UNIVERSITY OF MALTA

BOARD OF STUDIES FOR INFORMATION TECHNOLOGY

Department of Computer Science & A.I.

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

May/June 2005 Assessment Session

CSA2090: Systems Programming **20th June 2005**

09.00-11.30

Answer **four** *questions out of the* **six** *provided. Each question carries 25 marksB (subsequently normalised to 60% of the total mark).*

1. (a) Explain the file system structure of the UNIX operating system explaining the partition contents. In addition explain how directory listings are stored. **[10 marks]**

   (b) Explain why some system calls are termed as re-entrant and others as non re-entrant and give an example of each. **[5 marks]**

   (c) Explain the advantages and disadvantages of hard and soft links. **[5 marks]**

   (d) Describe an example scenario where record locking would be used. **[5 marks]**

2. (a) What is the difference between making use of COW and calling *vfork()*? Include in your discussion a typical scenario where you would use these two constructs. **[10 marks]**

   (b) Explain the memory layout of a typical UNIX process. **[5 marks]**

   (c) Describe what a system call is? **[5 marks]**

   (d) Explain what is meant by *systems programming*. **[5 marks]**

3. (a) What are the checks that are performed by the UNIX system whenever one tries to

   (i) create a file in a directory;

   (ii) open a file for writing;

   (iii) change the ownership of a file?

   [12 marks]

   (b) Why does the SUID flag of the telnet daemon (the server) need to be enabled if one wishes to allow any user to start the deamon? **[8 marks]**

   (c) Explain how the i-node system makes it very difficult to un-delete a file. **[5 marks]**

4. (a) Describe a system that will allow users to subscribe to a group and be able to share files between them, without resorting to the UNIX in-built group facilities. **[20 marks]**

   (b) Explain why the C language is still the predominant programming language used for systems programming. **[5 marks]**

5. (a) Most operating systems offer some form or other of IPC structures. Nowadays modern operating systems give an abstraction of events whereby one is notified when an event occurs and the receiver can read data associated with the particular event (for example when a mouse is clicked, an event is received with the co-ordinates of where the mouse pointer resides).

   (i) Explain the main advantages and disadvantages of signals and message queues. **[5 marks]**

   (ii) Describe a system that will allow events to be sent and received on a UNIX-like system. **[10 marks]**

   (b) What is the tradional method used for reporting errors on the UNIX operating system. **[5 marks]**

   (c) Explain the advantages offered by memory-mapped IO. **[5 marks]**

6. (a) Explain in your own words the relevance of system programmers when today most of the computing effort seems to be on making faster hardware and solving real-world problems. **[5 marks]**

   (b) Why is one usually required to make a copy of the data returned by a UNIX system call whenever a pointer is returned? **[5 marks]**

   (c) Explain the need of the *sigsuspend()* system call.
   (You may use the following system calls in your description: *sigprocmask()*, used to block and unblock signals and *pause()*, used to block until a signal arrives). **[5 marks]**

   (d) Explain the extra functionality offered by System V semaphores when compared to Dijkstra's definition of semaphores. **[5 marks]**

   (e) What is the difference between named and un-named pipes and what are their advantages and disadvantages? **[5 marks]**

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