

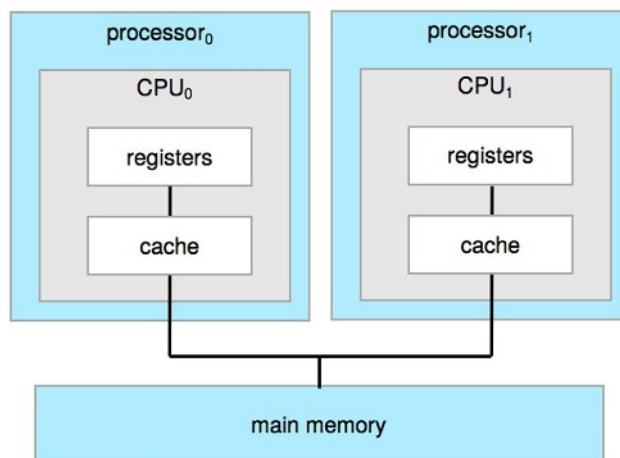


Assignment 2

Answer the following questions. It is important that you follow the instructions for submission given in Section 3 below; failure to do so will result in a 5 point deduction.

1 Questions

- (15%) Consider an SMP system similar to the one shown below. Describe a precise sequence of actions that could cause data residing in memory to have a different value in each of the local caches.



- (15%) Direct memory access is used for high-speed I/O devices in order to avoid increasing the CPU's execution load.
 - What does the CPU do to interface with the device to coordinate the transfer?
 - How does the CPU know when the memory operations are complete?
 - The CPU is allowed to execute other programs while the DMA controller is transferring data. Does DMA interfere with the execution of the other programs? If so, describe what form of interference are caused.
- (15%) When a user program needs the operating system to perform an input operation on its behalf such as reading a fixed number of bytes from a file into a string variable, it needs to issue a **system call**. Explain the sequence of events that take place when a user program issues a system call, until the time the request from the user program is satisfied, under the assumption that the computer has dual mode operation.
- (30%) Login to any of the `cs1ab` hosts in our network and find the manpage for `syscalls`. Using this manpage, find and identify one system call in each of the categories below:
 - File management (file creation, deletion, etc.)
 - Process scheduling (e.g., changing priority, creating, deleting processes)
 - I/O (e.g., reading or writing)



For each call, show the syntax of its prototype as given in the manpage and briefly describe what it does and what data, if any, is passed into or out of it.

5. (25%) Linux is an open source operating system. There is a copy of the kernel source code in the directory `/data/biocs/b/ubuntu/bionic/` on the Computer Science Department's server. You can login to any cslab host and navigate to that directory and browse its contents.
 - (a) (15%) Look at the file `./include/linux/kernel.h` in that directory. In that file, find the definitions of `INT_MAX`, `INT_MIN`, and `LONG_MAX` and write them as the first part of your answer to this question. What are the values of these constants? Write a small program that evaluates the expressions that define them and prints out their values so that you can see what they are on the particular machine you run it. Run your program and print the values as the second part of your answer to 5a.
 - (b) (10%) There is a file in `/data/biocs/b/ubuntu/bionic/` named `CREDITS`. Explain what it is and state how many people are listed in this file.

2 Grading Rubric

There are five questions in this assignment, each worth the percentage indicated. Questions are assessed on their completeness and correctness and graded in accordance with the *General Requirements for Assignments* document posted on the course website.

3 Instructions for Submitting the Homework

1. **Due Date:** This assignment is due by the end of the day (i.e. 11:59PM, EST) on September 18.
2. Your homework must comply with the *General Requirements for Assignments* document posted on the course website for full credit.
3. **The assignment must be submitted as a PDF.**
4. **You must put your name, first name followed by last name, in the upper left corner of the first page**, which is nothing but a title page; it should have nothing else on it.
5. **Each question must be written on a separate page, and be no longer than one page in length.** There will be exactly six pages in total.
6. To submit the assignment, you must use the `submitpdf_cs340` program that is located in the directory

```
/data/biocs/b/student.accounts/cs340_sw/bin
```

If you did the first assignment correctly, then you can execute this program by typing its name, otherwise you will have to type the full path name to the file. The precise steps are:

- (a) If you have written the assignment on your own computer, upload it to `eniac` first, using either `sftp` or `scp` (on Mac systems in the terminal window or on Linux systems in a terminal window), or in Windows using the PuTTY file transfer agent called `psftp` or `pscp`. or the `ssh` client you installed from my website. If you have never used any of these, read the documentation that comes with it (such as man pages in Linux or the Mac.)
- (b) Login using `ssh` to `eniac.cs.hunter.cuny.edu` with your valid username and password, **and then ssh into any cslab host.**
- (c) Navigate (`cd`) to the directory into which you uploaded the assignment.



- (d) Assuming that the assignment is named `hwk2.pdf`, you must run the command

```
submitpdf_cs340 2 hwk2.pdf
```

Do exactly this. The command will create a copy of your file in the directory

```
/data/biocs/b/student.accounts/cs340_sw/hwks/hwk2
```

It will be named `hwk2_username.pdf`, where *username* is your username on the network. You will not be able to read this file, nor will anyone else except for me. If you decide to make any changes and resubmit, just run the command again and it will replace the old file with the new one. Do not try to put your file into this directory in any other way - you will not be able to do so.