

Examination 1

CSC311 Systems Software

11 December 2015

1. In the context of our studies, what does the phrase “software is like a gas” mean?

—Write your answer here.—

2. If the size of an address space is 4GB and the size of pages is 4KB, how many pages are there?

—Write your answer here.—

3. Peter Denning argues that virtual memory is more than a means of automatically assigning to processes the memory that they need. He goes further by claiming that advantages that have followed from the invention of virtual memory, automation of the allocation of memory is not the most significant.

In Peter Denning’s judgment, what are the most significant advantages that virtual memory gives us?

—Write your answer here.—

4. At the same time that computer scientists were developing virtual memory, they were developing multiprogramming. How are the two ideas related?

—Write your answer here.—

5. A common form of pedagogy presents students first with a problem, a naive solution to the problem, an analysis of the defects of that naive solution, and then (after one or more iterations) with a practical solution to the problem.

Relate two or more algorithms for page replacement in this way. Describe the problem, a naive solution, and a practical improvement upon the naive solution.

—Write your answer here.—

6. The following code is available on Moodle. It is in a file named *processControl-7.c*. That file is in turn in a tar file named *processControl.tar.gz*. Look for the *Process control exercises* in Week 3 on Moodle.

If you download that file on Linux, you can unpack it by typing: `tar xzvf processControl.tar.gz`. Tar is also available on Macintosh computers. On a Windows computer, you might try using 7-Zip to unpack the file.

- (a) What value does WIFEXCITED compute? For what purpose might we use this?
- (b) What value does WEXITSTATUS compute? For what purpose might we use this?

```
#include <stdio.h>

// here is code taken from...
// /usr/include/stdlib.h
// /usr/include/bits/waitstatus.h
// we used this code in our experiments
// with fork() and waitpid()

#define WIFEXITED( status )    __WIFEXITED( __WAIT_INT( status ) )
#define __WIFEXITED( status )  ( _WTERMSIG( status ) == 0 )
#define WTERMSIG( status )    _WTERMSIG( __WAIT_INT( status ) )
#define _WTERMSIG( status )   (( status ) & 0x7f )
#define __WAIT_INT( status )  (* (int *) &( status ))
#define WEXITSTATUS( status )  _WEXITSTATUS( __WAIT_INT( status ) )
#define _WEXITSTATUS( status ) ((( status ) & 0xff00 ) >> 8 )

int main( int argc , char **argv ) {

    int status[8] = { 0xFFFF, 0xFF80, 0xFF40, 0xFF20,
                    0xFF10, 0xFF00, 0x0F00, 0x0000 };
}
```

```

int i;
for( i = 0; i < 8; i++ ) {
    printf( "i=%2d status=%6d",
           i, status[i] );
    printf( "WIFEXITED(%6d)=%6d",
           status[i], WIFEXITED(status[i]) );
    printf( "WEXITSTATUS(%6d)=%6d\n",
           status[i], WEXITSTATUS(status[i]) );
} // for

return 0;
} // main( int, char** )

```

- (a) —Write your answer here.—
- (b) —Write your answer here.—

7. (a) Searching for the smallest free segment that is big enough to hold a process's image sounds like a good way to allocate memory. What is a disadvantage of this approach?
- (b) Why might we even consider an algorithm whose name is worst fit?
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- (a) —Write your answer here.—
- (b) —Write your answer here.—

8. The working set page replacement algorithm attempts to identify a page that is no longer in a process' working set. What criterion does it use to identify such pages?
-

—Write your answer here.—

9. Why is a TLB the key to the performance of a system that uses an inverted page table?
-

—Write your answer here.—

10. Write a program that creates two threads. One thread waits a random amount of time and then prints the word “I saw hello.” The other thread also waits a random amount of time and then prints the word “You say goodbye.” In each case, the random amount of time is equally likely to be 0, 1, 2, or 3 seconds.
-

```
// Write your answer here.  
  
// Test your program before copying the  
// source code into this space.  
  
// If you are using the Emacs text editor,  
// you can insert the contents of the file  
// that contains your source code by typing:  
// CTRL-x i and responding to the prompt  
// with the name of the file that contains  
// your source code..
```