CS 432 – Algorithms
Tom Horton (Fall 2003)

Course Objectives:

1. Comprehend **fundamental ideas in algorithm analysis**, including: time and space complexity; identifying and counting basic operations; order classes and asymptotic growth; lower bounds; optimal algorithms.
2. Apply these fundamental ideas to **analyze and evaluate important problems and algorithms** in computing, including search, sorting, graph problems, and optimization problems.
3. Apply appropriate **mathematical techniques in evaluation and analysis**, including limits, logarithms, exponents, summations, recurrence relations, lower-bounds proofs and other proofs.
4. Comprehend, apply and evaluate the use of **algorithm design techniques** such as divide and conquer, the greedy approach, dynamic programming, and exhaustive or brute-force solutions.
5. Comprehend the fundamentals ideas related to the **problem classes NP and NP-complete**, including their definitions, their theoretical implications, Cook's theorem, etc. Be exposed to the design of polynomial reductions used to prove membership in NP-complete.

See final page of this document for how these map to degree program outcomes for the BSCS degree.

Assessment of Student Learning:

Students did 6 homework sets, and took three exams. For the third exam, 35% of the point-values were on material covered on the earlier exams.

Because students in this large class were allowed to work on homework problems in pairs, I have assessed student performance only using scores on questions from all the exams. The scores for each exam had been recorded on a per-question basis. I inspected the exams and mapped each question to the course objectives. (One question seemed to apply to two objectives, and it was counted towards both.)

The table below provides some measurements of student performance by course objective. The first column shows the total number of exam points that were counted towards an objective. Objective 2 had by far the largest number of points; this is probably not a surprise given the nature of the course. The average of the sets of students' performance on each objective is listed. Because grade distributions are not usually a normal curve, the media and first- and third-quartiles are also listed.

Finally, we have been asked to give a value for the number of students who meet what we believe to be minimum performance for each objective. I found it difficult to decide how to decide what constitutes minimum performance for each objective. So three separate threshold values for “minimum performance” are given. The first reflects the different averages for each objective; it is calculated as the average minus one standard deviation. The second threshold is fixed at 65% of the total available points for that objective, and the third is fixed at 75% of the total. These results will be discussed in the sections below that discuss student performance by objective.

	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5
# points	57	207	44	38	39
Average	72.2%	84.9%	65.3%	75.5%	80.7%
Q3	80.3%	91.3%	74.4%	86.8%	92.3%
Median	73.7%	87.9%	65.9%	76.3%	84.6%
Q1	64.9%	80.4%	61.4%	68.4%	69.9%
Avg-stddev threshold	59.2%	75.3%	53.6%	60.7%	65.0%
% qual	85.9%	90.6%	87.5%	87.5%	82.8%
% >65%	73.4%	96.9%	62.5%	85.9%	82.8%
% >75%	48.4%	90.6%	26.6%	57.8%	67.2%

To be continued….

Mapping of Course Objectives to BSCS Outcomes:

In the columns, “D” means “in Depth”; “F” means “Familiarity”; “X” means “Exposure”.

CS Degree Outcomes: Students who graduate with a BSCS will…	**Course Obj. 1**	**Course Obj. 2**	**Course Obj. 3**	**Course Obj. 4**	**Course Obj. 5**
(1: Math & DLD) Have demonstrated comprehension in relevant areas of mathematics (including calculus, discrete math, and probability), and in the area of logic design.	D		D		
(2: Fundamentals) Have demonstrated comprehension in fundamental topics of computing, including the intellectual core of computing, software design and development, algorithms, computer organization and architecture, and software systems.	D	D	D	F	X
(3: Analysis & Evaluation) Have applied knowledge of areas of computing to analyze and evaluate algorithms, designs, implementations, systems, or other computing artifacts or work-products. Application of this knowledge includes the ability to design, conduct and evaluate the results of experiments and testing activity.		D	D	F	
(4: Build Solutions) Have applied knowledge of areas of computing to create solutions to challenging problems, including specifying, designing, implementing and validating solutions for new problems.				F	
(5: Research Awareness) Be aware of current research activity in computing through activities including reading papers, hearing research presentations, and successfully planning and completing an individual research project in computing or its application.					
(6: Broadening) Have demonstrated comprehension of subjects in the humanities, social sciences, and the natural sciences in order to broaden a student's education beyond engineering and computing.					
(7: Social and Professional) Comprehend important social, ethical, and professional considerations related to computing practice and research, and be able to apply this knowledge when analyzing new situations.					
(8: Post-graduation) Be prepared to enter graduate programs in computing or related fields, and be prepared to begin a professional career in computing.					
(9: Life-long Learning) Have demonstrated a self-directed ability to acquire new knowledge in computing, including the ability to learn about new ideas and advances, techniques, tools, and languages, and to use them effectively; and to be motivated to engage in life-long learning.					
(10: Teamwork) Have demonstrated the ability to work effectively in a development team.					
(11: Communication) Have demonstrated the ability to communicate effectively (orally and in writing) about technical issues.					
(12: Professional development practices) Comprehend important issues related to the development of computer-based systems in a professional context using a well-defined process to guide development.					