

(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<NPDETRIES; i++){
        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:

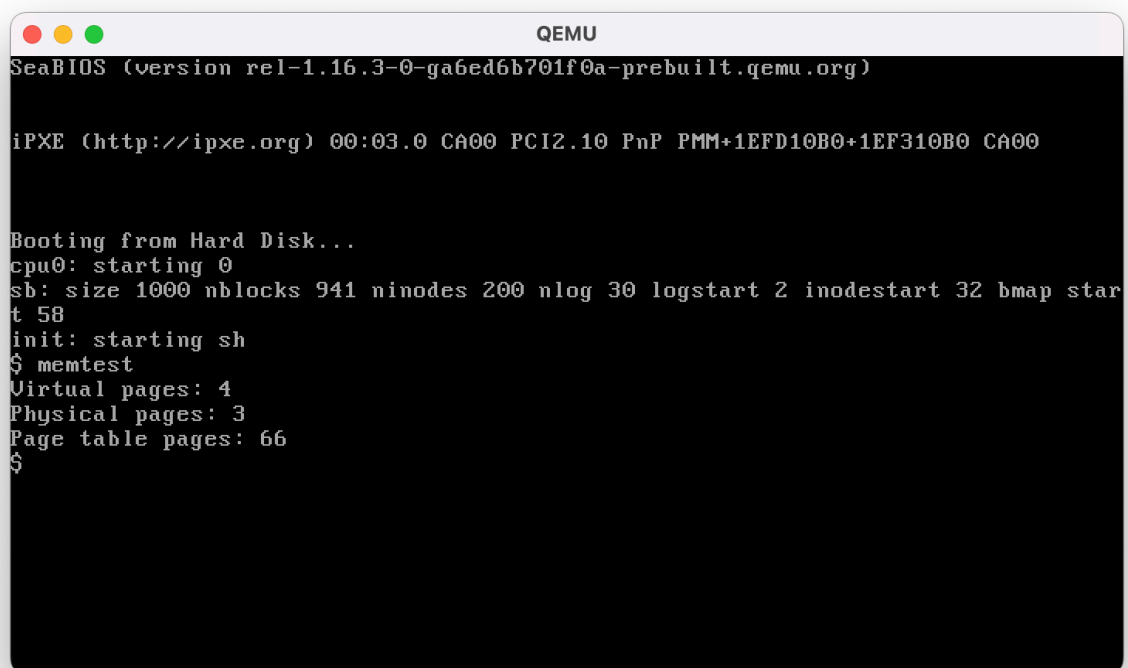
```
_memtest
```

(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)
```



Screenshot of the QEMU terminal