

CPSC 457
OPERATING SYSTEMS
SAMPLE MIDTERM

Department of Computer Science
University of Calgary
Professor: Carey Williamson

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This is a CLOSED BOOK exam. Textbooks, notes, laptops, calculators, personal digital assistants, cell phones, and Internet access are NOT allowed.

It is a 50 minute exam, with a total of 45 marks. There are 9 questions, and 7 pages (including this cover page). Please read each question carefully, and write your answers legibly in the space provided. You may do the questions in any order you wish, but please USE YOUR TIME WISELY.

When you are finished, please hand in your exam paper and sign out. Good luck!

Student Name: _____

Student ID: _____

Score: _____ / 45 = _____ %

Multiple Choice

Choose the best answer for each of the following 5 questions, for a total of 5 marks.

- 1 1. A novel command-line feature introduced by the original Unix system was:
 - (a) pipes
 - (b) cigars
 - (c) cigarettes
 - (d) keyboard input

- 1 2. The operating system interface on most Windows systems today is:
 - (a) punched cards
 - (b) batch processing
 - (c) command-line interface
 - (d) Graphical User Interface (GUI)
 - (e) Extra-Sensory Perception (ESP)

- 1 3. Which of the following system calls alters the user's environment in the Linux shell?
 - (a) `chdir()`
 - (b) `getpid()`
 - (c) `sleep()`
 - (d) `socket()`

- 1 4. The Win32 API for process creation:
 - (a) requires up to 10 parameters
 - (b) is more complicated than `fork()` in Linux
 - (c) combines the functionality of Linux `fork()` and `exec()` together
 - (d) is impossible for your professor to figure out
 - (e) all of the above

- 1 5. POSIX Threads (PThreads):
 - (a) is a specification for standardizing the API for threads
 - (b) can provide support for user-level threads via a thread library
 - (c) can provide support for kernel-level threads in the OS
 - (d) all of the above
 - (e) none of the above

Operating System Concepts and Definitions

10 6. For each of the following pairs of terms, define each term, making sure to clarify the key difference(s) between the two terms.

(a) (2 marks) “`fork()`” and “`exec()`”

(b) (2 marks) “foreground” and “background”

(c) (2 marks) “CPU-bound” and “I/O-bound”

(d) (2 marks) “preemptive” and “non-preemptive”

(e) (2 marks) “library routine” and “system call”

CPU Scheduling

- 10 7. Suppose that 5 jobs arrive simultaneously into an otherwise-empty ready queue in a Linux system with a single CPU. The following Gantt chart shows the result from RR scheduling for these jobs, using a quantum size (q) of 10. (The times indicated are associated with the vertical lines on the Gantt chart. The last job completes and departs at time 61.)

J_1	J_2	J_3	J_4	J_5	J_2	J_5	J_2	
0	10	20	23	30	40	50	52	61

- (a) (2 marks) Calculate the job sizes in this example.
- (b) (2 marks) Calculate the average job waiting time for RR ($q = 10$).
- (c) (2 marks) Draw a Gantt chart showing FCFS scheduling for these jobs.
- (d) (2 marks) Draw a Gantt chart showing SJF scheduling for these jobs.
- (e) (2 marks) Which of these 3 policies provides the lowest waiting time for these jobs?

Operating System Utilities

10 8. The output on the next page is from a user's interactive shell on a local Linux system. Use the output and your knowledge of Linux systems to answer the following questions:

(a) (1 mark) How many regular files are in the current working directory?

(b) (1 mark) How many sub-directories does this user have here?

(c) (1 mark) What is the default umask for this user?

(d) (1 mark) How many C source code files reside here?

(e) (1 mark) How many executable files reside here?

(f) (1 mark) Which executable file was compiled most recently?

(g) (1 mark) Which executable file is largest?

(h) (1 mark) Which executable file is the oldest?

(i) (1 mark) When was this sample midterm exam created?

(i) (1 mark) What is your professor's favourite word processor?

```
[carey@csl 2008]$ pwd
/home/dsl/carey/classes/CPSC457/2008
[carey@csl 2008]$ ls -l
```

```
total 484
drwx----- 5 carey profs 4096 Sep 23 22:48 330
drwxr-xr-x 13 carey profs 4096 Oct 2 13:18 ass1
drwxr-xr-x 2 carey profs 4096 Oct 10 13:58 ass2
drwxr-xr-x 2 carey profs 4096 Sep 14 21:15 ass3
drwxr-xr-x 2 carey profs 4096 Sep 14 21:15 ass4
-rwx--x--x 1 carey profs 5012 Oct 10 14:14 burner
-rw----- 1 carey profs 413 Sep 22 13:26 burner.c
-rwx----- 1 carey profs 5635 Sep 24 11:48 canada
-rw----- 1 carey profs 1262 Sep 24 11:48 canada.c
-rwx----- 1 carey profs 5474 Sep 24 12:36 lister
-rw----- 1 carey profs 672 Sep 24 12:36 lister.c
-rw----- 1 carey profs 377 Oct 12 13:57 midterm2.aux
-rw----- 1 carey profs 7972 Oct 12 13:57 midterm2.dvi
-rw----- 1 carey profs 6425 Oct 12 13:57 midterm2.log
-rw----- 1 carey profs 33934 Oct 12 13:57 midterm2.pdf
-rw----- 1 carey profs 82710 Oct 12 13:57 midterm2.ps
-rw-r--r-- 1 carey profs 6014 Oct 12 14:00 midterm2.tex
-rw-r--r-- 1 carey profs 375 Oct 12 13:52 midterm.aux
-rw-r--r-- 1 carey profs 13128 Oct 12 13:52 midterm.dvi
-rw-r--r-- 1 carey profs 6424 Oct 12 13:52 midterm.log
-rw-r--r-- 1 carey profs 44667 Oct 12 13:52 midterm.pdf
-rw-r--r-- 1 carey profs 112337 Oct 12 13:52 midterm.ps
-rw----- 1 carey profs 10716 Oct 12 13:22 midterm.tex
-rwx----- 1 carey profs 5323 Sep 24 12:46 sleepfun
-rw----- 1 carey profs 498 Sep 24 11:33 sleepfun.c
drwxr-xr-x 2 carey profs 4096 Oct 2 13:56 soha
-rwx----- 1 carey profs 5274 Oct 1 12:08 summer1
-rw-r--r-- 1 carey profs 694 Oct 1 12:08 summer1.c
-rwx----- 1 carey profs 5884 Sep 29 12:44 summer2
-rw-r--r-- 1 carey profs 1520 Sep 28 17:32 summer2.c
-rwx----- 1 carey profs 6137 Sep 29 12:48 summer3
-rw----- 1 carey profs 2281 Sep 28 17:39 summer3.c
-rwx----- 1 carey profs 6369 Oct 1 12:10 summer4
-rw----- 1 carey profs 3118 Sep 28 17:47 summer4.c
-rwx----- 1 carey profs 6306 Sep 29 12:48 summer5
-rw----- 1 carey profs 3059 Sep 28 17:53 summer5.c
```

Communicating Processes

10 9. Linux systems have several communication mechanisms for cooperating processes.

(a) (2 marks) What are *signals*? How do they work?

(b) (2 marks) What are *pipes*? How do they work?

(c) (3 marks) What is *shared-memory*? How does it work?

(d) (3 marks) What is *inter-process communication* (IPC)? How does it work?

*** THE END ***