm/src/gui_beval.c to -->>> ../tocopy/src/gui_beval.c
Copying file from ../testdir/src/libvterm/src/if_perlsfio.c to -->>> ../tocopy/src/if_perlsfio.c
Copying file from ../testdir/src/libvterm/src/GvimExt/uninst.bat to -->>> ../tocopy/src/GvimExt/uninst.bat
Copying file from ../testdir/src/libvterm/src/GvimExt/gvimext.h to -->>> ../tocopy/src/GvimExt/gvimext.h
Copying file from ../testdir/src/libvterm/src/GvimExt/gvimext_ming.def to -->>> ../tocopy/src/GvimExt/gvimext_ming.def
```

```
Copying file from ../testdir/src/libvterm/t/18state_termprops.test to -->>> ../tocopy/t/18state_termprops.test
Copying file from ../testdir/src/libvterm/t/22state_save.test to -->>> ../tocopy/t/22state_save.test
Copying file from ../testdir/src/libvterm/t/46screen_extent.test to -->>> ../tocopy/t/46screen_extent.test
Copying file from ../testdir/src/libvterm/t/42screen_damage.test to -->>> ../tocopy/t/42screen_damage.test
Copying file from ../testdir/src/libvterm/t/90vttest_01-movement-4.test to -->>> ../tocopy/t/90vttest_01-movement-4.test
Copying file from ../testdir/src/libvterm/t/90vttest_02-screen-1.test to -->>> ../tocopy/t/90vttest_02-screen-1.test
Copying file from ../testdir/src/libvterm/t/29state_fallback.test to -->>> ../tocopy/t/29state_fallback.test
Copying file from ../testdir/src/libvterm/t/10state_putglyph.test to -->>> ../tocopy/t/10state_putglyph.test
Copying file from ../testdir/src/libvterm/t/48screen_termprops.test to -->>> ../tocopy/t/48screen_termprops.test
Copying file from ../testdir/src/libvterm/t/90vttest_01-movement-1.test to -->>> ../tocopy/t/90vttest_01-movement-1.test
Copying file from ../testdir/src/libvterm/t/harness.c to -->>> ../tocopy/t/harness.c
Copying file from ../testdir/src/libvterm/t/90vttest_02-screen-2.test to -->>> ../tocopy/t/90vttest_02-screen-2.test
Copying file from ../testdir/src/libvterm/t/03encoding_utf8.test to -->>> ../tocopy/t/03encoding_utf8.test
Copying file from ../testdir/src/libvterm/t/25state_input.test to -->>> ../tocopy/t/25state_input.test
Copying file from ../testdir/src/libvterm/t/90vttest_02-screen-3.test to -->>> ../tocopy/t/90vttest_02-screen-3.test
Copying file from ../testdir/src/libvterm/t/15state_mode.test to -->>> ../tocopy/t/15state_mode.test
Copying file from ../testdir/src/libvterm/.bzrignore to -->>> ../tocopy/.bzrignore
Copying file from ../testdir/src/libvterm/tbl2inc.c.pl to -->>> ../tocopy/tbl2inc.c.pl
Copying file from ../testdir/src/libvterm/t/11state_movecursor.test to -->>> ../tocopy/t/11state_movecursor.test
Copying file from ../testdir/src/libvterm/bin/vterm-dump.c to -->>> ../tocopy/bin/vterm-dump.c
Copying file from ../testdir/src/libvterm/t/47screen_dbl_wh.test to -->>> ../tocopy/t/47screen_dbl_wh.test
Copying file from ../testdir/src/libvterm/vterm.pc.in to -->>> ../tocopy/vterm.pc.in
Copying file from ../testdir/src/libvterm/README to -->>> ../tocopy/README
Copying file from ../testdir/src/libvterm/Makefile to -->>> ../tocopy/Makefile
Copying file from ../testdir/src/libvterm/bin/unterm.c to -->>> ../tocopy/bin/unterm.c
Copying file from ../testdir/src/libvterm/bin/vterm-ctrl.c to -->>> ../tocopy/bin/vterm-ctrl.c
```

-----STATISTICS-----

Consumers: 10 - Buffer Size: 10  
Number of Regular File: 194  
Number of FIFO File: 0  
Number of Directory: 7  
TOTAL BYTES COPIED: 25009680  
TOTAL TIME: 00:00.036 (min:sec.mili)

## Test2

```
arife@LAPTOP-SRROEDP3:~/hw4/hw4test/put_your_codes_here$ ./MwCp 10 4 ../testdir/src/libvterm/src ../toCopy
Copying file from ../testdir/src/libvterm/src/digraph.c to --> ../toCopy/digraph.c
Copying file from ../testdir/src/libvterm/src/gui_at_sb.c to --> ../toCopy/gui_at_sb.c
Copying file from ../testdir/src/libvterm/src/dosinst.h to --> ../toCopy/dosinst.h
Copying file from ../testdir/src/libvterm/src/globals.h to --> ../toCopy/globals.h
Copying file from ../testdir/src/libvterm/src/gui_xmewb.h to --> ../toCopy/gui_xmewb.h
Copying file from ../testdir/src/libvterm/src/iid_ole.c to --> ../toCopy/iid_ole.c
Copying file from ../testdir/src/libvterm/src/installml.sh to --> ../toCopy/installml.sh
Copying file from ../testdir/src/libvterm/src/MRT10.pdf to --> ../toCopy/MRT10.pdf
Copying file from ../testdir/src/libvterm/src/bigvim64.bat to --> ../toCopy/bigvim64.bat
Copying file from ../testdir/src/libvterm/src/evalfunc.c to --> ../toCopy/evalfunc.c
Copying file from ../testdir/src/libvterm/src/if_python3.c to --> ../toCopy/if_python3.c
Copying file from ../testdir/src/libvterm/src/crypt.c to --> ../toCopy/crypt.c
Copying file from ../testdir/src/libvterm/src/gui_dwrite.cpp to --> ../toCopy/gui_dwrite.cpp
Copying file from ../testdir/src/libvterm/src/termScreen.c to --> ../toCopy/termScreen.c
Copying file from ../testdir/src/libvterm/src/parser.c to --> ../toCopy/parser.c
Copying file from ../testdir/src/libvterm/src/config.mk.in to --> ../toCopy/config.mk.in
Copying file from ../testdir/src/libvterm/src/gui_w32.c to --> ../toCopy/gui_w32.c
Copying file from ../testdir/src/libvterm/src/hangulin.c to --> ../toCopy/hangulin.c
Copying file from ../testdir/src/libvterm/src/keyboard.c to --> ../toCopy/keyboard.c
Copying file from ../testdir/src/libvterm/src/gvmtutor to --> ../toCopy/gvmtutor
Copying file from ../testdir/src/libvterm/src/dict.c to --> ../toCopy/dict.c
Copying file from ../testdir/src/libvterm/src/INSTALLpc.txt to --> ../toCopy/INSTALLpc.txt
Copying file from ../testdir/src/libvterm/src/gui_x11.c to --> ../toCopy/gui_x11.c
Copying file from ../testdir/src/libvterm/src/create_cmdidxs.vim to --> ../toCopy/create_cmdidxs.vim
Copying file from ../testdir/src/libvterm/src/if_cscope.h to --> ../toCopy/if_cscope.h
Copying file from ../testdir/src/libvterm/src/gui_gtk_x11.c to --> ../toCopy/gui_gtk_x11.c
Copying file from ../testdir/src/libvterm/src/fold.c to --> ../toCopy/fold.c
Copying file from ../testdir/src/libvterm/src/if_mzsch.h to --> ../toCopy/if_mzsch.h
Copying file from ../testdir/src/libvterm/src/mouse.c to --> ../toCopy/mouse.c
Copying file from ../testdir/src/libvterm/src/gui_beval.c to --> ../toCopy/gui_beval.c
Copying file from ../testdir/src/libvterm/src/if_perlsfio.c to --> ../toCopy/if_perlsfio.c
Copying file from ../testdir/src/libvterm/src/GvimExt/uninst.bat to --> ../toCopy/GvimExt/uninst.bat
Copying file from ../testdir/src/libvterm/src/GvimExt/gvimext.h to --> ../toCopy/GvimExt/gvimext.h
Copying file from ../testdir/src/libvterm/src/GvimExt/gvimext_ming.def to --> ../toCopy/GvimExt/gvimext_ming.def
Copying file from ../testdir/src/libvterm/src/GvimExt/resource.h to --> ../toCopy/GvimExt/resource.h
Copying file from ../testdir/src/libvterm/src/GvimExt/README.txt to --> ../toCopy/GvimExt/README.txt
Copying file from ../testdir/src/libvterm/src/GvimExt/gvimext_ming.rc to --> ../toCopy/GvimExt/gvimext_ming.rc
Copying file from ../testdir/src/libvterm/src/GvimExt/gvimext.def to --> ../toCopy/GvimExt/gvimext.def
Copying file from ../testdir/src/libvterm/src/GvimExt/gvimext_inf to --> ../toCopy/GvimExt/gvimext_inf
Copying file from ../testdir/src/libvterm/src/gui_at_fs.c to --> ../toCopy/gui_at_fs.c
Copying file from ../testdir/src/libvterm/src/gui_photon.c to --> ../toCopy/gui_photon.c
Copying file from ../testdir/src/libvterm/src/autocmd.c to --> ../toCopy/autocmd.c
Copying file from ../testdir/src/libvterm/src/keymap.h to --> ../toCopy/keymap.h
Copying file from ../testdir/src/libvterm/src/glbl_ime.h to --> ../toCopy/glbl_ime.h
Copying file from ../testdir/src/libvterm/src/vterm.c to --> ../toCopy/vterm.c
Copying file from ../testdir/src/libvterm/src/INSTALL to --> ../toCopy/INSTALL
Copying file from ../testdir/src/libvterm/src/dehqx.py to --> ../toCopy/dehqx.py
Copying file from ../testdir/src/libvterm/src/charset.c to --> ../toCopy/charset.c
Copying file from ../testdir/src/libvterm/src/gui_xmdlg.c to --> ../toCopy/gui_xmdlg.c
Copying file from ../testdir/src/libvterm/src/utf8.h to --> ../toCopy/utf8.h
Copying file from ../testdir/src/libvterm/src/isl1551098739430.pdf to --> ../toCopy/isl1551098739430.pdf
Copying file from ../testdir/src/libvterm/src/ex_getln.c to --> ../toCopy/ex_getln.c
Copying file from ../testdir/src/libvterm/src/INSTALLami.txt to --> ../toCopy/INSTALLami.txt
Copying file from ../testdir/src/libvterm/src/hardcopy.c to --> ../toCopy/hardcopy.c
Copying file from ../testdir/src/libvterm/src/config.h.in to --> ../toCopy/config.h.in
Copying file from ../testdir/src/libvterm/src/buffer.c to --> ../toCopy/buffer.c
Copying file from ../testdir/src/libvterm/src/state.c to --> ../toCopy/state.c
Copying file from ../testdir/src/libvterm/src/diff.c to --> ../toCopy/diff.c
Copying file from ../testdir/src/libvterm/src/gui_mac.c to --> ../toCopy/gui_mac.c
Copying file from ../testdir/src/libvterm/src/install-sh to --> ../toCopy/install-sh
Copying file from ../testdir/src/libvterm/src/if_perl.xs to --> ../toCopy/if_perl.xs
Copying file from ../testdir/src/libvterm/src/gui_xmewbp.h to --> ../toCopy/gui_xmewbp.h
Copying file from ../testdir/src/libvterm/src/if_xcmdsrv.c to --> ../toCopy/if_xcmdsrv.c
Copying file from ../testdir/src/libvterm/src/if_ole.cpp to --> ../toCopy/if_ole.cpp

-----STATISTICS-----
Consumers: 4 - Buffer Size: 10
Number of Regular File: 140
Number of FIFO File: 0
Number of Directory: 2
TOTAL BYTES COPIED: 24873082
TOTAL TIME: 00:01.698 (min:sec.mili)
```

## Test3

```
arife@LAPTOP-SRROEDP3:~/hw4/hw4test/put_your_codes_here$ ./MwCp 10 10 ../testdir ../toCopy
```

```
Copying file from ../testdir/runtime/tutor/tutor.ja.euc to -->>> ../toCopy/runtime/tutor/tutor.ja.euc
Copying file from ../testdir/runtime/tutor/tutor.zh_tw.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.zh_tw.utf-8
Copying file from ../testdir/runtime/tutor/tutor.ca to -->>> ../toCopy/runtime/tutor/tutor.ca
Copying file from ../testdir/runtime/tutor/tutor.cs.cp1250 to -->>> ../toCopy/runtime/tutor/tutor.cs.cp1250
Copying file from ../testdir/runtime/tutor/tutor.eo to -->>> ../toCopy/runtime/tutor/tutor.eo
Copying file from ../testdir/runtime/tutor/tutor.tr.iso9 to -->>> ../toCopy/runtime/tutor/tutor.tr.iso9
Copying file from ../testdir/runtime/tutor/tutor.es.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.es.utf-8
Copying file from ../testdir/runtime/tutor/tutor.sk.cp1250 to -->>> ../toCopy/runtime/tutor/tutor.sk.cp1250
Copying file from ../testdir/runtime/tutor/Makefile to -->>> ../toCopy/runtime/tutor/Makefile
Copying file from ../testdir/runtime/tutor/tutor.zh.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.zh.utf-8
Copying file from ../testdir/runtime/tutor/tutor.nb.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.nb.utf-8
Copying file from ../testdir/runtime/tutor/tutor.ru.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.ru.utf-8
Copying file from ../testdir/runtime/tutor/tutor.el.cp737 to -->>> ../toCopy/runtime/tutor/tutor.el.cp737
Copying file from ../testdir/runtime/tutor/tutor.ja.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.ja.utf-8
Copying file from ../testdir/runtime/tutor/tutor.sr.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.sr.utf-8
Copying file from ../testdir/runtime/tutor/tutor.ko.euc to -->>> ../toCopy/runtime/tutor/tutor.ko.euc
Copying file from ../testdir/runtime/tutor/tutor to -->>> ../toCopy/runtime/tutor/tutor
Copying file from ../testdir/runtime/tutor/tutor.sk to -->>> ../toCopy/runtime/tutor/tutor.sk
Copying file from ../testdir/runtime/tutor/tutor.da.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.da.utf-8
Copying file from ../testdir/runtime/tutor/tutor.bar.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.bar.utf-8
Copying file from ../testdir/runtime/tutor/tutor.eo.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.eo.utf-8
Copying file from ../testdir/runtime/tutor/tutor.ca.utf-8 to -->>> ../toCopy/runtime/tutor/tutor.ca.utf-8
Copying file from ../testdir/runtime/icons.info to -->>> ../toCopy/runtime/icons.info
Copying file from ../testdir/runtime/vimlogo.xpm to -->>> ../toCopy/runtime/vimlogo.xpm
Copying file from ../testdir/runtime/doc.info to -->>> ../toCopy/runtime/doc.info
Copying file from ../testdir/Makefile to -->>> ../toCopy/Makefile
Copying file from ../testdir/.travis.yml to -->>> ../toCopy/.travis.yml
Copying file from ../testdir/ci/appveyor.bat to -->>> ../toCopy/ci/appveyor.bat
Copying file from ../testdir/.hgignore to -->>> ../toCopy/.hgignore
Copying file from ../testdir/tools/rename.bat to -->>> ../toCopy/tools/rename.bat
Copying file from ../testdir/CONTRIBUTING.md to -->>> ../toCopy/CONTRIBUTING.md
```

```
-----STATISTICS-----
```

```
Consumers: 10 - Buffer Size: 10
Number of Regular File: 3116
Number of FIFO File: 0
Number of Directory: 151
TOTAL BYTES COPIED: 73520554
TOTAL TIME: 00:00.289 (min:sec.mili)
```

```
arife@LAPTOP-SRROEDP3:~/hw4/hw4test/put_your_codes_here$
```

Ln 36, Col 1 (25 selected) - Tab Stop 4