Section	No	Name	Signature		Q1	Q2	Q3	Q4	Q5	Total
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1. The Linux kernel provides three mechanisms for mutual exclusion.

   (a) List these mechanisms and explain how each one works.

   (b) When should each mechanism be preferred over the others? Explain.

2. What are the problems of timeslice based scheduling used in traditional UNIX systems? What is the approach proposed in CFS (Completely Fair Scheduler)? Explain.

3. When developing a file system in FUSE, which system calls have to be implemented to serve an "ls -l" request on a directory? What information should each system call produce in order to satisfy the request?

4. *ANSWER THIS QUESTION ON THE FRONT SIDE OF THE SECOND PAPER.* Write a NASM function which takes a string as input parameter from a C function and returns its length. Explain your code.

5. *ANSWER THIS QUESTION ON THE BACK SIDE OF THE SECOND PAPER.* Consider the function which implements the read system call for a character device as given in the box below:

```
    static ssize_t foo_read(struct file *file, char *buf,
                            size_t count, loff_t *f_pos) {
        char *text = "LINUX";
        char *kbuf = kmalloc(count, GFP_KERNEL);
        for (int i = 0: i < count; i++)
            kbuf[i] = text[i % 5];
        copy_to_user(buf, kbuf, count);
        kfree(kbuf);
        return count;
    }
```

user-space program:

```
 read(fd, buffer, 4);
 read(fd, buffer+4, 6);
```

(a) Assuming that the variable "fd" holds an opened descriptor for this device, what would be the contents of the "buffer" variable after executing the two read system calls as given in the user-space program above?

(b) How would you change the foo_read function in order for it the contents of the "buffer" variable to be "LINUXLINUX" as a result of the same user-space program? (Consider the general case with an arbitrary number of subsequent reads with arbitrary amounts of data to read.) Only write the changed part of the code and explain.