

CSE344 Homework 4 Report

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1. Problem Definition

Develop a directory copying utility called "MWCp" that copies files and sub-directories in parallel. Use a worker-manager approach to synchronize thread activity. Use POSIX and Standard C libraries.

2. General Structure

Simplified version of the code. For detailly (signal handler, closing file etc.) implementation you can look code file.

```
pthread_mutex_t the_mutex; // Mutex for synchronization between threads
pthread_cond_t condc, condp; // Condition variables for controlling if buffer is full or empty
pthread_mutex_t flag; // Mutex for SIGINT
typedef struct {
    int srcFd; // File descriptor for source file
    int destFd; // File descriptor for destination file
    char srcName[PATH_SIZE]; // Source file name
    char destName[PATH_SIZE]; // Destination file name
} Files;
typedef struct {
    int bufferSize; // Buffer size Files *buffer; // Buffer
    int count; // Number of items in buffer
    int head; // Head of buffer int last; // Last of buffer
    int doneFlag; // Done flag
} Buffer;
```

```

manager(arg) {
    char **argv = (char **) arg;
    createDirectory(argv[3], argv[4]);
    lock(&thread_mutex);
    buffer.doneFlag = 1;
    broadcast(&condc);
    unlock(&thread_mutex);
}

worker(arg) {
    while(1) {
        item = remove_item();
        if(item.srcFd == -1 and item.dest == -1) break;
        if(item.srcFd == -1 or item.dest == -1) continue;
        while(bytes_read = read(item.src) > 0) {
            bytes_write = write(item.destFd);
            totalWritten += bytes_write;
        }
        close(item.srcFd);
        close(item.dstFd);
        lock(&thread_mutex);
        totalBytes += totalWritten;
        unlock(&thread_mutex);
    }
    pthread_exit(0);
}

```

```
add_item(Files item) {
```

```
    lock(&thread_mutex);
```

```
    while(buffer.count == maxBuffer) cond_wait(&condp, &thread_mutex);
```

```
    buffer.buffer[buffer.last] = item;
```

```
    buffer.last = (buffer.last + 1) % buffer.bufferSize;
```

```
    buffer.count++;
```

```
    cond_signal(&condc);
```

```
    unlock(&thread_mutex);
```

```
}
```

```
remove_item() {
```

```
    lock(&thread_mutex);
```

```
    while(buffer.count == 0 && buffer.doneFlag == 0) cond_wait(&condc, &thread_mutex);
```

```
    if(buffer.count > 0) {
```

```
        item = buffer.buffer[buffer.head];
```

```
        buffer.head = (buffer.head + 1) % buffer.bufferSize;
```

```
        buffer.count--;
```

```
        cond_signal(&condp);
```

```
        unlock(&thread_mutex);
```

```
        return item;
```

```
    }
```

```
    unlock(&thread_mutex);
```

```
    return (Files) {-1, -1, "", ""};
```

```
}
```

3. Tests

- Test1: valgrind ./MWCp 10 10 ../testdir/src/libvterm ../tocopy, #memory leak checking, buffer size=10, number of workers=10, sourceFile, destinationFile

Still reachable blocks because of dynamic linker

```
a@DESKTOP-5F6OAM7: /mnt, X + v
==66== by 0x4006E96: _dl_map_object_from_fd (dl-load.c:997)
==66== by 0x400A61A: _dl_map_object (dl-load.c:2236)
==66== by 0x4015D46: dl_open_worker (dl-open.c:513)
==66== by 0x49DAB47: _dl_catch_exception (dl-error-skeleton.c:208)
==66== by 0x4015609: _dl_open (dl-open.c:837)
==66== by 0x49D9AE0: do_dlopen (dl-libc.c:96)
==66== by 0x49DAB47: _dl_catch_exception (dl-error-skeleton.c:208)
==66== by 0x49DAC12: _dl_catch_error (dl-error-skeleton.c:227)
==66== by 0x49D9C14: dlerror_run (dl-libc.c:46)
==66== by 0x49D9C14: __libc_dlopen_mode (dl-libc.c:195)
==66== by 0x486B9FA: pthread_cancel_init (unwind-forcedunwind.c:53)
==66==
==66== 384 bytes in 1 blocks are still reachable in loss record 3 of 4
==66== at 0x483DD99: calloc (in /usr/lib/x86_64-linux-gnu/valgrind/vgpreload_memcheck-amd64-linux.so)
==66== by 0x401331C: _dl_check_map_versions (dl-version.c:274)
==66== by 0x40160FC: dl_open_worker (dl-open.c:577)
==66== by 0x49DAB47: _dl_catch_exception (dl-error-skeleton.c:208)
==66== by 0x4015609: _dl_open (dl-open.c:837)
==66== by 0x49D9AE0: do_dlopen (dl-libc.c:96)
==66== by 0x49DAB47: _dl_catch_exception (dl-error-skeleton.c:208)
==66== by 0x49DAC12: _dl_catch_error (dl-error-skeleton.c:227)
==66== by 0x49D9C14: dlerror_run (dl-libc.c:46)
==66== by 0x49D9C14: __libc_dlopen_mode (dl-libc.c:195)
==66== by 0x486B9FA: pthread_cancel_init (unwind-forcedunwind.c:53)
==66== by 0x486BC13: _Unwind_ForcedUnwind (unwind-forcedunwind.c:127)
==66== by 0x4869F65: __pthread_unwind (unwind.c:121)
==66==
==66== 1,198 bytes in 1 blocks are still reachable in loss record 4 of 4
==66== at 0x483DD99: calloc (in /usr/lib/x86_64-linux-gnu/valgrind/vgpreload_memcheck-amd64-linux.so)
==66== by 0x400D283: _dl_new_object (dl-object.c:89)
==66== by 0x4006E96: _dl_map_object_from_fd (dl-load.c:997)
==66== by 0x400A61A: _dl_map_object (dl-load.c:2236)
==66== by 0x4015D46: dl_open_worker (dl-open.c:513)
==66== by 0x49DAB47: _dl_catch_exception (dl-error-skeleton.c:208)
==66== by 0x4015609: _dl_open (dl-open.c:837)
==66== by 0x49D9AE0: do_dlopen (dl-libc.c:96)
==66== by 0x49DAB47: _dl_catch_exception (dl-error-skeleton.c:208)
==66== by 0x49DAC12: _dl_catch_error (dl-error-skeleton.c:227)
==66== by 0x49D9C14: dlerror_run (dl-libc.c:46)
==66== by 0x49D9C14: __libc_dlopen_mode (dl-libc.c:195)
==66== by 0x486B9FA: pthread_cancel_init (unwind-forcedunwind.c:53)
==66==
==66== LEAK SUMMARY:
==66== definitely lost: 0 bytes in 0 blocks
==66== indirectly lost: 0 bytes in 0 blocks
==66== possibly lost: 0 bytes in 0 blocks
==66== still reachable: 1,654 bytes in 4 blocks
==66== suppressed: 0 bytes in 0 blocks
==66==
==66== For lists of detected and suppressed errors, rerun with: -s
==66== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
```

```
a@DESKTOP-5F60AM7:/mnt/c/Users/akif_/Desktop/SystemPro/Hw4/hw4test/put_your_codes_here$
```

- Test2: ./MWCp 10 4 ../testdir/src/libvterm/src ../toCopy #buffer size=10, number of workers=4, sourceFile, destinationFile

```
a@DESKTOP-5F6OAM7: /mnt, X + v
Copied ../testdir/src/libvterm/src/if_ole.idl to ../toCopy/if_ole.idl
Copied ../testdir/src/libvterm/src/if_perlsfio.c to ../toCopy/if_perlsfio.c
Copied ../testdir/src/libvterm/src/if_perl_xs to ../toCopy/if_perl_xs
Copied ../testdir/src/libvterm/src/if_perl_msvc/stdbool.h to ../toCopy/if_perl_msvc/stdbool.h
Copied ../testdir/src/libvterm/src/if_python.c to ../toCopy/if_python.c
Copied ../testdir/src/libvterm/src/if_python3.c to ../toCopy/if_python3.c
Copied ../testdir/src/libvterm/src/if_ruby.c to ../toCopy/if_ruby.c
Copied ../testdir/src/libvterm/src/if_tcl.c to ../toCopy/if_tcl.c
Copied ../testdir/src/libvterm/src/if_py_both.h to ../toCopy/if_py_both.h
Copied ../testdir/src/libvterm/src/if_xcmdsrv.c to ../toCopy/if_xcmdsrv.c
Copied ../testdir/src/libvterm/src/iid_ole.c to ../toCopy/iid_ole.c
Copied ../testdir/src/libvterm/src/infplist.xml to ../toCopy/infplist.xml
Copied ../testdir/src/libvterm/src/indent.c to ../toCopy/indent.c
Copied ../testdir/src/libvterm/src/INSTALL to ../toCopy/INSTALL
Copied ../testdir/src/libvterm/src/install-sh to ../toCopy/install-sh
Copied ../testdir/src/libvterm/src/inexpand.c to ../toCopy/inexpand.c
Copied ../testdir/src/libvterm/src/INSTALLami.txt to ../toCopy/INSTALLami.txt
Copied ../testdir/src/libvterm/src/INSTALLmac.txt to ../toCopy/INSTALLmac.txt
Copied ../testdir/src/libvterm/src/installman.sh to ../toCopy/installman.sh
Copied ../testdir/src/libvterm/src/installml.sh to ../toCopy/installml.sh
Copied ../testdir/src/libvterm/src/INSTALLpc.txt to ../toCopy/INSTALLpc.txt
Copied ../testdir/src/libvterm/src/INSTALLvms.txt to ../toCopy/INSTALLvms.txt
Copied ../testdir/src/libvterm/src/INSTALLx.txt to ../toCopy/INSTALLx.txt
Copied ../testdir/src/libvterm/src/iscygpty.c to ../toCopy/iscygpty.c
Copied ../testdir/src/libvterm/src/iscygpty.h to ../toCopy/iscygpty.h
Copied ../testdir/src/libvterm/src/json.c to ../toCopy/json.c
Copied ../testdir/src/libvterm/src/json_test.c to ../toCopy/json_test.c
Copied ../testdir/src/libvterm/src/keyboard.c to ../toCopy/keyboard.c
Copied ../testdir/src/libvterm/src/keymap.h to ../toCopy/keymap.h
Copied ../testdir/src/libvterm/src/kword_test.c to ../toCopy/kword_test.c
Copied ../testdir/src/libvterm/src/mouse.c to ../toCopy/mouse.c
Copied ../testdir/src/libvterm/src/parser.c to ../toCopy/parser.c
Copied ../testdir/src/libvterm/src/pen.c to ../toCopy/pen.c
Copied ../testdir/src/libvterm/src/rect.h to ../toCopy/rect.h
Copied ../testdir/src/libvterm/src/state.c to ../toCopy/state.c
Copied ../testdir/src/libvterm/src/termScreen.c to ../toCopy/termScreen.c
Copied ../testdir/src/libvterm/src/unicode.c to ../toCopy/unicode.c
Copied ../testdir/src/libvterm/src/utf8.h to ../toCopy/utf8.h
Copied ../testdir/src/libvterm/src/vterm.c to ../toCopy/vterm.c
Copied ../testdir/src/libvterm/src/vterm_internal.h to ../toCopy/vterm_internal.h
Copied ../testdir/src/libvterm/src/MRT10.pdf to ../toCopy/MRT10.pdf
Copied ../testdir/src/libvterm/src/isl1551098739430.pdf to ../toCopy/isl1551098739430.pdf

-----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: 00:00.293 (min:sec.mili)
a@DESKTOP-5F6OAM7: /mnt/c/Users/akif_/Desktop/SystemPro/Hw4/hw4test/put_your_codes_here$
```

Masauüstü > SystemPro > Hw4 > hw4test > tocopy > tocopy klasöründe ara				
Ad	Değiştirme tarihi	Tür	Boyut	
QvimExt	18.05.2024 23:23	Dosya klasörü		
if_perl_msvc	18.05.2024 23:23	Dosya klasörü		
autocmd.c	18.05.2024 23:23	C Kaynak Dosyası	66 KB	
beval.c	18.05.2024 23:23	C Kaynak Dosyası	7 KB	
beval.h	18.05.2024 23:23	C Header Kaynak ...	3 KB	
biqvim.bat	18.05.2024 23:23	Windows Toplu İş ...	1 KB	
biqvim64.bat	18.05.2024 23:23	Windows Toplu İş ...	1 KB	
blob.c	18.05.2024 23:23	C Kaynak Dosyası	5 KB	
blowfish.c	18.05.2024 23:23	C Kaynak Dosyası	24 KB	
buffer.c	18.05.2024 23:23	C Kaynak Dosyası	143 KB	
change.c	18.05.2024 23:23	C Kaynak Dosyası	59 KB	
channel.c	18.05.2024 23:23	C Kaynak Dosyası	144 KB	
charset.c	18.05.2024 23:23	C Kaynak Dosyası	49 KB	
config.h.in	18.05.2024 23:23	İN Dosyası	12 KB	
config.mk.dist	18.05.2024 23:23	DİST Dosyası	1 KB	
config.mk.in	18.05.2024 23:23	İN Dosyası	5 KB	
configure	18.05.2024 23:23	Dosya	1 KB	
configure.ac	18.05.2024 23:23	AC Dosyası	145 KB	
create_cmdides.vim	18.05.2024 23:23	VİM Dosyası	4 KB	
crypt.c	18.05.2024 23:23	C Kaynak Dosyası	15 KB	
crypt_zip.c	18.05.2024 23:23	C Kaynak Dosyası	4 KB	
debugger.c	18.05.2024 23:23	C Kaynak Dosyası	22 KB	
dehq.py	18.05.2024 23:23	Python File	2 KB	
dict.c	18.05.2024 23:23	C Kaynak Dosyası	21 KB	
diff.c	18.05.2024 23:23	C Kaynak Dosyası	79 KB	
digraph.c	18.05.2024 23:23	C Kaynak Dosyası	55 KB	
dimid.idl	18.05.2024 23:23	Interface Definitio...	26 KB	

- Test3: ./MWCp 10 10 ../testdir ../toCopy #buffer size=10, number of workers=10, sourceFile, destinationFile

```
a@DESKTOP-SF6OAM7: /mnt, X + v
Copied ../testdir/src/which.sh to ../toCopy/src/which.sh
Copied ../testdir/src/winclip.c to ../toCopy/src/winclip.c
Copied ../testdir/src/xdiff/README.txt to ../toCopy/src/xdiff/README.txt
Copied ../testdir/src/xdiff/COPYING to ../toCopy/src/xdiff/COPYING
Copied ../testdir/src/xdiff/xdiff.h to ../toCopy/src/xdiff/xdiff.h
Copied ../testdir/src/window.c to ../toCopy/src/window.c
Copied ../testdir/src/xdiff/xdiffi.h to ../toCopy/src/xdiff/xdiffi.h
Copied ../testdir/src/xdiff/xemit.c to ../toCopy/src/xdiff/xemit.c
Copied ../testdir/src/xdiff/xemit.h to ../toCopy/src/xdiff/xemit.h
Copied ../testdir/src/xdiff/xdiffi.c to ../toCopy/src/xdiff/xdiffi.c
Copied ../testdir/src/xdiff/xhistogram.c to ../toCopy/src/xdiff/xhistogram.c
Copied ../testdir/src/xdiff/xmacros.h to ../toCopy/src/xdiff/xmacros.h
Copied ../testdir/src/xdiff/xinclude.h to ../toCopy/src/xdiff/xinclude.h
Copied ../testdir/src/xdiff/xpatience.c to ../toCopy/src/xdiff/xpatience.c
Copied ../testdir/src/xdiff/xprepare.c to ../toCopy/src/xdiff/xprepare.c
Copied ../testdir/src/xdiff/xprepare.h to ../toCopy/src/xdiff/xprepare.h
Copied ../testdir/src/xdiff/xtypes.h to ../toCopy/src/xdiff/xtypes.h
Copied ../testdir/src/xdiff/xutils.c to ../toCopy/src/xdiff/xutils.c
Copied ../testdir/src/xdiff/xutils.h to ../toCopy/src/xdiff/xutils.h
Copied ../testdir/src/xpm/COPYRIGHT to ../toCopy/src/xpm/COPYRIGHT
Copied ../testdir/src/xpm/include/simx.h to ../toCopy/src/xpm/include/simx.h
Copied ../testdir/src/xpm/README.txt to ../toCopy/src/xpm/README.txt
Copied ../testdir/src/xpm/arm64/lib-vc14/libXpm.lib to ../toCopy/src/xpm/arm64/lib-vc14/libXpm.lib
Copied ../testdir/src/xpm/include/xpm.h to ../toCopy/src/xpm/include/xpm.h
Copied ../testdir/src/xpm/x64/lib/libXpm.a to ../toCopy/src/xpm/x64/lib/libXpm.a
Copied ../testdir/src/xpm/x64/lib/libXpm.lib to ../toCopy/src/xpm/x64/lib/libXpm.lib
Copied ../testdir/src/xpm/x64/lib-vc14/libXpm.lib to ../toCopy/src/xpm/x64/lib-vc14/libXpm.lib
Copied ../testdir/src/xpm/x86/lib/libXpm.a to ../toCopy/src/xpm/x86/lib/libXpm.a
Copied ../testdir/src/xpm/w32.c to ../toCopy/src/xpm/w32.c
Copied ../testdir/src/xpm/x86/lib/libXpm.lib to ../toCopy/src/xpm/x86/lib/libXpm.lib
Copied ../testdir/src/xpm/w32.h to ../toCopy/src/xpm/w32.h
Copied ../testdir/src/xpm/x86/lib-vc14/libXpm.lib to ../toCopy/src/xpm/x86/lib-vc14/libXpm.lib
Copied ../testdir/src/xxd/Makefile to ../toCopy/src/xxd/Makefile
Copied ../testdir/src/xxd/Make_amiga.mak to ../toCopy/src/xxd/Make_amiga.mak
Copied ../testdir/src/xxd/Make_ming.mak to ../toCopy/src/xxd/Make_ming.mak
Copied ../testdir/src/xxd/Make_mvc.mak to ../toCopy/src/xxd/Make_mvc.mak
Copied ../testdir/src/xxd/Make_vms.mms to ../toCopy/src/xxd/Make_vms.mms
Copied ../testdir/src/xxd/xxd.c to ../toCopy/src/xxd/xxd.c
Copied ../testdir/tools/rename.bat to ../toCopy/tools/rename.bat
Copied ../testdir/uninstal.txt to ../toCopy/uninstal.txt
Copied ../testdir/vimtutor.bat to ../toCopy/vimtutor.bat
Copied ../testdir/vimtutor.com to ../toCopy/vimtutor.com

-----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: 00:04.527 (min:sec.mili)
a@DESKTOP-SF6OAM7: /mnt/c/Users/akif_/Desktop/SystemPro/Hw4/hw4test/put_your_codes_here$ |
```

Ad	Değiştirme tarihi	Tür	Boyut
github	18.05.2024 23:25	Dosya klasörü	
ci	18.05.2024 23:25	Dosya klasörü	
isis	18.05.2024 23:25	Dosya klasörü	
pixmaps	18.05.2024 23:25	Dosya klasörü	
READMEdir	18.05.2024 23:25	Dosya klasörü	
runtime	18.05.2024 23:25	Dosya klasörü	
.gitignore	18.05.2024 23:25	Git Ignore Kaynak ...	2 KB
.hgignore	18.05.2024 23:25	HGIGNORE Dosyası	2 KB
.jgtn.yml	18.05.2024 23:25	Yaml Kaynak Dosy...	1 KB
.travis.yml	18.05.2024 23:25	Yaml Kaynak Dosy...	6 KB
appveyor.yml	18.05.2024 23:25	Yaml Kaynak Dosy...	1 KB
configure	18.05.2024 23:25	Dosya	1 KB
CONTRIBUTING.md	18.05.2024 23:25	Markdown Kayna...	3 KB
Filelist	18.05.2024 23:25	Dosya	23 KB
Makefile	18.05.2024 23:25	Dosya	21 KB
README.md	18.05.2024 23:25	Markdown Kayna...	6 KB
README.txt	18.05.2024 23:25	TXT Dosyası	5 KB
src	18.05.2024 23:25	Dosya klasörü	
tools	18.05.2024 23:25	Dosya klasörü	
uninstal.txt	18.05.2024 23:25	TXT Dosyası	4 KB
vimtutor.bat	18.05.2024 23:25	Windows Toplu İş ...	2 KB
vimtutor.com	18.05.2024 23:25	MS-DOS Uygulam...	3 KB