CS342301: Operating System
MP2: Multi-Programming

Deadline: 2020/11/15 23:59

I. Goal

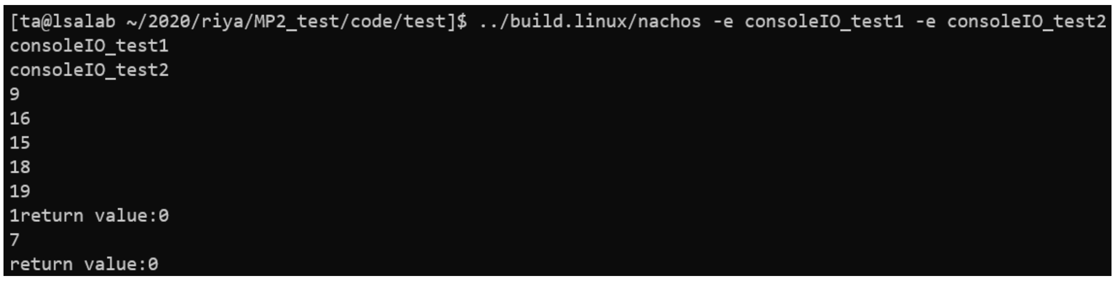
1. Understand how memory management works in NachOS
2. Understand how to implement page table mechanism

II. Assignment

1. Trace code
   - Starting from "threads/kernel.cc **Kernel::ExecAll()**", "threads/thread.cc **`thread::Sleep`**" until "machine/mipssim.cc **Machine::Run()**" is called for executing the first instruction from the user program.

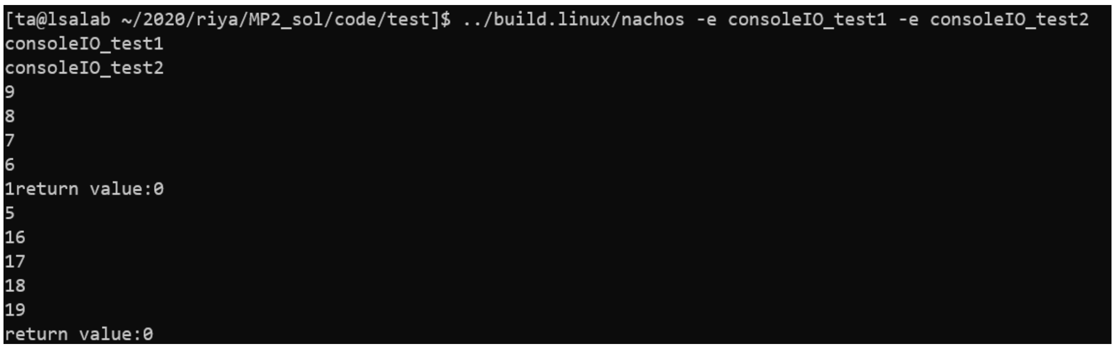
2. Implement page table in NachOS

- Working item: Modify its memory management code to make NachOS support multi-programming.
- Verification:
  - Wrong results without multi-programming



```
[ta@lsalab ~/2020/riya/MP2_test/code/test]$ ../build.linux/nachos -e consoleIO_test1 -e consoleIO_test2
consoleIO_test1
consoleIO_test2
9
16
15
18
19
1return value:0
7
return value:0
```

  - Correct results with multi-programming



```
[ta@lsalab ~/2020/riya/MP2_sol/code/test]$ ../build.linux/nachos -e consoleIO_test1 -e consoleIO_test2
consoleIO_test1
consoleIO_test2
9
8
7
6
1return value:0
5
16
17
18
19
return value:0
```

- **Note:**
  - Be careful that program size might exceed a pagesize

        - You must put the data structure recording used physical memory in kernel.h / kernel.cc
        - You must set up “valid, readOnly, use, and dirty” field for your page table, which is defined under “translate.h TranslationEntry class”
        - The size of your page table must be able to contain the whole physical memory
    - Hint: The following files “may” be modified…
        - userprog/addrspace.*
        - threads/kernel.*

3. Report
    - Cover page, including team members, Team member contribution.
    - Explain your implementation as requested in Part II-2.
    - Explain how NachOS creates a thread(process), load it into memory and place it into scheduling queue as requested in Part II-1. Your explanation on the functions along the code path should **at least** cover answer for the questions below:
        - How Nachos allocates the memory space for new thread(process)?
        - How Nachos initializes the memory content of a thread(process), including loading the user binary code in the memory?
        - How Nachos creates and manages the page table?
        - How Nachos translates address?
        - How Nachos initializes the machine status (registers, etc) before running a thread(process)
        - Which **object** in Nachos acts the role of **process control block**
        - When and how does a thread get added into the ReadyToRun queue of Nachos CPU scheduler?

III. Instruction

1. Copy your code for MP1 to a new folder
    - cp -r NachOS-4.0_MP1 NachOS-4.0_MP2
2. Copy test file
    - cp /home/os2020/share/consoleIO_test* NachOS-4.0_MP2/code/test/
3. Test your program
    - cd NachOS-4.0_MP2/code/test
    - ../build.linux/nachos -e consoleIO_test1 -e consoleIO_test2

IV. Grading

1. Implementation correctness – 60%

    - Execute “../build.linux/nachos -e consoleIO_test1 -e consoleIO_test2” correctly

2. Report – 20%
    - Upload it to iLMS with the Filename: **MP2_report_[GroupNumber].pdf**.
3. Demo– 20%
    - Answer questions during demo.
    - Demo will take place on our server, so you are responsible to make sure your code works on our server.

***Refer to syllabus for late submission penalty.**