Grading in Cotton College State University

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The objectives of introducing a grading system have been discussed extensively; and implementation of such a system has been a part of the reforms of higher education in our country. Since a grading system has been already adopted for implementation in Cotton College State University, it is important to follow procedures for grading that are fair to all, defendable and would not require frequent amendments.

Formally, grading systems can be classified into two broad categories:
(a) Norm referenced grading
(b) Criterion referenced grading

In a Norm referenced grading (also called as relative grading), a student's grade is determined by her/his relative performance with respect to the other students' in a class. Thus the highest grades in a class are awarded to the best student(s).

In a Criterion referenced grading, the grades are determined relative to fixed standards of reference. So in principle, all students can get any grade or, in principle, even the highest grade.

Both systems have their benefits and limitations. Usually most universities adopt a judicious combination of these two approaches, as has been done by Cotton College State University. While attempting to identify bright students across disciplines, it also attempts to nurture the intellectual growth of all students. A more detailed discussion of these two approaches can be found in http://cfe.unc.edu/pdfs/FYC10.pdf

Since we are used to giving marks, the best strategy to convert marks into letter grades, is to have a (weighted) convolution of both the approaches. In larger classes (≥ 100), the standard deviation method of grading may be most appropriate.

Standard deviation method (SDM)

Let us illustrate it in the following way, although with only 4 numbers, for the ease of demonstration.

1. Suppose 4 students get marks such as 34, 42, 48 and 28 (out of 50) in a particular subject that you may be teaching.

2. The average mark is (34+42+48+28)/4 = 38.

3. Subtract each mark from this average mark and square the corresponding result (*i.e.* take square of the mean difference)

$(34\text{-}38)^2 = 16$
$(42\text{-}38)^2 = 16$
$(48\text{-}38)^2 = 100$
$(28\text{-}38)^2 = 100$

4. Adding 232 = Numerator (N)
5. Denominator = (No. of students - 1) = 4 - 1 = 3 = (D)
6. N/D = 77.3

$\sqrt{(\mathrm{N/D})} = 8.79$ = 8.8 = Standard Deviation (SD)

- At least 1.3 times SD above the mean — Ex
- Between 1 (inclusive) and 1.3 (exclusive) SD above the mean — A
- Between 0.7 (inclusive) and 1 (exclusive) SD above the mean — A-
- Between 0.0 (inclusive) and 0.7 (exclusive) SD above the mean — B+

- Between 0.7 (inclusive) and 0.0 (exclusive) SD below the mean B
- Between 1 (inclusive) and 0.7 (exclusive) SD below the mean B-
- Between 1.3 (inclusive) and 1.0 (exclusive) SD below the mean C
- Below 1.3 times SD below the mean F

SD = 8.8, Mean = 38, Marks = M

Letter Grade	Range of the Marks
Ex	> 49.44
A	49.44 ≥ M > 46.80
A-	46.80 ≥ M > 44.16
B+	44.16 ≥ M > 38.00
B	38.00 ≥ M > 31.84
B-	31.84 ≥ M > 29.20
C	29.20 ≥ M > 26.56
F	M ≤ 26.56

According to the above table, the grading for the 4 numbers can be done as follows:

34 ≡ B
42 ≡ B+
48 ≡ A
28 ≡ C

To remind ourselves, the standard deviation method is best suited for large class sizes. In Masters and PhD courses, where the number of students to be evaluated may not be as large and a skewed distribution of scores as in Fig. 1 may be obtained. A

standard deviation method such as the one described above will result in an unfair grading that is illustrated in Fig. 2. The good students are clearly disadvantaged with no one getting an ‘Ex’ or an ‘A’ grade. A more efficient median, absolute deviation method (MAD) may be more helpful in converting the marks obtained to letter grades.

Figure 1. Positively Skewed Distribution of Hypothetical Scores

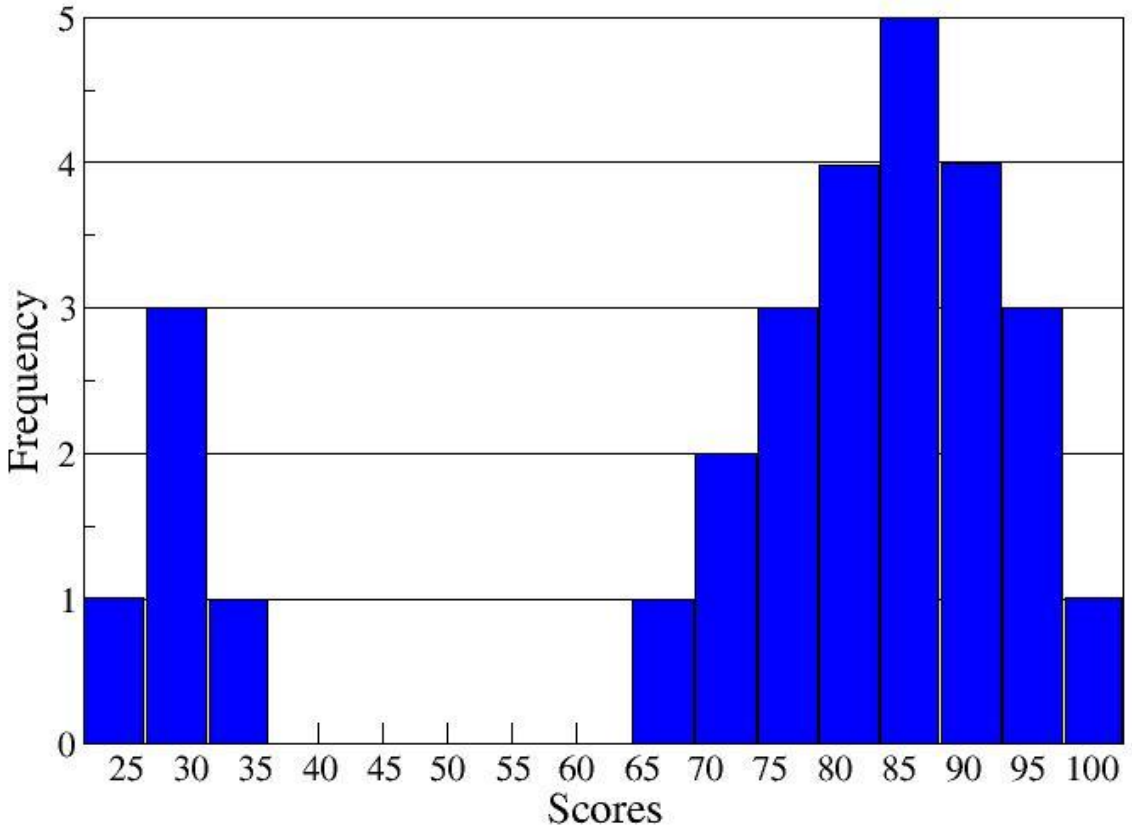
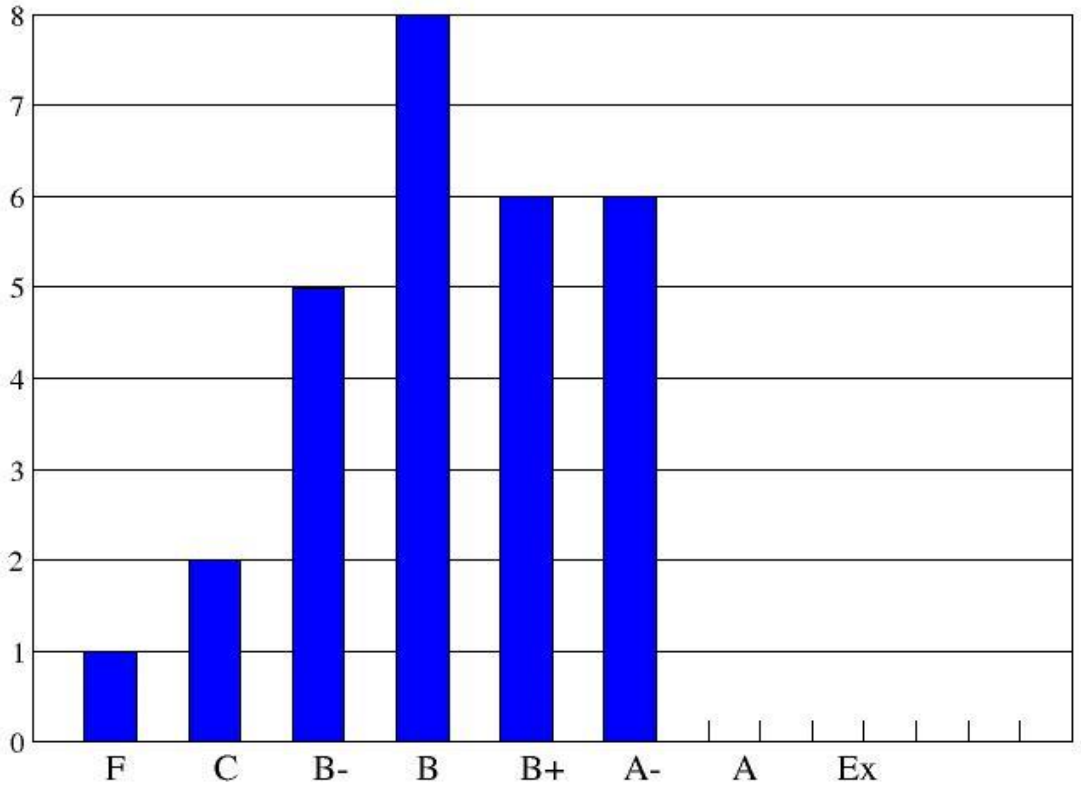


Figure 2. Grade Distribution Using Standard Deviation to Obtain Standard Scores



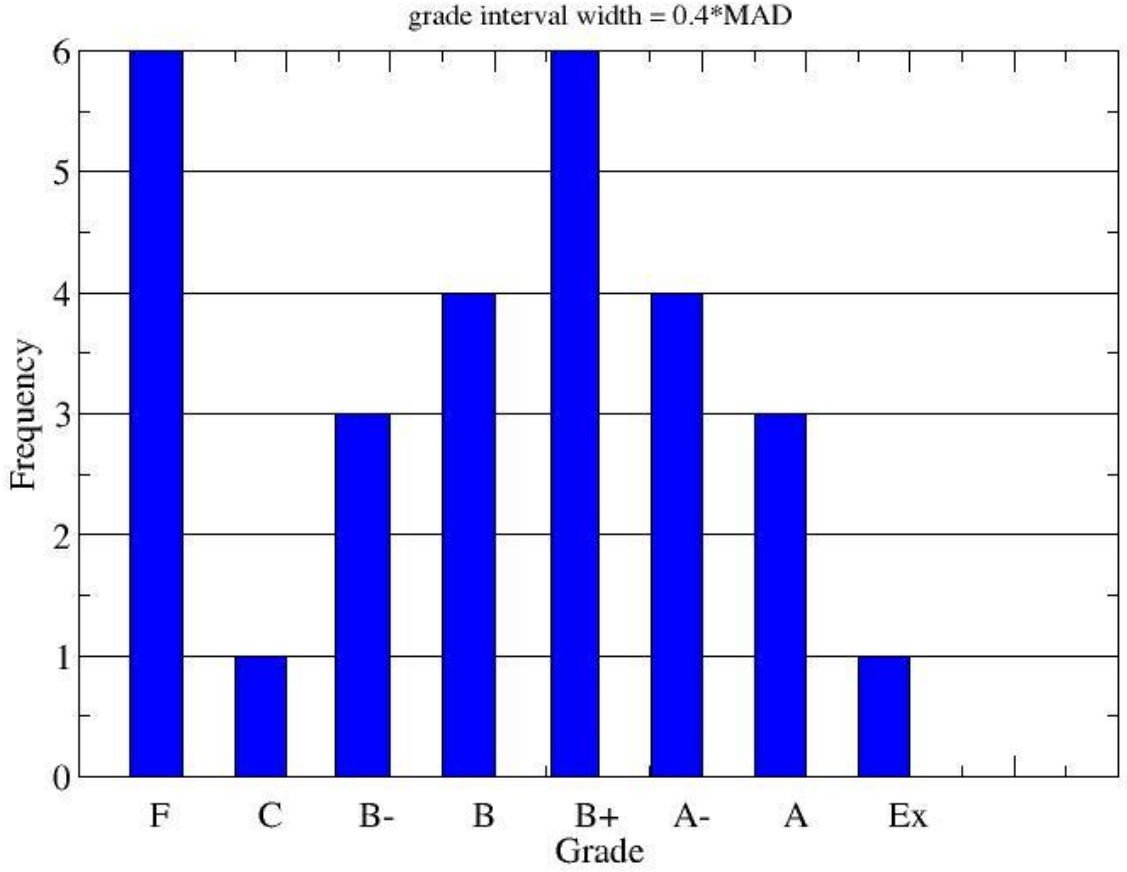
Median Absolute Deviation (MAD)

The Median Absolute Deviation (MAD) is a robust statistic, more resilient to outliers.

1. Consider a set of marks presented in ascending order: {1, 3, 6, 9, 15, 20, 22}.
2. The median can be found which is 9 here.
3. Absolute deviation from the median yields {8, 6, 3, 0, 6, 11, 13}.
4. Arrange this in ascending order once again {0, 3, 6, 6, 8, 11, 13}.
5. The Median Absolute Deviation (MAD) of this set is 6.
   For comparison, the Standard Deviation for this set of numbers is 8.3.
6. Grade interval widths may be set by a fraction of MAD.

An acceptable grading is obtained choosing a grading interval of 0.4×MAD (see Fig. below) where awarding an ‘Ex’ grade to one student has been possible, although leaving us with the possibility of a significant number of ‘F’ grades.

Figure 4. Grade Distribution Using Median Absolute Deviation (MAD) to obtain Standard Scores



Finally, every evaluation procedure will require slightly different variants of either of the methods with the prime requirement of them being defensible in terms of consistency and rationale.

Let us consider another possibility for the marks illustrated here.

The maximum number of students are clustered between 85 and 90 marks. This suggests that it should have been a reasonably easy paper, unless the class was an exceptional one, which the teacher would know.

Then the huge gap of at least 30 marks between the lower lot and the bottom end of the upper lot justifies that those at the lower end be Failed. This would lead to five failures.

The ones with the maximum number could be B+; and accordingly the next higher ones could be A-, A and one Ex (if that student is deemed to be excellent; otherwise s/he could be included in A). In this case there would be 5 students in B+ category, 4 in A- and 3/4 in A depending on whether one student is put in the Ex category.

On the lower side of B+, the two immediately lower bins could be B and B- with 4 and 3 students respectively, and the remaining 3 put in the C category.

This is essentially similar to what was obtained with the MAD method; except that the number of failures has been kept at five and the number in the C grade has gone up from one to three.

Overall this is more satisfying. It does not increase the number of failures beyond those at the extreme lower end.

At the end of the day, we have to examine the distribution of marks carefully, ensure that these are defensible, and also reflect the ability and performance of the students.

Reference

Grading Systems (http://cfe.unc.edu/pdfs/FYC10.pdf)