

UNIVERSITY OF MALTA  
BOARD OF STUDIES FOR INFORMATION TECHNOLOGY/  
FACULTY OF SCIENCE

Department of Computer Science & A.I.

B.Sc. I.T.(Hons.)/B.Sc.(Hons.) Year II

May/June 2006 Assessment Session

CSA2090: Systems Programming

6th June, 2006

14:15-16:45

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*Read **ALL** questions before starting. Choose **four** questions out of the six provided. Each question carries 25 marks of the total grade for this exam script.*

1. (a) Explain the difference or similarities between pointer types, strings and arrays in the C Programming Language in terms of syntax restrictions and underlying implementation. Also include in your description where the loader places these elements in the memory process space on a UNIX system.
- (b) Making reference to paging, explain how you think shared memory is implemented in an Operating System. **[8 marks]**
- (c) Explain the use of the number of links in a typical i-node based file system. **[5 marks]**
- (d) Explain any security risks that are introduced with the use of the SUID flag. **[5 marks]**
2. (a) Explain how memory mapped I/O is implemented in a typical operating system. Make use of standard operating systems concepts in your description. **[10 marks]**
- (b) If a signal is sent to a process A every time that a message is placed for it on a message queue, describe a mechanism that will ensure that

A will be able to receive all messages intended for it. You can assume that signals are not queued and thus process A is guaranteed to receive only one signal every time it is scheduled. **[10 marks]**

- (c) Explain a mechanism that allows different operations on a file to different users in an advanced operating system. **[5 marks]**
3. (a) Give an outline of a system that will allow processes to make use of an asynchronous event mechanism on a Unix operating system. **[20 marks]**
- (b) Explain a scenario where *sigsuspend()* is necessary. Also explain how the same behaviour cannot be obtained through the use of *pause()* and *sigprocmask()*. **[5 marks]**
4. (a) Describe a system that will two-player games to be played on the Internet without incurring unnecessary overheads on any one server. **[20 marks]**
- (b) If two TCP connections to a server on port 80 are made, what mechanism is used to distinguish between the two connections from a programmer's point of view. **[5 marks]**
5. (a) Explain why the shadow file is used for password management. **[4 marks]**
- (b) Explain why copy-on-write (COW) is a beneficial addition to operating systems while still guaranteeing no unpredictable side-effects. **[5 marks]**
- (c) How is it possible that two processes on a Unix operating system can write to the same file without ever overwriting each other's output? **[6 marks]**
- (d) Assuming a round-robin scheduling algorithm, show how fairness can be guaranteed for semaphore operations on a typical operating system. **[10 marks]**
6. (a) Explain the use of the *setjmp()* and the *longjmp()* calls. **[6 marks]**

- (b) Explain how a server can service multiple Internet connections while guaranteeing that any new connection requests will not be starved. [**6 marks**]
- (c) Explain how one can implement the Unix pipe (|) command in a command shell that does not support it. [**13 marks**]
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