UNIVERSITY OF MALTA

Faculty of I.C.T.

Department of Computer Science

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

May/June 2008 Assessment Session

CSA2090: Systems Programming **11th June, 2008**

09:15-11:45

Read **ALL** *questions before starting. Please answer two questions out of the three provided. All questions carry 50 marks of the total grade for this exam script.*

1. (a) With reference to the typical memory layout of a process, explain where local variables are stored and where `malloc()` allocates memory from. Also explain the two main differences between these two memory regions.

[10 marks]

(b) Explain how the operating system knows that a user is trying to access memory outside the allocated and 'allowed' memory region.

[20 marks]

(c) With reference to operating systems structures, explain how the kernel can allow two processes to share a single file offset on a particular file.

[10 marks]

(d) Explain why every operating system needs the concept of the *SUID* flag and also explain why this could be a security nightmare.

[10 marks]

2. (a) Draw up the i-node and directory blocks of the following directory structure. Make sure to include all possible details relevant to this structure.

```
dir1
    |- .
    |- ..
    |- dir2-----|- .
    |           |- ..
    |           |- file3
    |           |- file4
    |- file1
    |- file2
```

Note: **file4 is actually a hard link to file2.**

[15 marks]

(b) Explain how things would be different than (a) if `file4` was a soft link to `file2`.

[10 marks]

(c) Discuss the main advantage and the main disadvantage of soft links.

[10 marks]

(d) What can go wrong if the following pseudo code is run by Process 1

```
while (1) {
    send SIGUSR1 to Process 2
}
```

and Process 2 runs the following code to count the incoming signals?

```
int count = 0;
void signal_handler(..) {
    count++;
    setup signal handler appropriately again
}
```

[15 marks]

3. (a) Explain why adding to the *environment variable* list might require the whole list of variables to be moved in the process memory space.

[10 marks]

(b) Explain what happens from a user's point of view when `fork()` is issued. Also explain what happens when *COW* is used.

[15 marks]

(c) Explain the main difference between a concurrent and an iterative server. Name one typical usage of each server type.

[10 marks]

(d) Describe the reason why all network traffic has to be in *network byte ordering* format.

[15 marks]

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end of paper