```
(1) Added in syscall.h:
#define SYS_numvp 22
#define SYS numpp 23
#define SYS_getptsize 24
(2) Added in user.h:
int numvp(void);
int numpp(void);
int getptsize(void);
(3) Added in sysproc.c:
extern pte_t* walkpgdir(pde_t *pgdir, const void *va, int alloc);
int sys_numvp(void) {
struct proc *p = myproc();
return (p->sz + PGSIZE - 1)/PGSIZE + 1;
int sys_numpp(void) {
struct proc *p = myproc();
pte_t *pte;
int count = 0;
for(uint a = 0; a < p->sz; a += PGSIZE){
pte = walkpgdir(p->pgdir, (void*)a, 0);
if(pte && (*pte & PTE_P)) count++;
return count;
int sys_getptsize(void) {
struct proc *p = myproc();
int count = 1; // outer page directory
for(int i=0;i<NPDENTRIES;i++)</pre>
if(p->pgdir[i] & PTE_P) count++;
return count;
}
(4) Added in syscall.c:
extern int sys_numvp(void);
extern int sys_numpp(void);
extern int sys_getptsize(void);
[SYS_numvp] sys_numvp,
[SYS_numpp] sys_numpp,
[SYS_getptsize] sys_getptsize,
```

(5) Created memtest.c and added:

```
#include "types.h"
#include "stat.h"
#include "user.h"
int main(void) {
  printf(1, "Virtual pages: %d\n", numvp());
  printf(1, "Physical pages: %d\n", numpp());
  printf(1, "Page table pages: %d\n", getptsize());
  exit();
}
```

(6) Added in Makefile:

_memtest

(7) Added in usys.S:

SYSCALL(numvp) SYSCALL(numpp) SYSCALL(getptsize)

(8) In vm.c removed static and the new line is the following:

```
pte_t * walkpgdir(pde_t *pgdir, const void *va, int alloc)
```

```
QEMU

SeaBIOS (version rel-1.16.3-0-ga6ed6b701f0a-prebuilt.qemu.org)

iPXE (http://ipxe.org) 00:03.0 CA000 PCI2.10 PnP PMM+1EFD10B0+1EF310B0 CA00

Booting from Hard Disk...

cpu0: starting 0

sb: size 1000 nblocks 941 ninodes 200 nlog 30 logstart 2 inodestart 32 bmap start 58

init: starting sh

$ memtest

Virtual pages: 4

Physical pages: 3

Page table pages: 66

$
```