Exam Feedback

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A Word on the Final Exam

- Disclaimer
  - Past performance is not a guarantee of future results
- The course will change
  - Up to now: basics
    - What you need for Project 3
  - Coming: advanced topics
    - Design issues
    - Things you won't implement

A Word on the Final Exam

- Examination will change to match
  - More design
  - Some things you won't have implemented

Basic Assumptions

- This is a ***C*** programming class!
  - sizeof (char) == 1 /* 8 bits */
  - sizeof (int) == 4 /* 32 bits, ***mostly*** true now */
  - You need to ***really*** understand pointers
- Semantics
  - '\0' isn't "just" an 1-byte zero – it's the zero ***char***
- Other languages are excellent
  - ...but very few are ok for writing OS code

A&B exams: Q1

- Definitions
- Papers looked mostly ok

A:Q2: malloc() loop *in kernel*

```
void foo(void)
{
  while (1)
    (void) malloc(1);
}
```

- What we're looking for
  - Vicious memory leak
  - Kernel memory is ***limited***
  - When it's gone ***no process*** can get more

B:Q2: user-mode “summation” loop

```
void bar(void) {
  int sum = 0, *ip; /*2 decl, 1 set*/
  ip = &sum;
  while (1) { sum += *ip; --ip; }
}
```

- What we're looking for
  - It's infinite stack growth
  - ***Eventually*** the kernel will kill the process
  - Other processes may suffer – ***or be killed!***

A:Q3(a)

- Why ***multiple*** kernel stacks?
- Not: “protection”!
  - “Monolithic kernel” model: ***all*** kernel code is trusted
- Key issue: ***preemption***
  - User process in kernel mode
  - Stack contains: trap frame, N procedure call frames
  - Switch to another process: copy all that around?
  - From/to where??? Wouldn't that be a stack too?

A:Q3(b) - How to set kernel stack size

- Kernel virtual memory size typically fixed, ***small***
  - (Why small?)
  - Large stacks means fewer stacks, so fewer threads
- ***Not:*** "run it and see what happens"
- Good: examine call chains, local variable usage
- Very good: factor in ***interrupt handlers!***

B:Q3(a) – How many page faults?

```
void foo(void) {
  int i; char x[2000];
  for (i = 0; i < 2000; i++)
    x[i] = '\0';
}
```

- What we wanted to see
  - Stack ***and code*** are involved
  - Page ***alignment*** may not be ideal even if size fits
- Minimum "good" answer: 4 pages
- Competitive paging: easy to get ~4k/~6k faults

B:Q3(b) – Stack growth, wild access

- "stack growth due to one memory reference"

```
void foo(void) {
        char x[65536];
        x[0] = '\0';
}
pushl %ebp
movl %esp,%ebp
subl $65536,%esp
movb $0,-65536(%ebp) ; memory ref
```

- How far is too far? ***Not right:*** "one page"

B:Q3(b) – Good vs. bad?

```
void one(void) {
  double a[1024];
  int i;

  for (i = 1024;
     i >= 0;
     i--)
    a[i] = 0.0L;
}
```

```
void one(void) {
  double a[1024];
  int i;

  for (i = 0;
     i < 1024;
     i++)
    a[i] = 0.0L;
}
```

B:Q3(b) - Stack growth, wild access

- Also not:
  - Let stack grow ***all the way*** to top of heap
  - That means ***no such thing*** as a wild pointer access!
- Reasonable
  - Some ***large*** size
  - Halfway through the void

Other questions

- Q4 – deadlock
- Q5 – broken mutual exclusion protocol