Name ______________________ Student No. ______________________

No aids allowed. Answer all questions on test paper. Use backs of sheets for scratch work.

Total Marks: 70

[20] 1. **Processes:**

(a) What is a context switch? Describe the actions taken by the kernel to perform a context switch between processes.

(b) Consider a computer system which has multiple register sets. Describe the actions of a context switch if the new context is already loaded into one of the register sets.

(c) In the above case (i.e., multiple registers), what else must happen if the new context is in memory rather than in a register set, and all the register sets are in use?

(d) Describe the different IPCs (Interprocess Communication) mechanisms in Linux.

[20] 2. **Threads:**

(a) Provide two programming examples of multithreading that improve performance over a single-threaded solution.

(b) Provide two programming examples of multithreading that do *not* improve performance over a single-threaded solution.

(c) Suppose that `counter` is a global variable in a multi-threaded program. Discuss the possible problems, and how to fix them (in the context of Pthreads).

(d) What is the difference between kernel and user threads?

[15] 3. **Process Scheduling:**

(a) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time	Priority
P_1	5	8
P_2	3	1
P_3	3	1
P_4	2	1
P_5	7	2

The processes are assumed to have arrived in the order given. Draw a Gantt chart illustrating the execution of these processes using the Round Robin scheduling algorithm with time slice 1.

(b) In the above situation it was assumed that all the process arrived at time 0 in the ready queue, and no new process arrive until they all terminate. In general, new processes arrive continuously; how does this affect the Round Robin algorithm?

(c) Explain the details of the Linux "recrediting operation." In particular, what is the recrediting formula, and what is the rational behind it.

[15] 4. **UNIX Filesystem:**

(a) The file containing this test has the following properties:

```
228486 -rw-rw-r-- 1 soltys soltys 2461 Mar 13 11:21 test2.tex
```

Explain the meaning of all the fields. In particular, explain the permissions given by `-rw-rw-r--`.

(b) The file `/etc/passwd` contains entries of the form:

```
you:gkmbCTrJ04COM:500:500:You:/home/you:/bin/bash
```

where the second field contains the password information. Explain why this is not a security threat, even though all users have read permission for this file.

(c) The file `/dev/hdc` is the CD-ROM device driver. Explain the concept of mounting it on the file system.