COURSE DESCRIPTION

Dept., Number	CSci 581/582	Course Title	Special Topics in Computer Science I/II: Data Compression, Spring 2007
Semester hours	3	Course Coordinators	H. Conrad Cunningham, Professor Rainey Little, Adjunct Professor (Professor Emeritus of CS at Mississippi State University)

Current Catalog Description

Special topics in computer science.

Textbook

The reading list for the study consisted of the following:

1. Huffman, A Method for the Construction of Minimum-Redundancy Codes, Proc. IRE, vol. 40, no. 9, p. 1098 (1952)
2. Blasbalg, H. and Van Blerkom, R., Message Compression, IRE Trans. Space Electronics and Telemetry, vol. 8, p. 228, (Sept. 1962)
3. Aho, A. V. and Corasick, M. J., Efficient String Matching: An Aid to Bibliographic Search, CACM, vol. 18, no. 6, p. 333 (1975)
4. Rubin, F., Experiments in Text File Compression, CACM, vol. 19, no. 11, p. 617 (1976)
5. Pechura, M., File Archival Techniques Using Data Compression, CACM, vol. 25, no. 9, p. 605 (1982)
6. Storer, J. A. and Szymanski, T. G., Data Compression via Textual Substitution, JACM, vol 29, no. 4, p. 928 (1982)
7. Langdon, G. G., An Introduction to Arithmetic Coding, IBM JRD, vol 28, no. 2, p. 135 (1984)
8. McIntyre, D. R. and Pechura, M., Data Compression Using Static Huffman Code-Decode Tables, CACM, vol. 28, no. 6, p. 612 (1985)
9. Cormack, G. V., Data Compression on a Database System, CACM, vol. 28, no. 12, p. 1336 (1985)
10. Bentley, J. L., Sleator, D. D., Tarjan, R. E., and Wei, V. K., A Locally Adaptive Data Compression Scheme, CACM, vol. 29, no. 4, p. 320 (1986)
11. Witten, W. H., Neal, R. M., and Cleary, J. G., Arithmetic Coding for Data Compression, CACM, vol. 30, no. 6, p. 520 (1987)

12. Hamaker, D. W., Tech Correspondence ("Compress and Compact Discussed Further" and Authors' Response), CACM, vol. 31, no. 9, p. 1139 (1988)
13. Fiala, E. R. and Greene, D. H., Data Compression with Finite Windows, CACM, vol. 32, no. 4, p. 490 (1989)
14. Bell, T., Witten, I. H., and Cleary, J. G., Modeling for Text Compression, ACM Comp. Surveys, vol. 21, no. 4, p. 557 (1989)
15. Sunday, D. M., A Very Fast Substring Search Algorithm, CACM, vol. 33, no. 8, p. 132 (1990)
16. Fullbright, R. and Stephens, L. M., A New Metric for the Information Content of Strings, Proc. 24th ACMSE Conference, p. 87 (1996)
17. Several papers from Data Compression Conference Proceedings, 1994 forward.

References

http://en.wikipedia.org/wiki/Data_compression

http://www.data-compression.com/index.shtml

http://www.ics.uci.edu/~dan/pubs/DataCompression.html

http://www.rdrop.com/~cary/html/data_compression.html

Course Outcomes

This is an elective course taught by an adjunct professor visiting for one semester. Upon successful completion of this course, the students should understand the basic concepts and techniques of data compression. Specific outcomes include:

1. understand the statistical basis for and performance metrics for lossless compression,
2. understand the conceptual basis for commonly used lossless compression techniques,
3. understand how to use and evaluate several readily available implementations of those techniques,
4. understand the structural basis for and performance metrics for commonly used lossy compression techniques,
5. understand the conceptual basis for commonly used lossy compression techniques.

Relationship between Course Outcomes and Program Outcomes

This is an elective course available to graduate and undergraduate computer science students to enrich their programs. Course outcomes 1, 2, 4, and 5 contribute to program outcomes (a) and (j). Course outcome 3 contributes to the evaluation aspect of program outcome (c).

Prerequisites by Topic

1. Basic data structures and algorithms (CSCI 112, 211)
2. Fundamental concepts of computer architecture (CSCI 223)

Major Topics Covered in the Course

Course topics include basic information theory, metrics, statistical source modeling, optimum lossless coding, adaptive statistical source modeling and coding, dictionary-based source modeling and coding, lossy compression, distortion and other quality measures, predictive coding, transform-based compression, discrete cosine transforms, JPEG and MPEG standards, time coding methods, buffer design and control, error and system considerations, and Hamming error codes.

Assessment Plan for the Course

This is an elective course taught by an adjunct professor visiting for one semester and offered only once with the specified content. The offering had 2 examinations and 3 homework assignments. Outcome 1 was assessed by exam 1 and assignments 1 and 2. Outcome 2 was assessed by exam 1 and assignments 1 and 3. Outcome 3 was assessed by exam 1 and assignments 1, 2, and 3. Outcome 4 was assessed by exam 2. Outcome 5 was assessed by exam 2 and assignment 3. There is no plan to repeat the topic in the foreseeable future. However, if an offering is scheduled, the course coordinator will seek to discuss the previous offering with the instructor to make changes to the course content, organization, and pedagogy as appropriate.

How Data in the Course are Used to Assess Program Outcomes (unless adequately covered already in the assessment discussion under Criterion 4)

No undergraduate computer science students were enrolled in this section during the semester the topic was offered.

Estimate Curriculum Category Content (Semester hours)

Area	Core	Advanced	Area	Core	Advanced
Algorithms		1.5	Software design		
Data structures		1.5	Concepts of programming languages		