CSCI 4401

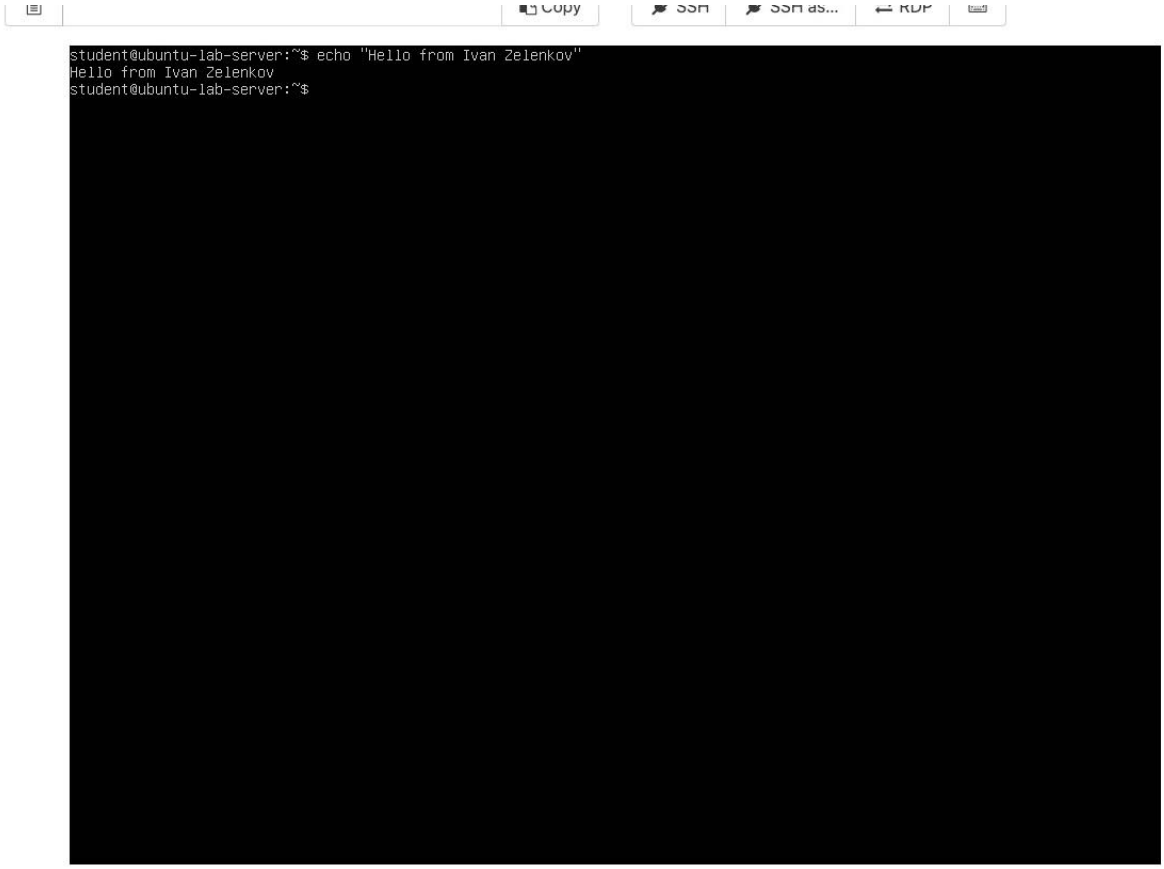
James Wagner

Ivan Zelenkov

August 18, 2022

Assignment 1

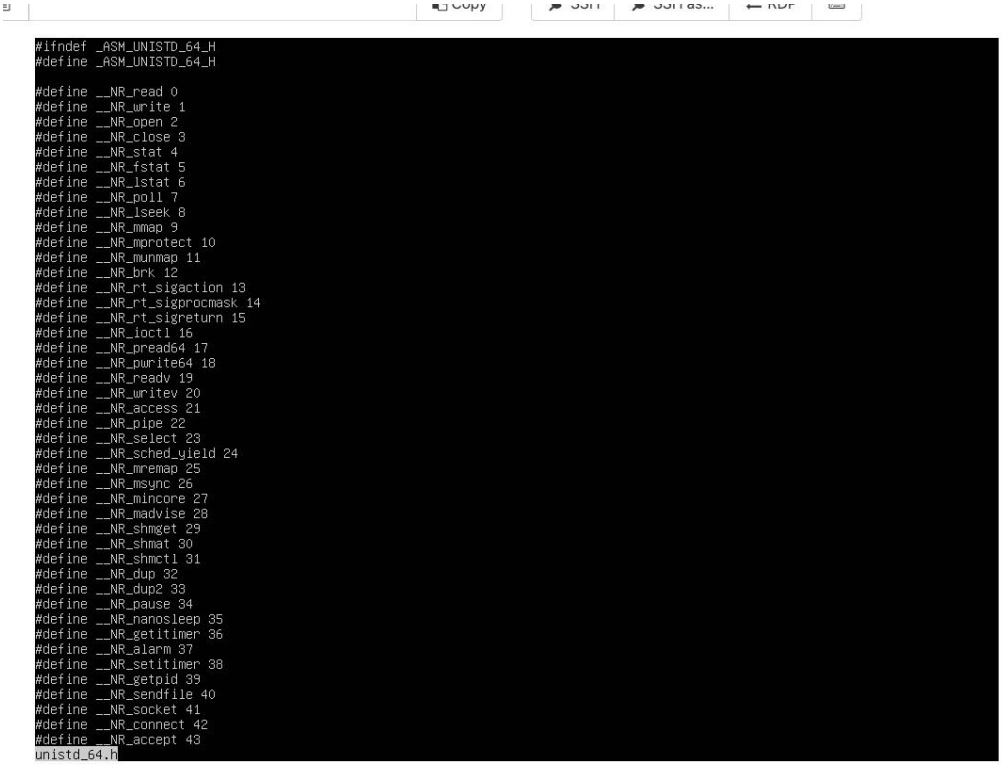
Question 1. Run **$echo "Hello from [your name]"**. Submit a screenshot of your running VM.



Question 2. What is your current kernel version?

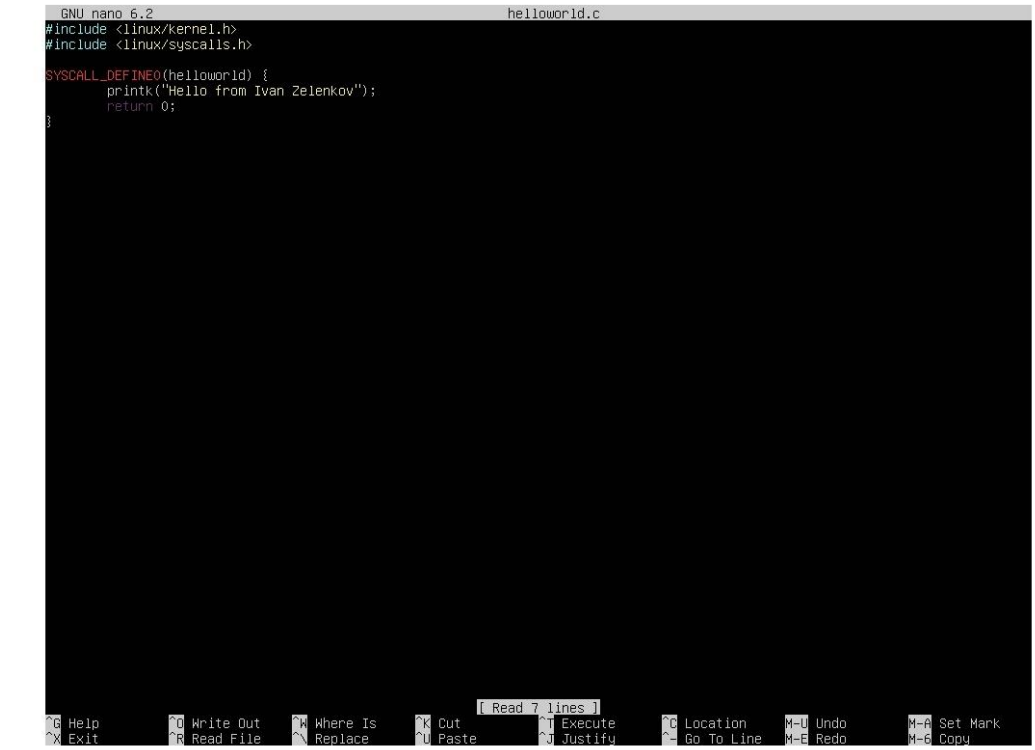
5.15.0-46-generic

Question 3. Submit a screenshot of at least ten of your system calls.



```
#ifndef _ASM_UNISTD_64_H
#define _ASM_UNISTD_64_H

#define __NR_read 0
#define __NR_write 1
#define __NR_open 2
#define __NR_close 3
#define __NR_stat 4
#define __NR_fstat 5
#define __NR_lstat 6
#define __NR_poll 7
#define __NR_lseek 8
#define __NR_mmap 9
#define __NR_mprotect 10
#define __NR_munmap 11
#define __NR_brk 12
#define __NR_rt_sigaction 13
#define __NR_rt_sigprocmask 14
#define __NR_rt_sigreturn 15
#define __NR_ioctl 16
#define __NR_pread64 17
#define __NR_pwrite64 18
#define __NR_readv 19
#define __NR_writev 20
#define __NR_access 21
#define __NR_pipe 22
#define __NR_select 23
#define __NR_sched_yield 24
#define __NR_mremap 25
#define __NR_msync 26
#define __NR_mincore 27
#define __NR_madvise 28
#define __NR_shmget 29
#define __NR_shmat 30
#define __NR_shmctl 31
#define __NR_dup 32
#define __NR_dup2 33
#define __NR_pause 34
#define __NR_nanosleep 35
#define __NR_getitimer 36
#define __NR_alarm 37
#define __NR_setitimer 38
#define __NR_getpid 39
#define __NR_sendfile 40
#define __NR_socket 41
#define __NR_connect 42
#define __NR_accept 43
unistd_64.h
```

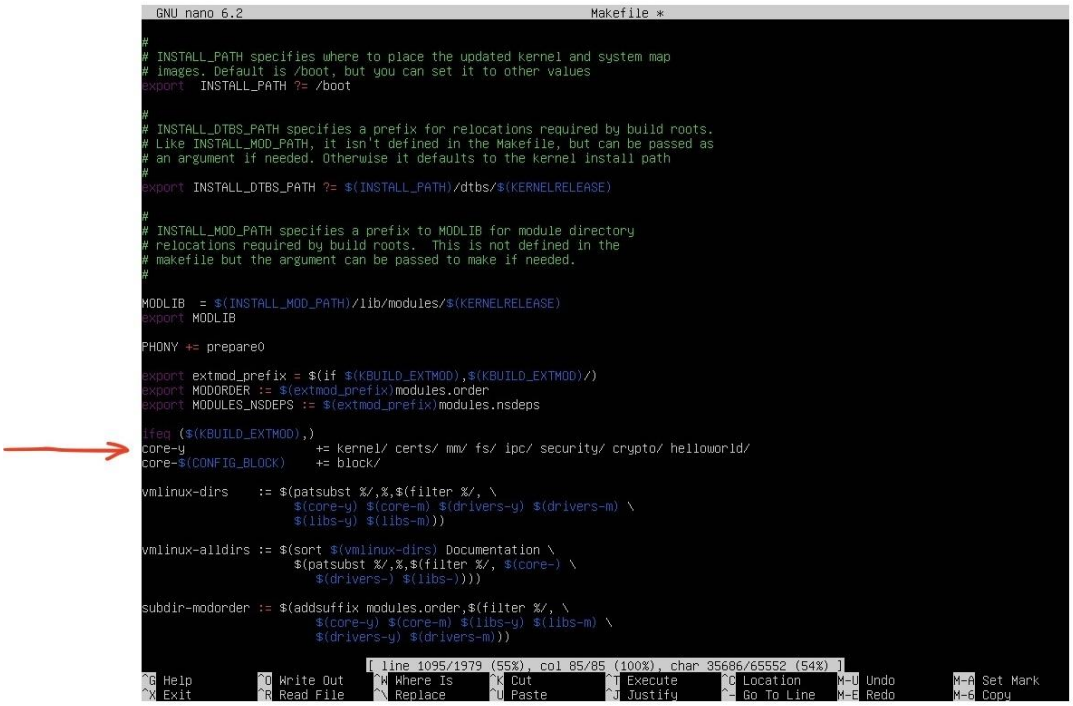
Question 4. Submit a screenshot of your system call code.



```
  GNU nano 6.2                                  helloworld.c
#include <linux/kernel.h>
#include <linux/syscalls.h>

SYSCALL_DEFINE0(helloworld) {
        printk("Hello from Ivan Zelenkov");
        return 0;
}
```

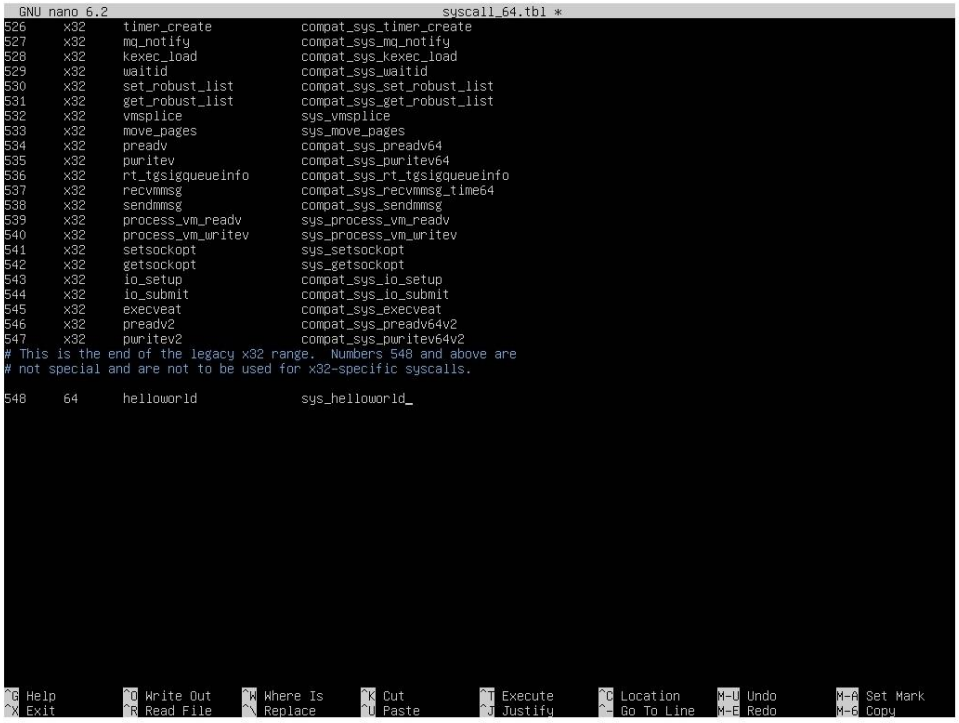
```
                        [ Read 7 lines ]
^G Help      ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo     M-A Set Mark
^X Exit      ^R Read File  ^\ Replace    ^U Paste      ^J Justify    ^_ Go To Line M-E Redo     M-6 Copy
```

Question 5. Submit a screenshot of your modified Makefile.



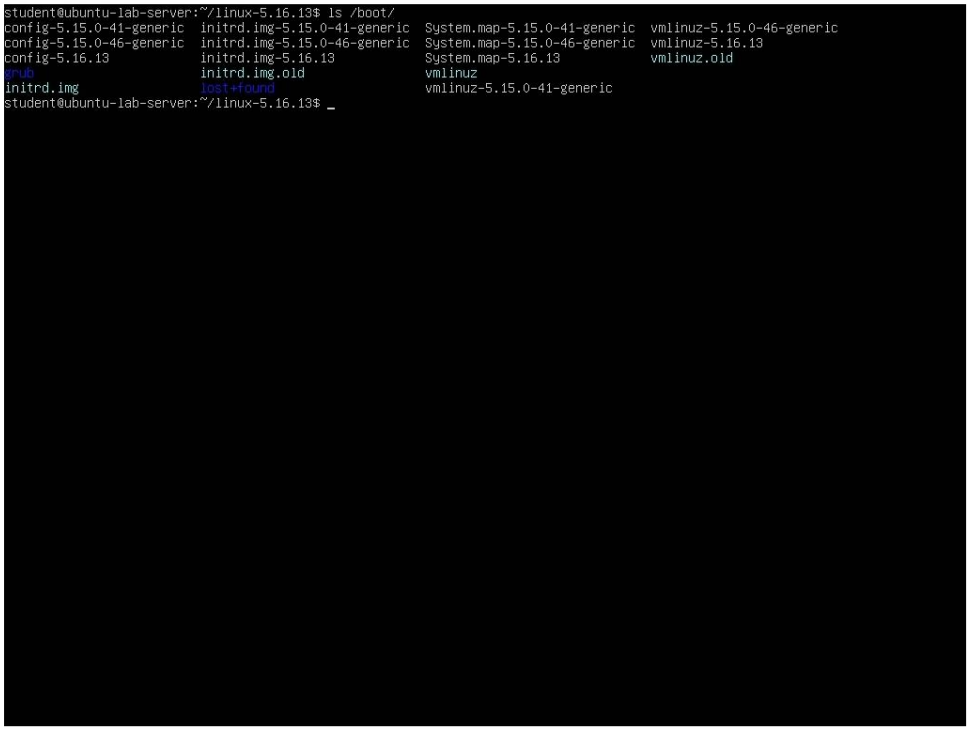
```
  GNU nano 6.2                                                  Makefile *

#
# INSTALL_PATH specifies where to place the updated kernel and system map
# images. Default is /boot, but you can set it to other values
export  INSTALL_PATH ?= /boot

#
# INSTALL_DTBS_PATH specifies a prefix for relocations required by build roots.
# Like INSTALL_MOD_PATH, it isn't defined in the Makefile, but can be passed as
# an argument if needed. Otherwise it defaults to the kernel install path
#
export INSTALL_DTBS_PATH ?= $(INSTALL_PATH)/dtbs/$(KERNELRELEASE)

#
# INSTALL_MOD_PATH specifies a prefix to MODLIB for module directory
# relocations required by build roots.  This is not defined in the
# makefile but the argument can be passed to make if needed.
#

MODLIB  = $(INSTALL_MOD_PATH)/lib/modules/$(KERNELRELEASE)
export MODLIB

PHONY += prepare0

export extmod_prefix = $(if $(KBUILD_EXTMOD),$(KBUILD_EXTMOD)/)
export MODORDER := $(extmod_prefix)modules.order
export MODULES_NSDEPS := $(extmod_prefix)modules.nsdeps

ifeq ($(KBUILD_EXTMOD),)
core-y                  += kernel/ certs/ mm/ fs/ ipc/ security/ crypto/ helloworld/
core-$(CONFIG_BLOCK)    += block/

vmlinux-dirs    := $(patsubst %/,%,$(filter %/, \
                     $(core-y) $(core-m) $(drivers-y) $(drivers-m) \
                     $(libs-y) $(libs-m)))

vmlinux-alldirs := $(sort $(vmlinux-dirs) Documentation \
                     $(patsubst %/,%,$(filter %/, $(core-) \
                        $(drivers-) $(libs-))))

subdir-modorder := $(addsuffix modules.order,$(filter %/, \
                        $(core-y) $(core-m) $(libs-y) $(libs-m) \
                        $(drivers-y) $(drivers-m)))

                                [ line 1095/1979 (55%), col 85/85 (100%), char 35686/65552 (54%) ]
^G Help          ^O Write Out    ^W Where Is     ^K Cut          ^T Execute      ^C Location     M-U Undo        M-A Set Mark
^X Exit          ^R Read File    ^\ Replace      ^U Paste        ^J Justify      ^/ Go To Line   M-E Redo        M-6 Copy
```

Question 6. Submit a screenshot of your syscall_64.tbl that includes your system call.



```
  GNU nano 6.2                                                syscall_64.tbl *
526     x32     timer_create            compat_sys_timer_create
527     x32     mq_notify               compat_sys_mq_notify
528     x32     kexec_load              compat_sys_kexec_load
529     x32     waitid                  compat_sys_waitid
530     x32     set_robust_list         compat_sys_set_robust_list
531     x32     get_robust_list         compat_sys_get_robust_list
532     x32     vmsplice                sys_vmsplice
533     x32     move_pages              sys_move_pages
534     x32     preadv                  compat_sys_preadv64
535     x32     pwritev                 compat_sys_pwritev64
536     x32     rt_tgsigqueueinfo       compat_sys_rt_tgsigqueueinfo
537     x32     recvmmsg                compat_sys_recvmmsg_time64
538     x32     sendmmsg                compat_sys_sendmmsg
539     x32     process_vm_readv        sys_process_vm_readv
540     x32     process_vm_writev       sys_process_vm_writev
541     x32     setsockopt              sys_setsockopt
542     x32     getsockopt              sys_getsockopt
543     x32     io_setup                compat_sys_io_setup
544     x32     io_submit               compat_sys_io_submit
545     x32     execveat                compat_sys_execveat
546     x32     preadv2                 compat_sys_preadv64v2
547     x32     pwritev2                compat_sys_pwritev64v2
# This is the end of the legacy x32 range.  Numbers 548 and above are
# not special and are not to be used for x32-specific syscalls.

548     64      helloworld              sys_helloworld_

^G Help          ^O Write Out    ^W Where Is     ^K Cut          ^T Execute      ^C Location     M-U Undo        M-A Set Mark
^X Exit          ^R Read File    ^\ Replace      ^U Paste        ^J Justify      ^/ Go To Line   M-E Redo        M-6 Copy
```

Question 7. Submit a screenshot of your boot directory containing a new kernel config file, System.map, and vmlinuz file.



Question 8. Submit a screenshot that verifies you are using your new kernel version.

Question 9. Submit a screenshot of your output from $dmesg containing the message from your system call.