

Midterm

October 17, 2008

1. What material did you use to prepare for the midterm? There only exist correct answers to this question. Please list a selection of (or specify other): Stalling's book, another book, lecture slides, own notes, nothing. [1p]
2. Explain the term stack frame and what happens during a nested procedure call. [7p]
3. Explain four advantages of a microkernel compared to a monolithic kernel. [8p]
4. Explain the facilities of the Linux kernel that give it many of the advantages of a microkernel architecture. [7p]
5. Name five signals that can be sent to a process in a POSIX-compliant system and explain what they do. [7p]
6. Name six elements of the process control block and explain their use. [7p]
7. Explain the key differences, with respect to the process control block, between a single-threaded process model and a multithreaded process model. [4p]
8. Explain how the following situation can occur: A process consists of two threads. Thread A is in the blocked state. Thread B is in the running state. The process itself is in the ready state. [7p]
9. Explain how Solaris handles multithreading? (thread-related concepts) [7p]
10. Explain the term zombie process. [2p]
11. Assume a system with two producer and three consumer threads. All producer threads call the function `producer()` and all consumer threads call the function `consumer()`. Write the pseudo-code for these two functions and program declaration part (global variables) assuming infinite buffers. Indicate what you would need to change if you use only one producer instead of two. [15p]

12. Consider the following program:

```
const int n = 50;
int tally;
void total() {
    int count;
    for (count = 1; count <= n; count++ ) {
        tally++;
    }
}
void main() {
    tally = 0;
    parbegin (total(), total());
    write (tally);
}
```

- (a) Determine the proper lower bound and upper bound on the final value of the shared variable `tally` output by this concurrent program. Assume processes can execute at any relative speed and that a value can only be incremented after it has been loaded into a register by a separate machine instruction. [8p]
- (b) Suppose that an arbitrary number of these processes are permitted to execute in parallel under the assumptions of part (a). What effect will this modification have on the range of final values of `tally`? [5p]
- (c) Does it make a difference whether `parbegin` starts processes or threads? Explain. [2p]

13. Consider a system with a total of 165 units of memory, allocated to three processes as shown:

Process	Max	Hold
A	80	55
B	70	50
C	60	15

- (a) Apply the banker's algorithm to determine whether it would be safe to grant the request that a 4th process arrives, with a maximal need of 60 and an initial need of 25. If yes, indicate a sequence of terminations that could be guaranteed possible. If no, show the reduction of the resulting allocation table. [8p]
- (b) Depending on the result of part (a), change the allocation of one of the processes so that the admission decision for the 4th process changes. [5p]

End of exam. Total points: 100