Report for Faculty Senate on Potential Impact of Institution of Minus Grades on Student Grade Point Averages

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At the November 2007 Faculty Senate Meeting during the discussion on the implementation of minus grades, I handed out a brief report that I composed to analyze the impact of the proposed new grading scheme on students grade point averages. This is posted at http://www.tiem.utk.edu/~gross/facsenate/minusgrades.pdf

The objective of this further report is to expand on the earlier one, now that the Faculty Senate has approved a new scheme including minus grades, and discuss the implications for student grade point averages. For this report, I used the complete set of grades assigned for the Math151 course (n=172 students) I taught in Fall 2007. I used the course grade percentages all students earned in this course and calculated:

(i) The grade point distribution according to the current scheme (e.g. the grade points students earned in Fall 2007) – here called "old"
(ii) The grade point distribution according to the new scheme including minus grades (e.g. the grade points students would have earned in Fall 2008) – here called "new"
(iii) The grade point distribution according to the new scheme including minus grades but with the addition of an A+ grade giving 4.3 grade points for grades in the range 97-100 (e.g. the grade points students would have earned in Fall 2008 if an A+ grade were included) – here called "newmod"
(iv) Finally, I calculated how many percentage points course grade would need to be added to every student's grade in order for the grade point distribution calculated in (ii) (e.g. using the "new" grade point scheme) to have the same mean value across the entire class as the grade point distribution calculated in (i) (e.g. using the "old" grade point scheme).

Current scheme for 2007-2008:			New scheme for 2008-2009:		
	UT grade pt				
90-100	A	4.0	93-100	A	4.0
87-89	B+	3.5	90-92	A-	3.7
80-86	B	3.0	87-89	B+	3.3
77-79	C+	2.5	83-86	B	3.0
70-76	C	2.0	80-82	B-	2.7
60-69	D	1.0	77-79	C+	2.3
0-59	F	0.0	73-76	C	2.0
			70-72	C-	1.7
			67-69	D+	1.3
			63-66	D	1.0
			60-62	D-	0.7
			0 -59	F	0.0

The percentage grades had mean 82.18, median 86.57 and standard deviation 14.09 for all these calculations (except of course for (iv) in which percentage points were added) and the distribution of these percentage grades is shown in Figure 1. Note that this course is taken by biology majors, many of whom are in pre-med, pre-vet and pre-dental programs, and thus the grade distribution may not be representative of the full range of students taking a 100-level math course.

The mean grade point assigned under the current scheme ("old") was 2.8721 and under the "new" scheme it would have been 2.7680, a difference of .1041 grade points. These are highly significantly different using a one-tailed t-test at the 0.0001 level (n=172). If an A+ grade had been implemented, the mean grade point would have been 2.7733, again highly significantly different from the "old" scheme using a one-tailed t-test at the 0.0001 level. The below figures show the grade point distributions assigned in these situations.

If a fixed number of percentage points were added to every students grade, it would require 1.15 percentage points to be added in order for there to be the same average grade point as the "old" scheme (2.8721) when using the "new" scheme. This would thus require a mean percentage grade of 83.33 rather than the mean of 82.18 that occurred.

Conclusions:

Based on this admittedly limited analysis of a single large 100-level class, a significant reduction in student grade points would occur simply due to the implementation of the new grading scheme. If the new grading scheme were applied by all faculty across all courses exactly as passed by the Senate (this is of course at each faculty member's discretion though) then the above analysis would predict a significant reduction in grade points to occur next year, all other factors being equal (e.g. exactly the same caliber of students, same distribution of grades within classes as that for this class, etc.). From this it would be possible to predict how many additional students would lose their lottery scholarship, by considering how many students were within .1041 grade points of the cutoff for loss of the scholarship. Notably, the addition of an A+ grade would make very little difference in the above analysis – there would still have been a very significant reduction in grade point average.

There are numerous caveats to the above analysis. The grade point distribution in Math151 may not at all be similar to that in many other courses. The reduction in grade point average arises in part from students who previously received an A now receiving a B+ with lower grade points assigned. It is possible that the grade point average could actually increase under the new scheme, but this would require a very large fraction of the class to have previously received a D and in the new scheme receiving a D+. Faculty are not obliged to follow the above conversion between percentage grades and grade points. Indeed faculty may decide to follow the old scheme and not assign minus grades at all. The point of carrying out this analysis is in part to alert faculty of the potential implications of the change in grading scheme for their classes.
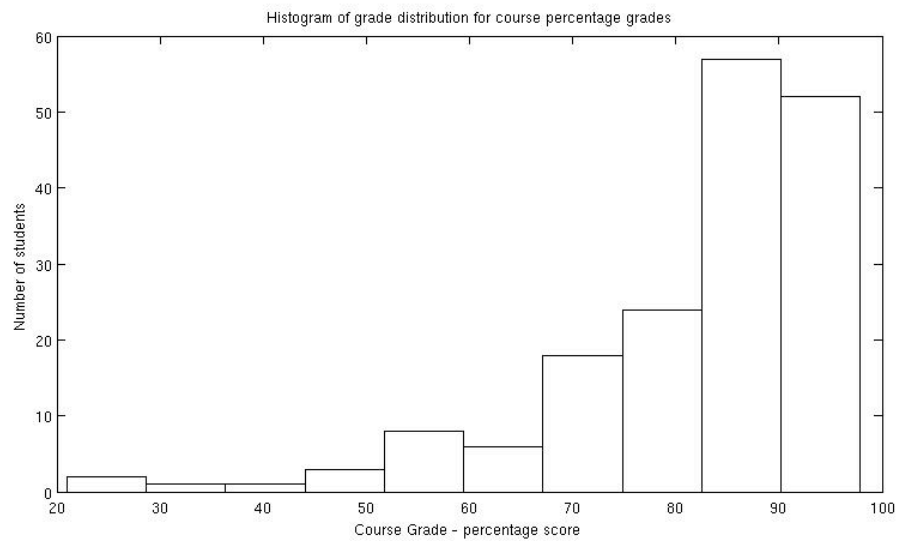
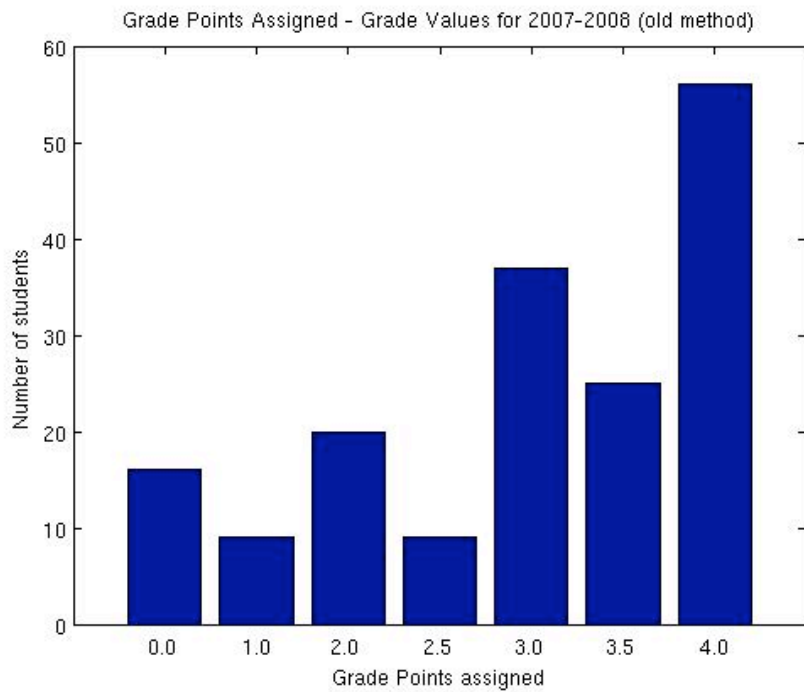Figure 1: Histogram of percentage grades for Math151 (n=172 students) for Fall 2007

Figure 2: Bar graph of grade points actually assigned for Math151 for Fall 2007
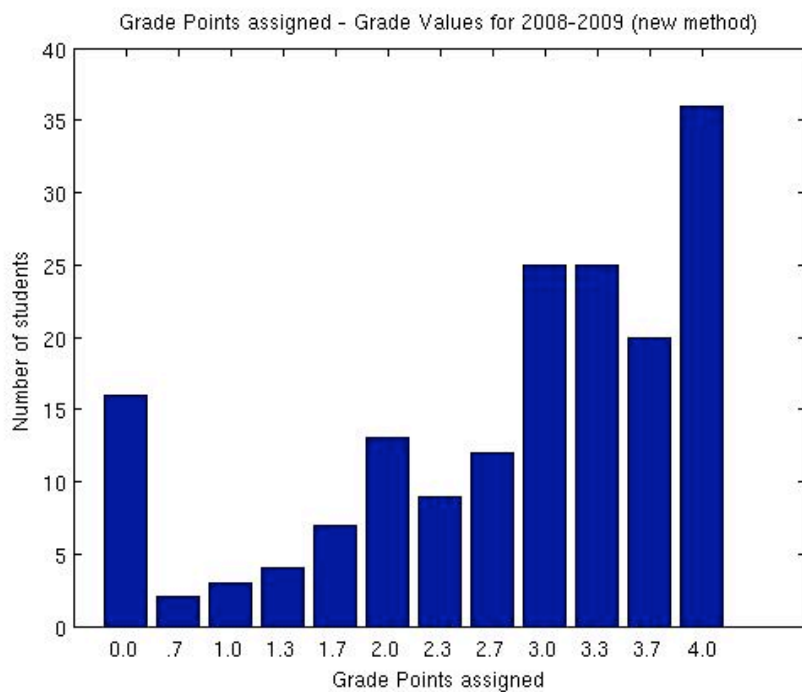
Figure 3: Bar graph of grade points which would be assigned for Math151 if the grade point assignments to be used for Fall 2008 had been implemented
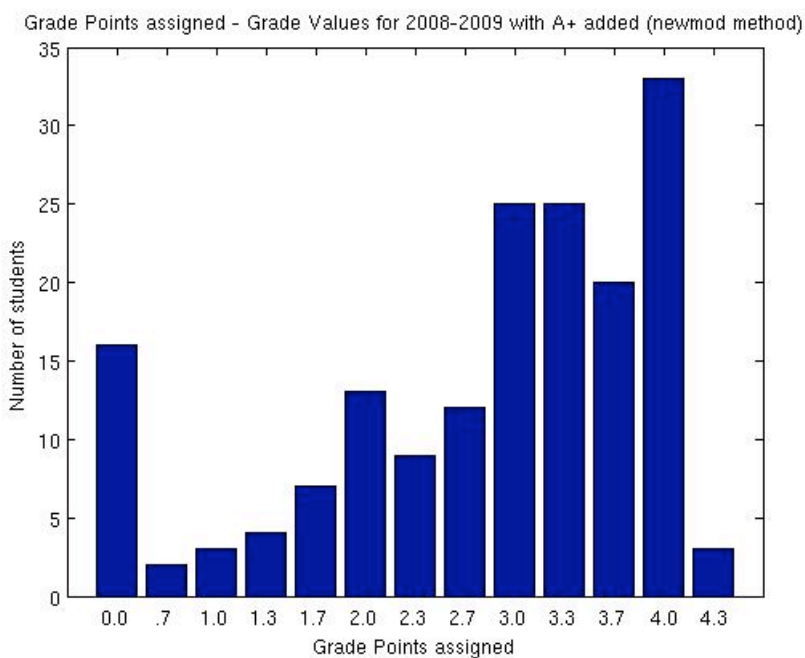

Figure 4: Bar graph of grade points which would be assigned for Math151 if an A+ grade were added to the new minus grade scheme.