EE 607: Advanced Network Algorithms Spring 2006

November 16, 2005
To get the latest information, see the instructor's web site www-ee.eng.hawaii.edu/~sasaki and then go to the EE 607 web page.

- **Instructor: Galen H. Sasaki. Email:** sasaki@spectra.eng.hawaii.edu. **Tel:** 956-6103. **Office:** Holmes 436. Office Hours: MWF 1:30-2:20.
- **Days and Times**: MWF 12:30-1:20pm
- **Room**: H 389
- **Brief Course Description:** The course will cover algorithms that are used in network research and implementation. These include graph algorithms, transmission scheduling, traffic management, and control algorithms for certain switch/router architectures. There will be an emphasis on TCP/IP as a case study. See the list of topics below.
- **Prerequisite**: EE 367 (data structures) and knowledge of C programming, or consent of instructor. Knowledge of C programming is required of everyone. Knowledge of undergraduate probability (e.g., EE 342) will be helpful, but not necessary.
- **Textbooks:**
  - Stevens, TCP/IP Illustrated, Vol. 1, Addison-Wesley
  - Cormen, Leiserson, and Rivest, Introduction to Algorithms, MacGraw Hill.
- **Grading:** Grading will be based on a midterm exam [20%], a final exam [20%], homework + midterm projects [40%], and final project [20%].
- **List of topics (tenative, with a possibility of some minor modifications. A final list will be given before the semester begins.):**
  - **Overview of the Internet Architecture**
    - Overview of computer commuication, computer networks, and TCP/IP
    - Packet switching, store-and-forwarding, connection-oriented and connectionless routing, routing tables, and source routing.
  - **Graph Algorithms**
    - Algorithms and their performance.
    - Graphs, breadth-first-search, spanning trees, minimum weighted spanning trees.
    - Shortest path problem, Dijkstra and Bellman-Ford algorithms, and applications to networks.
    - Max-flow problem, Ford-Fulkerson labeling algorithm, max-flow min-cut theorem, applications, bipartite matching.
    - NP-Completeness, approximation algorithms, greedy algorithms.
    - Broadcasting and multicasting.
  - **TCP/IP**
    - IP architecture
    - Flow control algorithms: sliding window, max-min fairness, leaky-bucket, leaky-bucket traffic model, TCP flow control
    - Error control algorithms: CRC, stop-and-wait, go-back-N, selective repeat.
  - **Routers and Switches**
    - Router and switch architecture overview: bus, crossbars, input and output queueing
    - Nonblocking definitions, 3-stage clos, TSI algorithms
    - Regular interconnection topologies: hypercubes and other hypecubic topologies like the omega network, torus, grids, low-latency routing.
    - If time permits:
      - Link bandwidth/buffer scheduling, partitioning, management, active queue management (e.g., RED).
      - Earliest deadline first scheduling, virtual clock service, work conservation, statistical multiplexing, WFQ end-to-end performance