1.vm.c (xv6 design & implementation. (xv6 source code))

Ans:

Vm.c(allocuvm):

```
int allocuvm(pde_t *pgdir, uint oldsz, uint newsz)
{
 char *mem;
 uint a;
 if(newsz >= KERNBASE)  return 0;
if(newsz < oldsz)  return oldsz;
a = PGROUNDUP(oldsz);
for(; a < newsz; a += PGSIZE){
mem = kalloc();
if(mem == 0){
cprintf("allocuvm out of memory\n");
deallocuvm(pgdir, newsz, oldsz);
return 0;
 }
 memset(mem, 0, PGSIZE);
if(mappages(pgdir, (char*)a, PGSIZE, V2P(mem), PTE_W|PTE_U) < 0){
cprintf("allocuvm out of memory (2)\n");
deallocuvm(pgdir, newsz, oldsz);
kfree(mem);
return 0;
 }
 }
 return newsz;
}
```

Vm.c(deallocuvm):

```
int deallocuvm(pde_t *pgdir, uint oldsz, uint newsz)
{
pte_t *pte;  uint a, pa;
if(newsz >= oldsz) return oldsz;
a = PGROUNDUP(newsz);
for(; a < oldsz; a += PGSIZE){
pte = walkpgdir(pgdir, (char*)a, 0);
if(!pte)
a = PGADDR(PDX(a) + 1, 0, 0) - PGSIZE;
else if((*pte & PTE_P) != 0){
pa = PTE_ADDR(*pte);
if(pa == 0)  panic("kfree");
char *v = P2V(pa);
kfree(v);
*pte = 0;
 }
 }
 return newsz;
}
```

Vm.c(seginit):

```
void seginit(void)
{
 struct cpu *c;
 // Map "logical" addresses to virtual addresses using identity map.
 // Cannot share a CODE descriptor for both kernel and user  //
because it would have to have DPL_USR, but the CPU forbids
// an interrupt from CPL=0 to DPL=3.
 c = &cpus[cpunum()];
c->gdt[SEG_KCODE] = SEG(STA_X|STA_R, 0, 0xffffffff,
0);  c->gdt[SEG_KDATA] = SEG(STA_W, 0, 0xffffffff, 0);
c->gdt[SEG_UCODE] = SEG(STA_X|STA_R, 0, 0xffffffff,
DPL_USER);
c->gdt[SEG_UDATA] = SEG(STA_W, 0,
0xffffffff,DPL_USER);
 // Map cpu, and curproc  c->gdt[SEG_KCPU] =
SEG(STA_W, &c->cpu, 8, 0);  lgdt(c-
>gdt,sizeof(c->gdt));
loadgs(SEG_KCPU << 3);
 // Initialize cpu-local storage.
 cpu = c;
proc = 0;
}
```

2.ps, back trace (xv6 customization)

Ans:

Ps.c

Follow the steps:

Step1: Ps.c

```
#include "types.h"
#include "stat.h"
#include "user.h"
#include "uproc.h"
#define STDOUT 1
#define NPROC 3  // maximum number of processes
void getprocdata()
{   int i = 0;
 struct uproc up;
printf(STDOUT, "Name\tpid\tppid\tsize\t\twaiting_on_channel\tkilled\n");
  printf(STDOUT, "--------------------------------------------------------------------------\n");
for (i=0; i<NPROC; i++) {
getprocinfo(i, &up);
printf(STDOUT, "%s\t%d\t%d\t%d\t\t%d\t\t%d\n", up.name, up.pid, up.ppid, up.sz,
up.wait, up.killed); }
exit(); }
```

```
int main(int argc, char *argv[])
{
  getprocdata();
exit();
}
```

Step 2: Syscall.c

```
extern int
sys_getprocinfo(void);
[SYS_getprocinfo]  sys_getprocinfo,
```

Step 3: Syscall.h

```
#define SYS_getprocinfo 22
```

Step 4: Sysproc.c

```
int
sys_getprocinfo()
{
  int proc_num,
size = sizeof(struct uproc);
struct uproc *up;
if ((argint(0, &proc_num) < 0) || (argptr(1, (char **)&up, size) < 0))
return -1;
return getprocinfo(proc_num, up);
}
```

Step 5: User.h

```
struct stat;
struct rtcdate;
struct uproc;
//Add this in System Calls block
int getprocinfo(int, struct
uproc*);
```

Step 6: usys.S

```
SYSCALL(getprocinfo)
```

Step 7: Proc.h

```
//Add at the
end struct
uproc{   char
name[16];   int
pid;
int ppid;
uint sz;
int state;
int wait;
int killed;
};
```

Step 8: Proc.c

```
// Add below code in proc.c at the end
int  getprocinfo(int proc_num, struct uproc *up)
{ struct proc *p;
if (proc_num >= NPROC)
   return -1;
p = &ptable.proc[proc_num];
memset(up, 0, sizeof(struct uproc));
memmove(up->name, p->name, 16);
up->pid = p->pid;
 up->state = p->state;
if ((up->state != UNUSED)) {
up->ppid = p->parent->pid;
up->sz = p->sz;
  }
  if (up->pid == 1) {
up->sz = p->sz;
up->ppid = 0;
  }
  if (p->chan)
up->wait = 1;
 else
up->wait = 0;
up->killed = p->killed;
return 0;
}
```

Step 9: defs.h

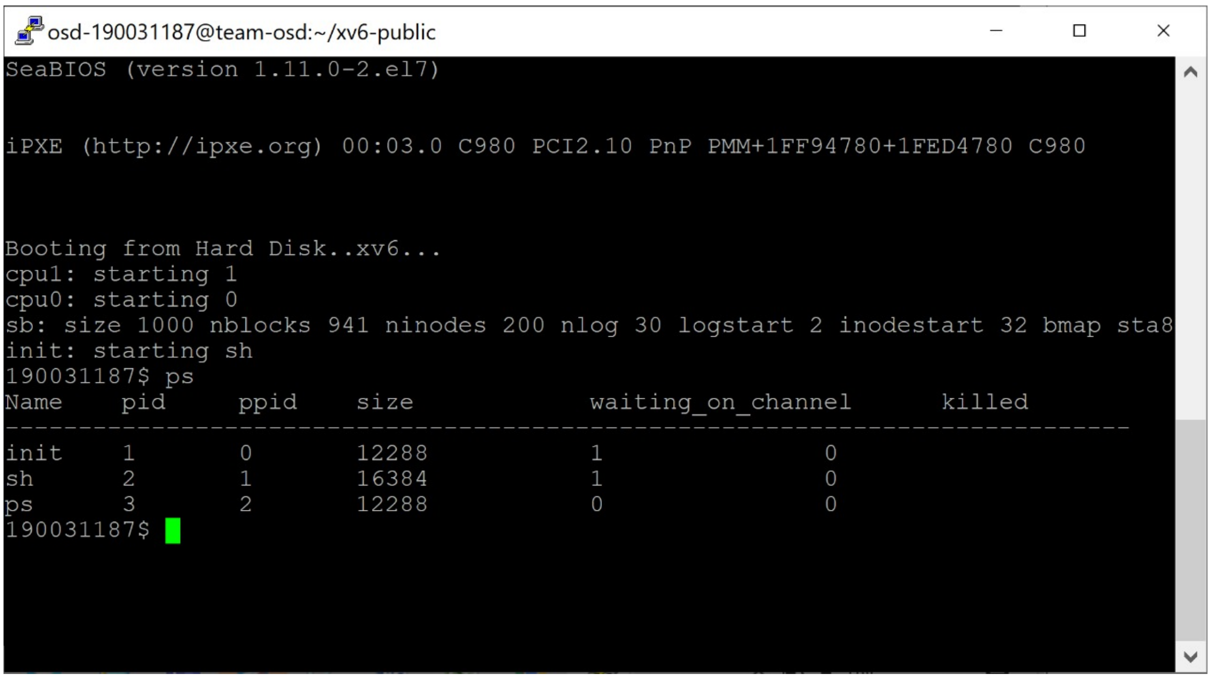
```
//Add uproc
here.. struct buf;
struct context;
struct file;
struct inode;
struct pipe;
struct proc;
struct uproc;

//pagebreak 16  //proc.c (In defs.h)
int   getprocinfo(int, struct uproc*);
```

Step 10: uproc.h

```
#include
"types.h" struct
uproc{   char
name[16];   int
pid;   int ppid;
uint sz;   int state;
int wait;   int
killed;
};
```

Step 11: Makefile:
$ nano Makefile
//In UPROGS\ section, Add
_ps\
//In Extras Section, Add
ps.c

OUTPUT



osd-190031187@team-osd:~/xv6-public

```
SeaBIOS (version 1.11.0-2.el7)


iPXE (http://ipxe.org) 00:03.0 C980 PCI2.10 PnP PMM+1FF94780+1FED4780 C980



Booting from Hard Disk..xv6...
cpu1: starting 1
cpu0: starting 0
sb: size 1000 nblocks 941 ninodes 200 nlog 30 logstart 2 inodestart 32 bmap sta8
init: starting sh
190031187$ ps
Name    pid     ppid    size            waiting_on_channel      killed
-----------------------------------------------------------------------------
init    1       0       12288           1               0
sh      2       1       16384           1               0
ps      3       2       12288           0               0
190031187$ 
```

Backtree.c

Follow the steps:

Step-1: Syscall.h

$ nano syscall.h

#define SYS_backtrace 23

Step 2: Syscall.c

$ nano syscall.c extern int
sys_backtrace(void);
[SYS_backtrace]
sys_backtrace,

Step 3: Sysproc.c $
nano sysproc.c

```
int
sys_backtrace(void
)
{
  //struct proc *curproc = myproc();   uint
ebp, ret_addr, next_addr;   int count = 0;
struct trapframe *tf = myproc()->tf;
cprintf("eax : 0x%x\n", tf->eax);
cprintf("ebx : 0x%x\n", tf->ebx);
cprintf("ecx : 0x%x\n", tf->ecx);   cprintf("edx
: 0x%x\n", tf->edx);   cprintf("edi : 0x%x\n",
tf->edi);   cprintf("esi : 0x%x\n", tf->esi);
cprintf("esp : 0x%x\n", tf->esp);
cprintf("ebp : 0x%x\n", tf->ebp);
cprintf("eip : 0x%x\n", tf->eip);   ebp = tf-
>ebp;   next_addr = tf->eip;
while(next_addr && next_addr != (uint)-1) {
ret_addr = *(uint *) (ebp + 4);
cprintf("#%d   0x%x\n", count++, ret_addr);
ebp = *(uint *)ebp;     next_addr = ret_addr;
  }
  return 0;
}
```

Step 4: Usys.S

$ nano usys.s
SYSCALL(backtrace
) Step 5: User.h
$ nano user.h int
backtrace(void);

Step 6: defs.h
$ nano defs.h
int backtrace(void);

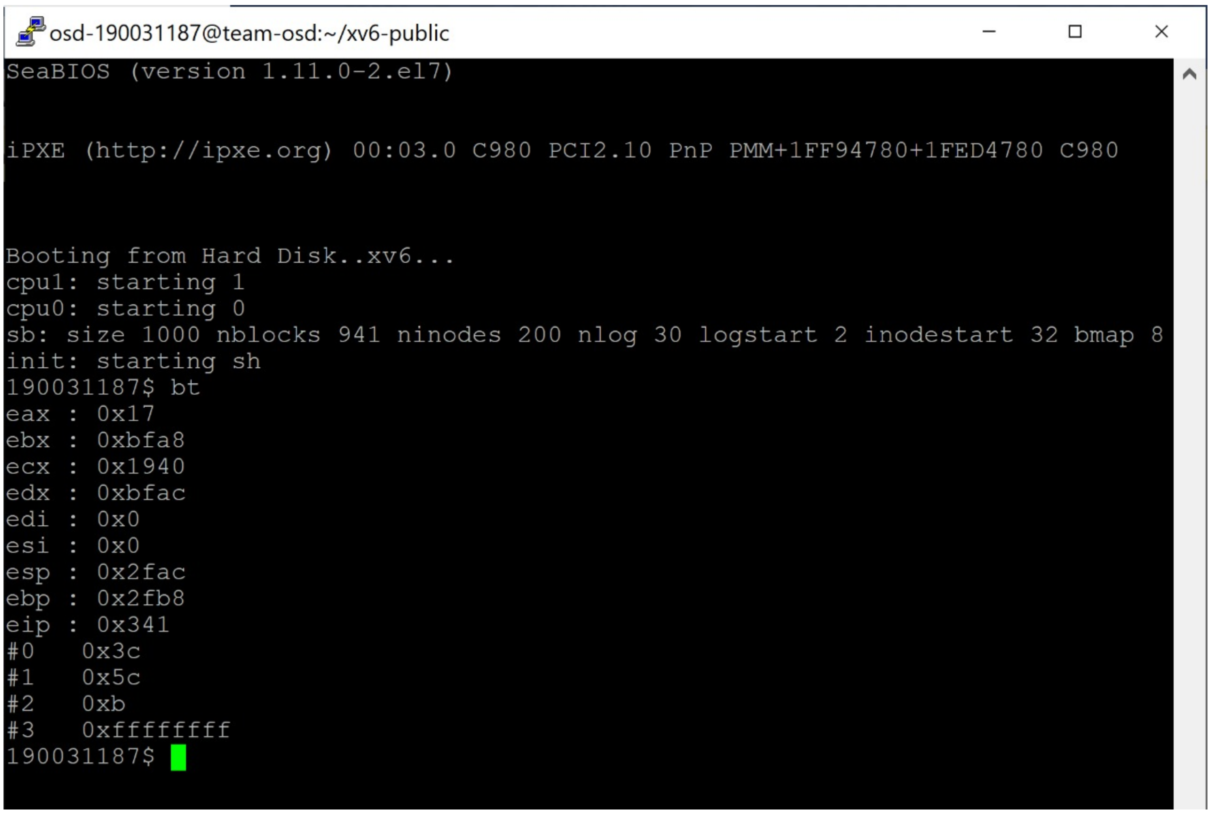
Step 7: bt.c
$ nano bt.c

```
#include "types.h"
#include "stat.h" #include
"user.h" int baz()
__attribute__((noinline)); int
baz() {    int a;    a = backtrace();
return a + uptime();
}
int bar()
__attribute__((noinline)); int
bar() {   int b;   b = baz();   return
b + uptime();
}
int foo()
__attribute__((noinline)); int
foo() {   int c; c = bar();   return c +
uptime();
} int main(int argc, char
*argv[])
{
foo();
exit();
}
```

Step 8: Makefile
$ nano Makefile

```
UPROGS:  _bt\
EXTRAS:   bt
```

OUTPUT



osd-190031187@team-osd:~/xv6-public

```
SeaBIOS (version 1.11.0-2.el7)


iPXE (http://ipxe.org) 00:03.0 C980 PCI2.10 PnP PMM+1FF94780+1FED4780 C980



Booting from Hard Disk..xv6...
cpu1: starting 1
cpu0: starting 0
sb: size 1000 nblocks 941 ninodes 200 nlog 30 logstart 2 inodestart 32 bmap 8
init: starting sh
190031187$ bt
eax : 0x17
ebx : 0xbfa8
ecx : 0x1940
edx : 0xbfac
edi : 0x0
esi : 0x0
esp : 0x2fac
ebp : 0x2fb8
eip : 0x341
#0   0x3c
#1   0x5c
#2   0xb
#3   0xffffffff
190031187$
```

.c