

- The output resulted from running `uvmpint` of the first process with `PID = 1`:

```

moslimscientist@TheMoslimScientist: ~/Desktop/operating_...
riscv64-linux-gnu-objdump -S kernel/kernel > kernel/kernel.asm
riscv64-linux-gnu-objdump -t kernel/kernel | sed '1,/SYMBOL TABLE/d; s/ .* / /;
/^$/d' > kernel/kernel.sym
qemu-system-riscv64 -machine virt -bios none -kernel kernel/kernel -m 128M -smp
3 -nographic -drive file=fs.img,if=none,format=raw,id=x0 -device virtio-blk-devi
ce,drive=x0,bus=virtio-mmio-bus.0

xv6 kernel is booting

hart 1 starting
hart 2 starting
page table 0x0000000087f6e000
..0: pte 0x0000000021fda801 pa 0x0000000087f6a000
.. ..0: pte 0x0000000021fda401 pa 0x0000000087f69000
.. .. ..0: pte 0x0000000021fdac1f pa 0x0000000087f6b000
.. .. ..1: pte 0x0000000021fda00f pa 0x0000000087f68000
.. .. ..2: pte 0x0000000021fd9c1f pa 0x0000000087f67000
..255: pte 0x0000000021fdb401 pa 0x0000000087f6d000
.. ..511: pte 0x0000000021fdb001 pa 0x0000000087f6c000
.. .. ..509: pte 0x0000000021fdd817 pa 0x0000000087f76000
.. .. ..510: pte 0x0000000021fddc07 pa 0x0000000087f77000
.. .. ..511: pte 0x0000000020001c0b pa 0x0000000080007000
init: starting sh
$

```

- Explain the output of `vmprint` in terms of Fig 3-4 from the text. What does page 0 contain? What is in page 2? When running in user mode, could the process read/write the memory mapped by page 1? What does the third to last page contain?

The physical address of page 0 is 0x0000000087f6b000

The physical address of page 1 is 0x0000000087f68000

page 1 entry in the page table is 0x0000000021fda00f so the last 5 bits are 01111 . hence `PTE_U = 0` and so we can't access this bit in the user space.

Since page 3 to last page aren't mapped in this process then no data exist in this space.

Page 0 of the page table contains a page table of 512 entries each with 28 bits. Each entry is a physical address of a page table. It contains a valid entry in the first entry and the last entry which are 0x0000000021fda801 , 0x0000000021fdb401.

Page 2 contains addresses of the third level page tables. One only is valid which is 0x0000000021fda401.

Page 1 is mapping in the page table with value = 0x0000000021fdac1f. Since the last 5 bits are 1's `PTE_R` , `PTE_W` = 1, `PTE_U` = 1 , hence we can read or write from them in user mode.

Pages from 3 to last page contain the addresses of the last pages in the memory which are: 0x0000000021fdd813 , 0x0000000021fddc07 , 0x0000000020001c0b.

- The result from seeing the pages that are accessed:

```
moslimscientist@TheMoslimScientist: ~/Desktop/operating_...
ce,drive=x0,bus=virtio-mmio-bus.0

xv6 kernel is booting

hart 2 starting
hart 1 starting
..0: pte 0x0000000021fda801 pa 0x0000000087f6a000
.. ..0: pte 0x0000000021fda401 pa 0x0000000087f69000
.. ..0: pte 0x0000000021fdac1f pa 0x0000000087f6b000
.. ..1: pte 0x0000000021fda00f pa 0x0000000087f68000
.. ..2: pte 0x0000000021fd9c1f pa 0x0000000087f67000
..255: pte 0x0000000021fdb401 pa 0x0000000087f6d000
.. ..511: pte 0x0000000021fdb001 pa 0x0000000087f6c000
.. ..509: pte 0x0000000021fdd817 pa 0x0000000087f76000
.. ..510: pte 0x0000000021fddc07 pa 0x0000000087f77000
.. ..511: pte 0x0000000020001c0b pa 0x0000000080007000
init: starting sh
$ pgtbltest
ugetpid_test starting
ugetpid_test: OK
pgaccess_test starting
pgaccess_test: OK
pgtbltest: all tests succeeded
$
```