Grading policy for Final Exam

I have taken a bit of heat from some students for my grading policy on the final exam, so I thought it might be helpful to write down my thoughts. I understand that most people who disagree with me have no interest in reading this document because they know that they are right and I am wrong. This document is more for those of you who (1) agree with me that *some penalty* for incorrect answers should be applied in order *to try account for those correct answers that were obtained by guessing*, and (2) are unsure what the penalty should be, and are interested in how I am thinking about it. If you have another opinion and can convince me that I'm wrong, I'm open to debate. (This is a university, after all.)

I argued in class that it is problematic in a multiple choice exam to take a student's grade at face value as the number of questions answered correctly, since students can guess correctly. There are two very real problems here. One is a student who has cheated on assignments during the semester and does well on them but knows next to nothing about the course. Such a student could randomly fill in responses on the multiple choice final exam, without even looking at the question sheet, and could get enough points to pass the course. A less extreme example – but one which I believe is more common and concerns me just as much – is a student who did not cheat on the assignments but does poorly with borderline passing grades overall on the assignments, and who also is poorly prepared for the final exam. Again,, through guessing, such a student get enough questions correct to squeeze by with a pass in the course. By accounting for correct answers from guessing, I can get a more accurate estimate of the student's ability and preparedness, and I can better ensure that those who pass are those who deserve it.

Formula used to calculate your final exam grade

There are 50 questions, all multiple choice. Each question has four choices. The number of questions that you answer correctly is your *raw grade*. Your actual grade will be computed by applying a $\frac{1}{5}$ point penalty for each incorrect or blank answer. The number of incorrect or blank answers is $50 - rawgrade$, and so we have

$$\begin{aligned} grade &= rawgrade - \frac{1}{5}(50 - rawgrade) \\ &= \frac{6}{5} * rawgrade - 10. \end{aligned}$$

I will discuss later why I have chosen not to distinguish between incorrect and blank answers.

Here are a few examples. If your raw grade is 50/50, then your grade will also be 50/50. If your raw grade is 40/50, then your grade will be 38/50. If your raw grade is 20/50, then your grade will be 14/50. If your raw grade is 9/50, then your grade will be 0.8/50 which rounds up to 1/50. (I will not give you a grade lower than 0.) If you were to guess on every question, you would get a raw grade of $\frac{50}{4} = 12.5$ *on average.*

Note that students who have lower raw grades (number of correct answers) tend to be those who can answer fewer questions correctly. Such students tend to be penalized more.

"Down curving"

Some students disapprove of my grading scheme, and have summarized it simply as "down curving" and hence bad. I want to address this criticism by distinguishing two different types of "down curving". [1]

One type of down curving is *to achieve a target distribution.* (This is *not* what I am doing). For example, a professor might decide at the start of the semester and announce to the students that the class average will be in some prespecified range (say 65-75). At the end of the course, the professor may need to lower or raise grades to achieve that target. The change in grades would depend on how students did overall in the exam, and this policy can lead to curving in either direction. To my knowledge, CS profs at McGill generally don't "down curve" in this way, although I've heard of profs in other departments (Management and Engineering) that do. It is much more common for professors to raise grades to achieve a target – many CS profs do that – and indeed this is what students think of by default when they use the word "curving".

The second type of "down curving" is what I am doing in the final exam, namely I'm trying to account for the fact that those students who know the answers to fewer questions will have a greater number of correct answers from guessing. *I am trying to account for this bias, which I believe unfairly benefits those who do poorly.*

Do not confuse the two types of "down curving". In particular, if the grades on my final exam are too low – for example, because some questions were too difficult or were problematic for other reasons (as happened in some Quiz questions) – then I will "upcurve" the grades to account for these problems. *But how I do so will depend on what the issues were, and generally will not cancel the grading formula that I described on page 1.*

Why not offer no penalty for a blank answer?

There *is* one problem with the grading scheme that I'm using: the grade still does depend on your luck for those times when you do guess. This problem is exacerbated for students who do poorly since there will guess on more questions and some will get very lucky or unlucky.

One way to reduce this randomness effect would be to not apply the $\frac{1}{5}$ penalty (or whatever penalty value is used) if the student chooses not to answer a question. With this method, a student could choose to leave a question blank and just get the 0/1 for that question rather than risking $-\frac{1}{5}$ for an unlucky guess (but also giving up the chance for 1/1 for a lucky guess).

It seems like a sensible option to offer, especially for students who are conservative and don't want to risk being unlucky. However, if you understand the basics of probability and you can accept a bit of risk, then I don't think you would leave questions blank. Rather, you would still be wise to guess, even if you have no idea how to answer. Why? Because the method I am using (page 1) *only partly compensates for lucky guessing.*

[1] I personally don't think either of these two types of down curving are bad, as long as the professor is transparent about it and students are treated equally.

Here is the calculation to show that guessing still benefits you. You have a probability of $\frac{3}{4}$ of getting an incorrect answer with penalty $\frac{1}{5}$ and you have a probability of $\frac{1}{4}$ of getting a correct answer for 1 point. So the *expected value* (See MATH 323) of the number of points on each question that you guess is

$$\frac{1}{4} * (1 \ point) + \frac{3}{4} * (-\frac{1}{5} \ point) = \frac{1}{10} \ point$$

where the "expected value" means long term average. So, yes, you still could get unlucky and lose points overall for your guesses, but on average you would be better off guessing.

The reason I don't give the blank answer option is that I don't think it is a good option and I don't want to encourage it. Moreover, I think that in many questions in which you are sure, you should at least have some idea of what the right answer is. So your expected gain should be even greater than $\frac{1}{10}$.

Let me know if you have any feedback on the ideas here.