Question 1.1

In this question, we have to create three threads and three functions which count from 1-2^32. We must set the thread's discipline to Fifo, other, and RR and start the threads. Later we have to start the timer using clock_t which counts the time from the beginning of the thread until the function is executed. Then we plot the histogram by getting different values using https://www.statskingdom.com/histogram-maker.html.

Question 1.2

In this question, we will create three processes using fork and execl. We are required to run the bash file(attached) using these processes which will compile the copies of the kernels. We will then get record the time required for each fork to complete the process is got using clock_gettime() similar to that of the first question.

Hence, we are required to make 3 copies of the Kernel source.
If we had not assigned enough memory to our kernels, then we might need to assign the values to them and later run these 3 processes which will compile 3 copies of our kernels.

Question 2

Making a copy of the kernel in which all changes will be made is necessary before we can see the differences between the two kernels.

We will write the new system Call in the following path:

- arch/x86_64/entry/syscalls/syscall_64.tbl

Then we define the system call in the kernel directory.

What is a system call?

We will pass a double pointer in this system call and then create a new array of void type with rows and columns the same as in that array which passes as an argument.

Then as defined in the question, we will use __copy_to_user() and __copy_from_user() system calls which will copy data from user space into the kernel space and then again perform vice versa operation i.e from kernel space to user space.

Then we will return the copied array.

We would require a program to test our system call.

Then we will compile our kernel using the following commands.

1. make
2. sudo make moduls_install
3. sudo cp arch/x86_64/boot/bzImage /boot/vmlinuz-linux-5.14.21
4. sudo cp System.map System.map-5.14.21
5. sudo mkinitcpio -k 5.14.21 -g /boot/initramfs-linux-5.14.21.img
6. sudo grub-mkconfig -o /boot/grub/grub.cfg

We get our modified kernel now, and we have our functionality achieved in our new kernel.

To test the differences between two kernels, we make a .patch file from the modified kernel.

We have to run the commands to find difference:

1. sudo diff -rupN path-to-original-kernel/ path-to-modified-kernel/ > kernlpatch.patch
2. sudo diff path-to-original-kernelfile/ path-to-modified-kernelfile/ > different.txt

SOURCES:

1. https://cool-dev.in/posts/How-to-Implement-a-System-Call-In-Linux/
2. https://www.youtube.com/watch?v=S65VBufKL8s

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