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
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 = 0xffffffffa0, EBP = 0xffffffffcc
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