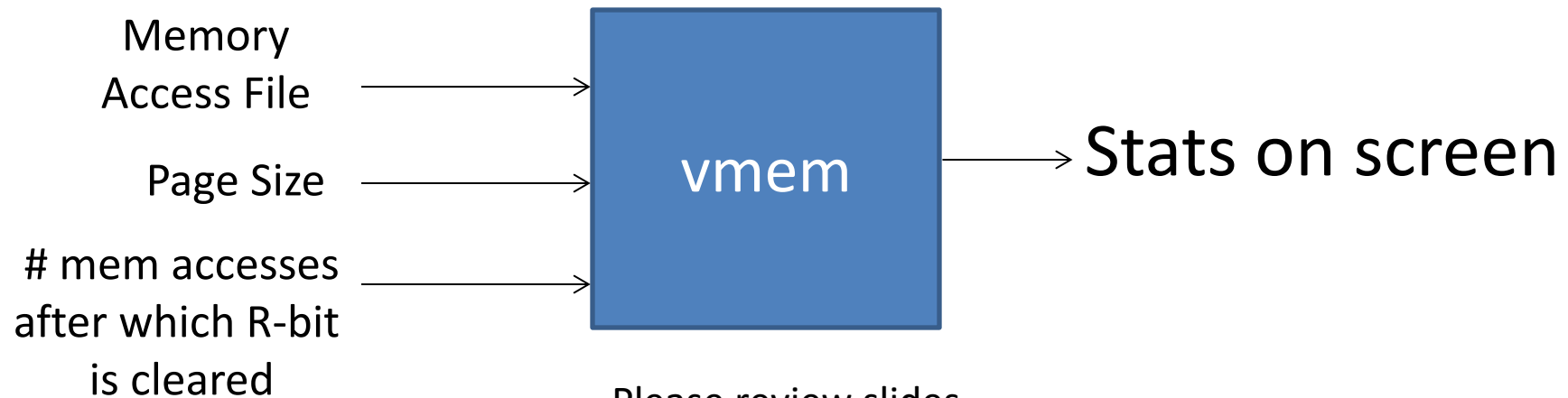


Programming Assignment

Virtual Memory

What Will We Do?

- In this project we will implement a simple virtual memory system.



Please review slides
14 and 15 from
“Memory Management 3”

./vmem filename page num

Assumptions

- Virtual address is 16 bits
- Physical address is 10 bits

Your Source Code

- vm.c
- compile with:

```
gcc -Wall -o vmem -std=c99 vm.c -lm
```

Input File Format

address read/write

You are provided with a file that
can generate input files for you.

Example:

0: Read

1: Write

abcd 0

123a 1

a345 0

3456 1

Example

Input File:

abcd 0
123a 1
a345 0
3456 1



page = 64 bytes → offset = 6 bits

abcd → 1010 1011 1100 1101

Remove offset:

1010 1011 1100 1101

→ 1010 1011 11 → 2af

./vmref example.in 64 2

num reads = 2

num writes = 2

percentage of page faults 1.00

mem[0]: 2af

mem[1]: 48

mem[2]: 28d

mem[3]: d1

mem[4]: ffffffff

mem[5]: ffffffff

mem[6]: ffffffff

mem[7]: ffffffff

mem[8]: ffffffff

mem[9]: ffffffff

mem[10]: ffffffff

mem[11]: ffffffff

mem[12]: ffffffff

mem[13]: ffffffff

mem[14]: ffffffff

mem[15]: ffffffff

Notes About Input

- page size: 32, 64, or 128 only
- Number of memory accesses after which R bit is cleared cannot be 0 or negative.
- We will not test your program with wrong inputs.

The Big Picture

- Read entry from the file: virtual address and op
- virtual address → virtual page number (VPN)
- Access page table using VPN
 - Page exists in physical memory
 - Update R & M bits
 - Page fault
 - Physical memory has empty slot
 - Physical memory is full
 - Apply NRU (slides 14 and 15 in “Memory Management 3”)
 - Update Page Table Accordingly ← Very important step

Regarding NRU

- Start from the beginning of physical memory (i.e. address 0) and go downward.
- Victimize the page with lowest RM.
- If more than one page have the lowest RM, then victimize the page in the lowest address.

What To Submit

Your source code: single file with the name **vm.c**

Do not submit anything else.

Avoid The Following Mistakes (Penalty applied for each)

- Late submission (-10% for each day for up to three days)
- The work is not your own (zero!)
- Output format is wrong.

Excuses not Accepted

- I submitted the wrong file.
- I submitted a bit after the deadline.
 - We highly suggest that you upload a version, even if not yet complete, each time you implement something and do not wait till you finish the whole program.
 - You are provided with one hour grace period.

One last thing

- To help you start, we are providing you with a binary file that works as a reference.
 - execute with: `./vmref filename page_size num_accesses`
- We are also providing you with another executable: genfile that can generate input files for you.
 - execute with: `./genfile filename #entries`
- Important: To use the provided binary files, do the following:
 - execute the following command first:
 - `chmod 777 ./vmref`
 - `chmod 777 ./genfile`

All the Best!