CSCE-611: Operating Systems Machine Problem 4

Name: Vamsi Tallam UIN: 432001932

Files Modified/added:

1. Page_table.C
2. Page_table.H
3. Vm_pool.H
4. Vm_pool.C
5. Kernel.C – commented #define _TEST_PAGE_TABLE_ and included changes to use simple frame pool
6. Makefile – made changes to include simple frame pool
7. Simple_frame_pool.C – used as it is
8. Simple_frame_pool.H – used as it is

Used simple_frame_pool.C and incorporated the necessary changes and added files from mp2.

Functions Implemented/updated:

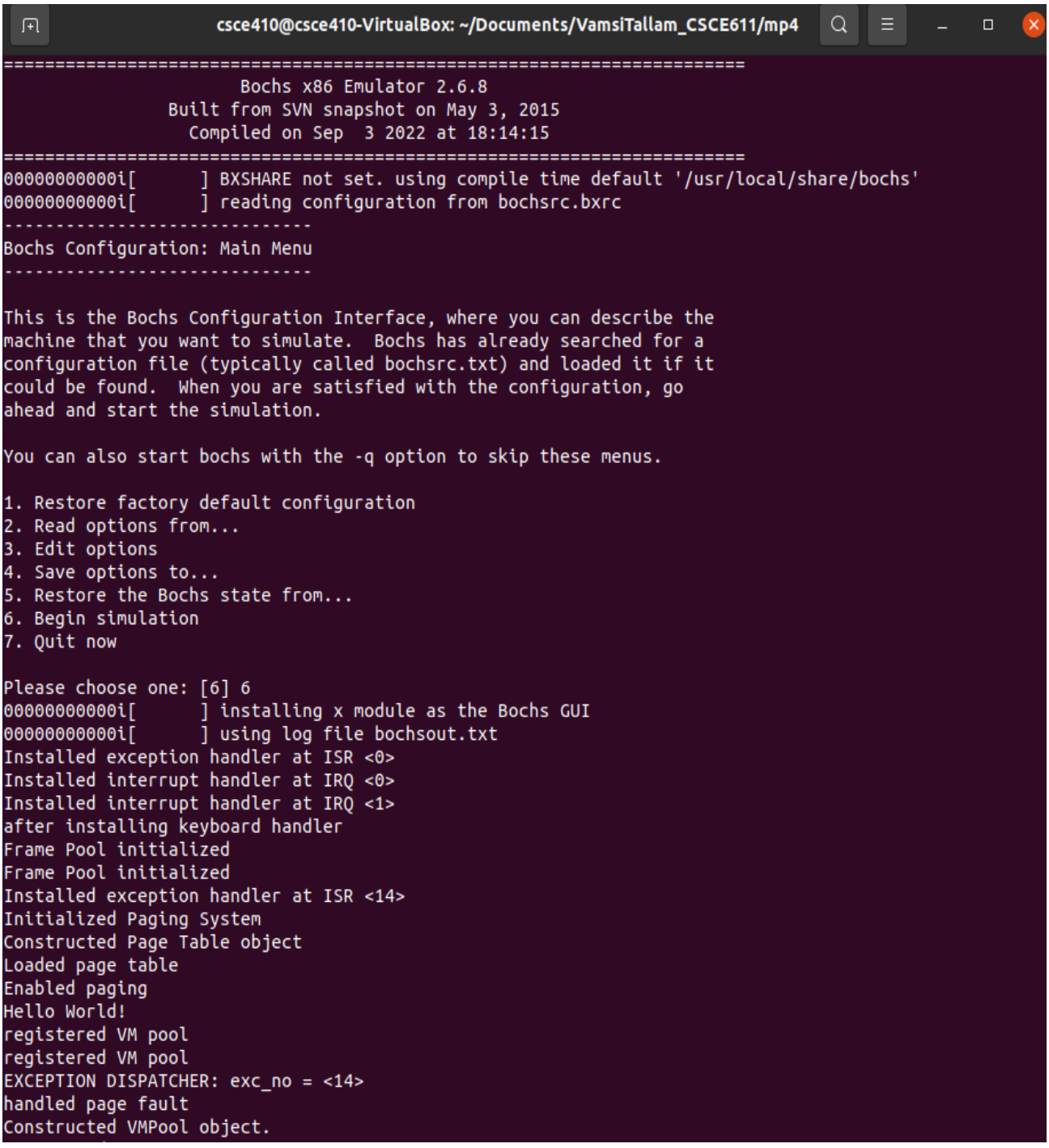
1. PageTable
    a. Constructor method also initializes virtual memory pool availability to zero.
2. init_page_directory:
    a. Acquires memory for the directory from process_mem_pool
    b. The last entry of the directory points to itself for incorporating the Recursive lookup.
3. handle_page_not_present:
    a. checks if the fault address (cr2 from error code) is part of any virtual memory pool list. If yes, proceed with handling page fault else, throw a segmentation fault.
    b. Translate the logical address of the directory and page table entry corresponding to the fault address (cr2) so that they can be modified after paging is enabled.
    c. PDE_address: translates the logical address for the directory corresponding to the address argument.
    d. PTE_address: translates the logical address for the pagetable entry corresponding to the address argument.
4. Create_page_table:
    a. For page table source memory from process_mem_pool and generate the corresponding addresses of each page table entry using PTE_address.

5. Free_page:
    a. Releases the page, clears the valid bit corresponding to the page table entry. Flush the TLB by reloading the directory address.

Functions from VMPool:

1. VMPool:
    a. Construct a VMPool object, set all instance attributes and initialize a region list, and set its address.
2. Allocate:
    a. Compute the number of pages we need based on the size argument and then traverse across the free space to identify the first region that fits the requirements. The new region is created at the boundary of the last region.
    b. If no free region is available, create a new one and add it to the list.
    c. If the count exceeds 256 then we throw an error as we only support 265 regions in the virtual memory pool.
3. Release:
    a. Traverse the list looking for a region whose base address matches the address argument. If found free the region page by page and the region list.

Results:


csce410@csce410-VirtualBox: ~/Documents/VamsiTallam_CSCE611/mp4
Bochs x86 Emulator 2.6.8
Built from SVN snapshot on May 3, 2015
Compiled on Sep 3 2022 at 18:14:15
000000000000i[ ] BXSHARE not set. using compile time default '/usr/local/share/bochs'
000000000000i[ ] reading configuration from bochsrc.bxrc
Bochs Configuration: Main Menu
This is the Bochs Configuration Interface, where you can describe the
machine that you want to simulate. Bochs has already searched for a
configuration file (typically called bochsrc.txt) and loaded it if it
could be found. When you are satisfied with the configuration, go
ahead and start the simulation.
You can also start bochs with the -q option to skip these menus.
1. Restore factory default configuration
2. Read options from...
3. Edit options
4. Save options to...
5. Restore the Bochs state from...
6. Begin simulation
7. Quit now
Please choose one: [6] 6
000000000000i[ ] installing x module as the Bochs GUI
000000000000i[ ] using log file bochsout.txt
Installed exception handler at ISR <0>
Installed interrupt handler at IRQ <0>
Installed interrupt handler at IRQ <1>
after installing keyboard handler
Frame Pool initialized
Frame Pool initialized
Installed exception handler at ISR <14>
Initialized Paging System
Constructed Page Table object
Loaded page table
Enabled paging
Hello World!
registered VM pool
registered VM pool
EXCEPTION DISPATCHER: exc_no = <14>
handled page fault
Constructed VMPool object.

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```
handled page fault
Constructed VMPool object.
VM Pools successfully created!
I am starting with an extensive test
of the VM Pool memory allocator.
Please be patient...
Testing the memory allocation on code_pool...
Allocated region of memory.
EXCEPTION DISPATCHER: exc_no = <14>
handled page fault
freed page
Released region of memory.
EXCEPTION DISPATCHER: exc_no = <14>
handled page fault
freed page
Released region of memory.
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```

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```
Released region of memory.
Testing the memory allocation on heap_pool...
Allocated region of memory.
EXCEPTION DISPATCHER: exc_no = <14>
handled page fault
freed page
Released region of memory.
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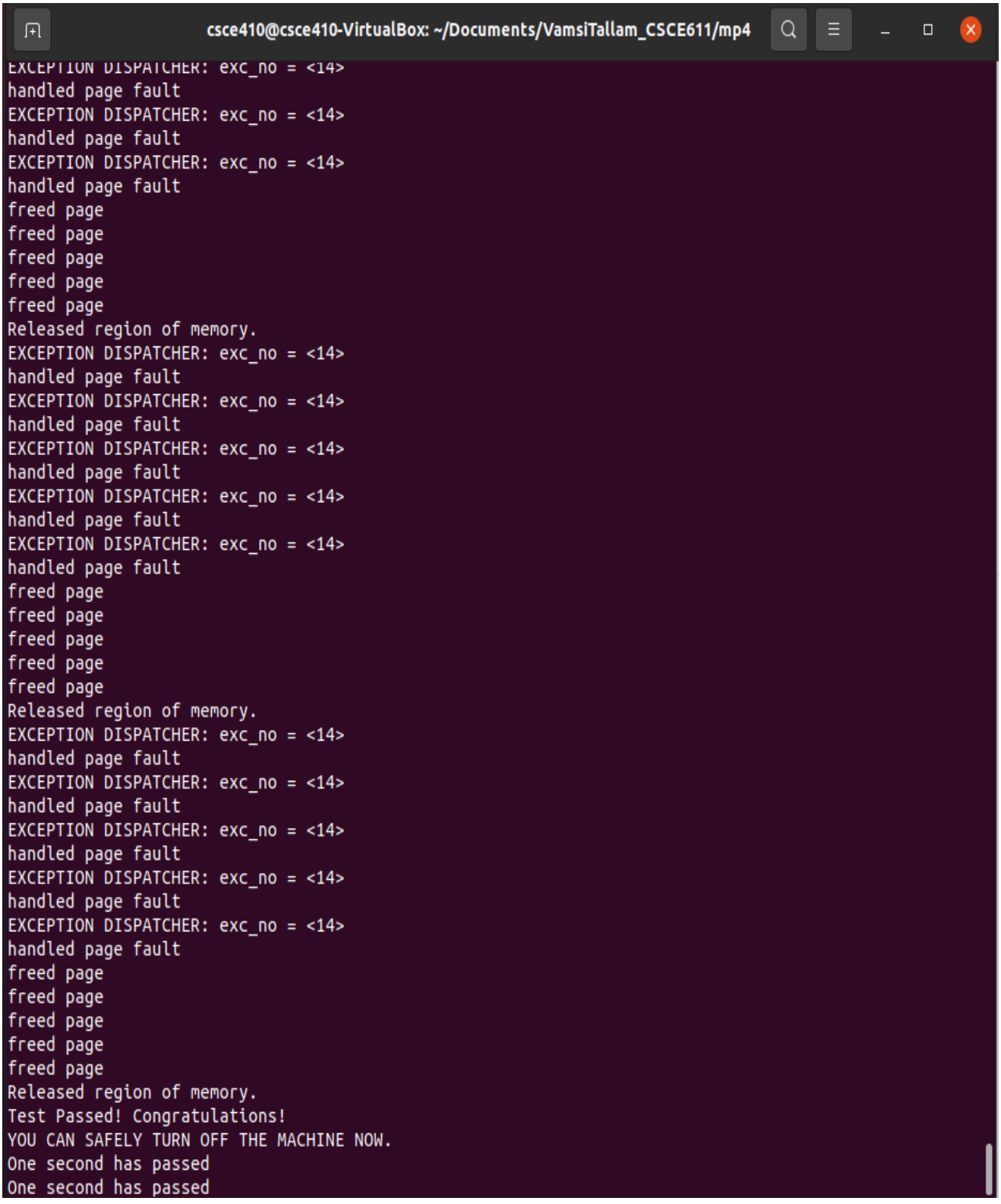
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freed page
freed page
freed page
freed page
freed page
Released region of memory.
Test Passed! Congratulations!
YOU CAN SAFELY TURN OFF THE MACHINE NOW.
One second has passed
One second has passed