Class Rankings

A local company plans to offer a new scholarship program for top Towson students. They would like to rank our students, and give the scholarship to the top 10%. However, their plans have run into a snag- How to determine who are the top students? They fear that simply using a students GPA would simply benefit those students who take easy courses, while penalizing students who took more difficult courses. Your job is to create a method that can be used to rank the students at Towson.

Their idea is to compare each student to the other students in each class, and using this information to build up a ranking. For example, if a student obtains an A in a class in which all students obtain an A, then this student is only “average” in this class. On the other hand, if a student obtains the only A in a class, then that student is clearly “above average.” Combining information from several classes might allow students to be placed in deciles (top 10%, next 10%, etc.) across the university.

Problem
- Assuming that the grades given out are (A+, A, A-, B+, . . . ), can this idea be made to work?
- Assuming that the grades given out are only (A, B, C, . . . ), can the this idea be made to work?
- Can any other schemes produce a desired ranking?
- A concern is that the grade in a single class could change many students deciles. Is this possible?

Data Sets
Teams should design data sets to test and demonstrate their algorithms. Teams should characterize data sets that limit the effectiveness of their algorithms.

Rules:
1. The assignment is due at the beginning of class on November 24, 2003.
   a. Students will complete a short written paper describing their result and their justification
   b. Students will prepare a 10-minute presentation describing their result, to be given in class on November 24, 2003.
2. This project is to be completed by teams of 1–4 students, and all students shall make a reasonable contribution to the solution of the problem. Separate from the assignment, each student shall hand in a sheet that describes the work of the group. This will be used in grading; students in the same group may receive different grades.
3. You may not discuss this project with other members of class, or with anyone outside of class. You may (only) discuss the project with the instructor.
4. Aside from the restrictions in (3) above, the use of outside references is acceptable, and indeed encouraged. However, all outside references need to be properly acknowledged.
Adapted from a problem from the 1998 Mathematical Contest in Modeling