15-410
“...misbehave(7)...”

Project 2
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Synchronization

**Partner issues**
- If you think you are dropping, or switching to P/F...
  - Please let us know
- If you think your partner is dropping
  - Please let us know
- I am aware of turmoil
  - Helping people match is helped if I know who to match
Synchronization

Project 2 out today

- Writeup this afternoon
  - Please read carefully!
- Tarball afternoon/evening
  - Feeling impatient? Consider reading the writeup again
- Group volumes should be ready this afternoon

Please make sure you've discussed with your partner

- How many late days?
- Project schedule in other classes
  - Write down a joint project schedule
- Auditing or pass/fail? Target 410 grade?
- Prior experience
- Interviews
Outline

What you'll build

- Mutex, condition variable
- Thread library
- Supplemental library routines
- Tests

How the pieces fit together

- A picture is worth 1000 words
- You'll need to read the handouts too
  - (two, each >1000 words)
  - kspec – specifies our kernel for P2, your kernel for P3
  - thr_lib – specifies thread library
Mutex & Condition Variable

mutex
cvar

410 kernel
Remainder of Thread Library

thr_create()  thr_exit()  ...

mutex  cvar

410 kernel
Supplemental Library Routines

- r/w lock
- semaphore
- thr_create()
- thr_exit()
- ...
- mutex
- cvar
- 410 kernel
Tests (Yours & Ours)

- user tests
- 410 tests
- r/w lock
- semaphore
- thr_create()
- thr_exit()
- ...
- mutex
- cvar
- 410 kernel
Building a “RAM disk” image

```
Building a "RAM disk" image

test1.o  410test1.o

libthread  libstdio  libthread  libstdio

user_apps.o

test1  410test1
```
Linking “RAM disk” to kernel

user_apps.o  boot image  kernel.o
Misbehave

misbehave(int mode)

- Special debugging-support system call in our 410 kernel
- Adjusts “behavior” of system
  - Multiple legal behaviors (you will feel this during P3)
  - Each mode selects a particular mix
  - We will not document these
  - We expect you to not “document” them to classmates either
- Debug your thread library with one mode, then the next...
  - A dazzling array of flavors
  - 0...63
  - maybe even more
  - -1
- You will not be required to implement misbehave() in P3
threadinfo

```
simics> tidinfo 11
REGISTER DUMP FOLLOWS
  CS = 0x00000043, EFLAGS = 0x00010246, SS = 0x0000004b
  EIP = 0x0100004a, ESP = 0xfffffffffa0, EBP = 0xfffffffffccc
  EDI = 0x00000000, ESI = 0x00000000, EAX = 0x31337000
  EBX = 0x00000000, ECX = 0x00000000, EDX = 0x01000c0a
```

Cool, what is it?

- Debugging information about thread 11
- The last instruction it executed in user space

Why would I want that?

- It might help with certain hard problems
Plea – Conceptual

This code is *tricky*

- Most of you have already written multi-threaded code
  - That can be tricky enough
- Writing the internals is harder
  - Get a part 99% done
  - Discover a “bug”...
  - ...which is really a misconception...
  - * Totally new design* to fix it

Make sure core parts are *solid*

- Better to skip readers/writers locks if not
Plea – Time

The first 90% will take the first 90% of the time
  - The last 10% will take the second 90% of the time

“Code complete”
  - Plan to spend at least three days debugging based on the tests we release
  - If your thread library doesn't pass cyclone and agility_drill it won't pass a bunch of our tests either
    - Resultant grade is unlikely to exceed a C

“You should be here” guidance in handout
  - Based on bitter experiences of former students