1 Administrivia

Return, collect homework.

Announcements

Assignment

From Last Time

Virtual memory.

Outline

1. Course evaluation.
2. Review for final.

Coming Up

Final.
2 Review for Final

- Chapters covered: 2–7.
- Refer to previous reviews for earlier material.
- Slight bias toward more recent material, but coverage will be fairly even.
- Final exam format:
  - 12 short answer questions. Each 10 points.
  - Two “essay” questions. Each 40 points.

1. Pipelining:
   (a) Changes to datapath, control
   (b) Hazards: structural, data, control. Penalties, solutions.

2. Superscalar execution:
   (a) IPC
   (b) Widening the *entire* datapath.
   (c) Applicability.
   (d) Types of data dependencies. True, false dependencies. Removal of false dependencies: register renaming.
   (e) Out-of-order execution, in-order completion.

3. Caches:
   (a) The memory hierarchy.
   (b) Exploiting program locality properties. Advantages of using caches.
(c) Cache types: direct mapped, set-associative, fully-associative.

(d) Address partitioning: tag, offsets.

(e) Ideas behind direct-mapped caches. Analysis of direct mapped caches.

(f)

4. Virtual memory:

(a) Mapping between virtual address space and physical address space (memory and paging device).

(b) Locality, advantages.

(c) Requirements:

   i. Kernel support: page fault handler, page placement and page replacement policies.

   ii. MMU support: valid/invalid bit, reference bit, dirty bit, read/write bit.
       Exceptions generated: memory fault (unmapped page), page fault (page not in memory), write on read-only fault.

   iii. CPU support: Instructions must be re-startable.

(d) Page fault sequence (memorize all 147 steps).

(e) Demand paging performance: effective access time.