Review Exam 2

CS 537: Introduction to Operating Systems

Louis Oliphant

University of Wisconsin - Madison

Fall 2024

Administrivia

- Project 4 due Tue Nov 5th @ 11:59pm
- Exam 2, Thu, Nov 7th 5:45-7:15pm
  - Conflict? – fill out the exam conflict form
  - Same format as Exam 1
  - Bring ID, #2 Pencil, and 1 sheet of notes
  - Last Name: **A-K** – Van Vleck B102
    L-Z – Ingraham B10
  - McBurney 5:45-8:00pm – CS 1257

Administrivia (cont.)

Exam 1 Question 27 – A system uses 16-bit VA with the 2 high-order bits specifying the segment. What is the largest VA for this process that will not cause any faults and be in the heap segment?

Segment (Bits)	Base	Bounds (Size)	Grows Positive?	Protection Bits (RWX)
Code (00)	0x3000	1KB	1	101
Heap (01)	0x3800	2KB	1	110
Unused (10)			0	000
Stack (11)	0x8800	4KB	0	110

A. 0x4400
B. 0x4800
C. 0x4FFF
D. 0x4000
E. None of the above

heap (01) with offset of $\underline{2KB - 1}$
WRONG: 0100 1000 0000 0000 (0x4800)
RIGHT: 0100 0111 1111 1111 (0x47FF)

Full points for option B or E.

Quiz: Concurrency Problems

https://tinyurl.com/cs537-fa24-q14

Major Concepts

- Processes and `fork()`
- Threads
  - What is shared between threads
  - Create and Join Threads
  - Pass parameters and return values
  - Race conditions
- Locks
  - Create and use locks
  - Lock implementation goals
  - Lock implementations and types (spin-wait, blocking)
  - Hardware support (TestAndSet, xchg, CompareAndSwap, LoadLinked/StoreConditional)
- Locked Data Structures
  - Big lock vs. more smaller locks
  - Counter, Approximate Counter, linked-list, queue, hash table

Major Concepts (cont.)

- Condition Variables
  - Create and use CV
  - Example use in thread join, producer/consumer
  - Program state
  - Hoare vs. Mesa semantics
  - Covering conditions and broadcast()
- Semaphores
  - Create and use Semaphores
    - replacing locks
    - replacing CV
  - Producer/Consumer problem with semaphores
  - Reader-Writer locks
  - Dining Philosophers
  - Building Semaphores with locks and CV
  - Zemaphores

Major Concepts (cont. . .)

- Concurrency Problems
  - Atomicity violations
  - Order violations
  - Deadlock
    - mutual exclusion, hold-and-wait, no preemption, circular wait
  - deadlock avoidance, recovery