An MS Excel Based Utility for Assigning Letter Grades

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Abstract- The main function and the duty of the teacher is to educate the next generation and prepare them for the challenges of the future. The task of teaching does not end by delivering the lectures, descriptions, demonstrations, or additional material that are designed to help the student follow the course. An integral part of teaching is assessment where the teacher is given the responsibility of assuring that the students have achieved the intended knowledge and skill targets prescribed in the course or the training program. Most teachers also find this as the most difficult component in their teaching career.

This software utility was developed to offer a convenient platform for the teacher to assign grades once the final marks have been computed for a certain course. It was developed using MS Excel 2007 environment which has improved flexibility in its functionality compared to its earlier versions. The teacher is given the space to transfer the final marks to the program and manipulate the grades division points in following any grade assignment protocol adopted or recommended by the educational institution. During the grade assignment procedures the program itself will provide graphical outputs of marks distribution plots in real time, to assist the teacher in his / her task. The final marks sheets can also be produced and printed with ease once the assignment is completed.

The program was given to the academic staff of the Faculty of Agriculture for their use, and a fully on-line survey was conducted where they were asked to provide their feedback on a 5 point Likert's scale. The summary of the responses were very positive in accepting the program as an efficient means of performing the grades assignment task. The design and implementation of different functions of the program were highly appreciated and accepted by the users.

Index Terms- Assessment, Letter Grades, Grade Assigning, MS Excel

I. INTRODUCTION

Teaching being the main job function, all teachers are tied with the responsibility of imparting knowledge, skills, and attitudes, and moreover, assessing how much of it is retained by the student. Even though testing and assessment has its own drawbacks and that alone is incapable of assuring the final performance ability of a graduate, it has inevitably become an integral part of teaching.

Nevertheless, assessment also has its use in ranking students within their population indicating their relative performance abilities, making it possible for the teacher as well as the society to identify those who perform better than others. Therefore, every teacher whether university or otherwise has not only the responsibility of teaching as well as identifying and highlighting the relative talents of the student population.

In order for the teacher to do this it is necessary that marks be compiled, and grades be assigned so that a numeric indicator for the rank each student has earned could be computed. In modern days, the educational institutions are adopting uniform grading and ranking procedures in order to make the final figures compatible and comparable across other academic institutes. This process comprises two main steps: (1) a weighted average is computed using the numerical scores obtained for different course components over the course of a grading period; and (2) assign a letter grade based on the final term average [1]. This inevitably requires the teachers to adopt certain mathematical and statistical operations on a routine basis, some of which may not be very familiar to the individual teachers depending on their area of expertise.

This effort was to investigate the possibility of using common application software to help the teachers to produce grades to students using what is known as the distribution based grading system, a procedure not as common and straightforward as the direct assignment of grades. The ability of using the MS Excel package to perform the statistical operations required was examined, and a ready to use flexible and automatic letter grade assigning software system was developed to facilitate any teacher to use his / her final marks lists to generate grades and assign them based on the marks distribution within the group / class. The inherent capability of storing, analyzing and presenting data within the MS Excel spreadsheet is advantageous since it prevents the redundant data entry. This paper describes the features of the software developed, the statistical background, and the excel routines incorporated. The system developed was tested by distributing it among the staff of the Faculty of Agriculture in the 2ndsemester 2012. Their feedback on the operation was also considered in producing the final refined version described herein. A comparative analysis was performed

through a survey to assess the effectiveness of the new software compared to individually performing the prescribed computation and analyses to generate the student's grades.

II.   AN OVERVIEW OF DIFFERENT GRADING SYSTEMS

   Grading systems used in conducting examinations in academic work are mainly two fold while there may be similarities and different types of blends of the same that can be adopted by some institutions and personnel. These are namely; Criterion-referenced systems and Norm-referenced system.

1.   *Criterion-referenced systems*:
   These tests are designed to measure the level of performance of individual students against a set of pre-determined performance levels. This provides a direct measure of their achievements in mastering the knowledge and skills during the course, and those who have achieved a predetermined minimum can be allowed to proceed or considered to have 'passed' the course.   Assigning intermediate grades is also done in the same manner by comparing the individual level of achievement against pre-set standards for each letter grade (e.g., 95-100 = A, 86-94 = B). However, a peculiar characteristic of this grading system is that since the standard in this grading system is absolute, it is possible that all students could get A grades or all students could get D grades [2].

   One of the disadvantages of criterion-referenced grading systems is identified as its deficiency in handling the variability among different batches of students, and the variability among different tests and teachers. If the course and the tests are handled by very experienced teachers, and the student cohort appears to be of the same standard, criterion referenced systems are considered to perform better, and can be considered to produce a fair and repeatable grading outcome. However, teachers find it difficult to design and conduct tests that would produce final marks that fall in the same range that could be matched with a fixed set of criteria for the purpose of assigning grades as described above.

2.   *Norm-referenced systems*:
   One of the ways of addressing the above problem is to adopt norm-referenced grading systems in processing final marks.   In norm-referenced systems, students are evaluated in relationship to one another (e.g., the top 10% of students receive an A, the next 30% a B). This grading system rests on the assumption that the level of student performance will not vary much from class to class. In this system, the instructor usually determines the percentage of students assigned each grade, although it may be determined (or at least influenced) by departmental policy [2].

   Advantages of norm-referenced systems are their convenience especially in differentiating among students and limiting the numbers reaching different standards. They are however, considered to be more appropriate in large courses which do not encourage cooperation among students.

   One objection to using norm-referenced systems is that an individual's grade is influenced by the performance of others, and inherently, this type of grading will not yield all As or all Ds.

   A second objection to norm-referenced grading is that it promotes competition rather than cooperation. When students are pitted against each other for the few As to be given out, they're less likely to be helpful to each other. Therefore, it is a method that is not recommended for small classes, generally less than 40.

   Pogge [3] describes the method adopted for assigning grades, or curving, where he highlights the necessity to investigate intricate details of the distribution and compare with past performance of the same class in order to make it a fair judgment. Godolphin [4] highlights the necessity to adopt criterion referenced systems in order to assess the performance of the individual rather than influencing it with the performance of the others.

   As it can be seen norm-referenced grading system has its own inherent disadvantages. However, it is more likely to be a fair way of assigning grades where the student cohort and the exam standard are bound to vary. Instead of adhering to fixed percentiles in allocating student numbers to different grades, a modification adopted by the Faculty of Agriculture in using the norm-referenced system is to examine the distribution of marks, and decide on the cutoff points for each grade by identifying groups that are markedly separated in the marks distribution.

   It is clear that independent of the grade assignment system adopted by the faculty or the teacher, it undoubtedly requires intricate examination of the marks distribution and adjustment of grade break points in order to make it fair to the best possible level. This operation undoubtedly requires a plot similar to the 'Dot Plot' or the 'Histogram' be generated, and the teacher examining it in

intricate detail to identify 'groups' within the distribution. In addition, there must be a facility to assign grades to each group identified with flexibility in changing the group boundaries based on the apparent break points in the histogram.

Reliability

Once a students' grade assigning method is selected it should be characterized by key functional attributes: (1) face and content validity, and (2) reliability, and realistic expectations. The first one denotes that a grading procedure must have clear and suitable matrices to measure the degree of relevance of the evaluation process and the method of evaluation to the course objectives, and such process must be transparent to students as well. An evaluation method for assigning students' grades is reliable if it would invariably produce, with little variations, the same results for the same students as denoted by the second point [5]. Kelly [6] also defines a test to be reliable if it allows for stable estimates of student ability. A reliable test is expected to provide similar results for students who have similar ability and knowledge levels.

The need

Ever since the Faculty of Agriculture adopted the above grade assigning convention, the staff members were required to produce the Dot Plot after finalizing their marks, and identify justifiable break points in the plot, and then assign grades to each sub group thus identified starting from the highest grade to the lowest. This however, posed additional problems to the teachers by having to go through fairly complicated analyses, some of which are not directly supported by common data analysis packages such as MS Excel (neither the Dot Plot, nor the Histogram are available in MS Excel through a single icon or as a menu selectable option).

Besides, the grade allocations made by the staff at times were questionable during the results board meetings and the relevant teachers were requested to re consider their grade allocation to make it appear more balanced. This undoubtedly required the academic staff to be able to perform the statistical analyses to generate the Dot Plot (or the Histogram), and be able to change the cutoff points for each grade based on the plot. This may be less strenuous for a small group whereas, it could be a straitened job if the student number is large and a considerable amount of time will be wasted on prohibitive-drudgery of overwhelming numeric processing.

Therefore, the development and adapting the uses of an automated grade assigning system would certainly be a relief for the educators. It is believed that if the mechanistic aspects of the evaluative process are included within an automated and user-friendly procedure, educators' efforts would then be more meaningfully focused on ensuring more reliable and fair evaluation of students' mastery of the designated learning outcomes in a given course [5]. The software utility presented herein was developed to address this need, and was made available to the academic staff. The responses from the academic staff after using the utility software were compiled to identify possible bugs and places for improvement. The final revision and its features together with the latest web based survey results are presented herein.

III.   THE SOFTWARE DEVELOPMENT

Based on the background described above and the problems faced by the teachers concerned, it was decided to embark on this development with the following objectives.

Objectives

The objective of this effort was to develop an easy to use software utility for the purpose of assisting the teachers in the process of assigning letter grades based on the marks distribution in the class. The software was to be developed within the MS Excel environment as it is one of the most common data analyses packages used by the staff for handling student's marks and grades. Besides, the MS Excel 2007 contained advanced features which aptly supported the intended task.

Development and testing process

The worksheet was divided into several regions for accepting user input, which consists of only the index numbers of students and final marks. Provision was made to handle different types of index number formats, and also entries in the marks column which may include 0, Ab or Absent, I, and other similar indicators. Automatic search routines were also added to identify whether any invalid number in entered by mistake into the marks column (numbers less than 0 or greater than 100 generated error signals to draw the attention of the user). The software is also capable of identifying missing values and informs the user about them (if any) in the marks list entered as the input.

Prime attention was paid to provide a work platform which is easy to use while ensuring that no errors occur due to lack of experience in using the program. In order to assure that the worksheet performs the intended analyses and produces the expected results, all areas that did not require direct user manipulation were write-protected. This was an essential step in ensuring that the results are error free.

In addition, the user was provided with slider bars (scroll bars used in form control) to adjust the break points of grades, in parallel with a visual display of the marks distribution making it very convenient for the person to adjust them (Figure 1). The resulting grade distribution plot was also readily generated and made available for inspection by the user (Figure 2).
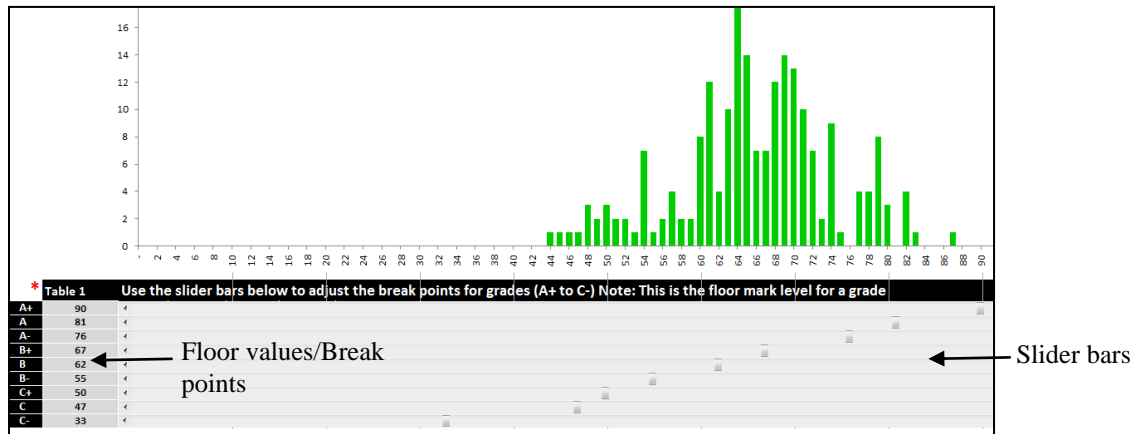

Figure 1: The histogram of final marks distribution

The letter grade floor value demarcation table and slider bars are also visible below the histogram.
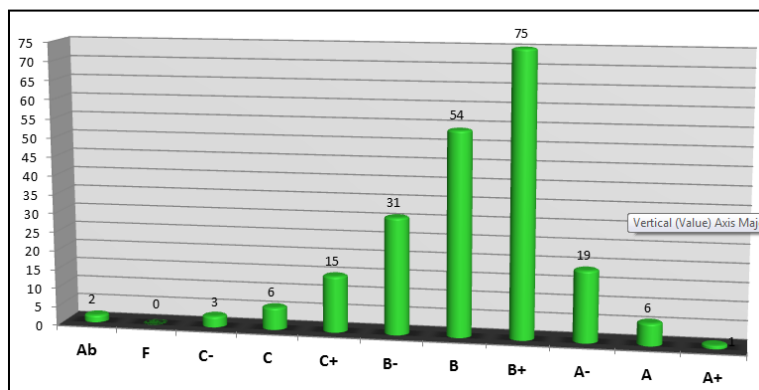

Figure 2: The grade distribution plot

Once the break points for each grade were determined, the user was given the provision to remove any blank lines that may remain in the output area using the Filter option available in MS Excel (Figure 3), and print the grade tables directly.

Error handling was mainly done by preventing the user from entering data into unauthorized tables, preventing accidental additions/deletions in the program area and also by generating error messages upon detection of an entry that lies outside of the standard range of magnitudes. The overall structure of the grading program is illustrated below in the Figure 4.
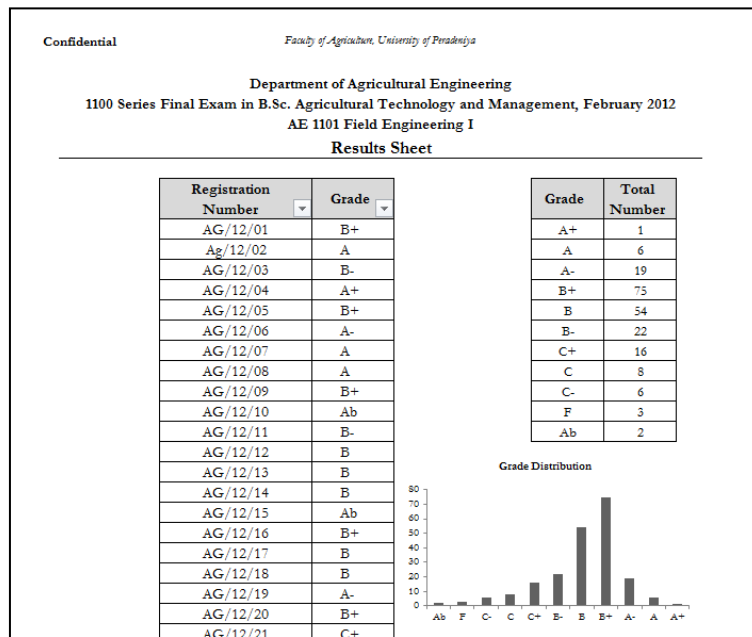
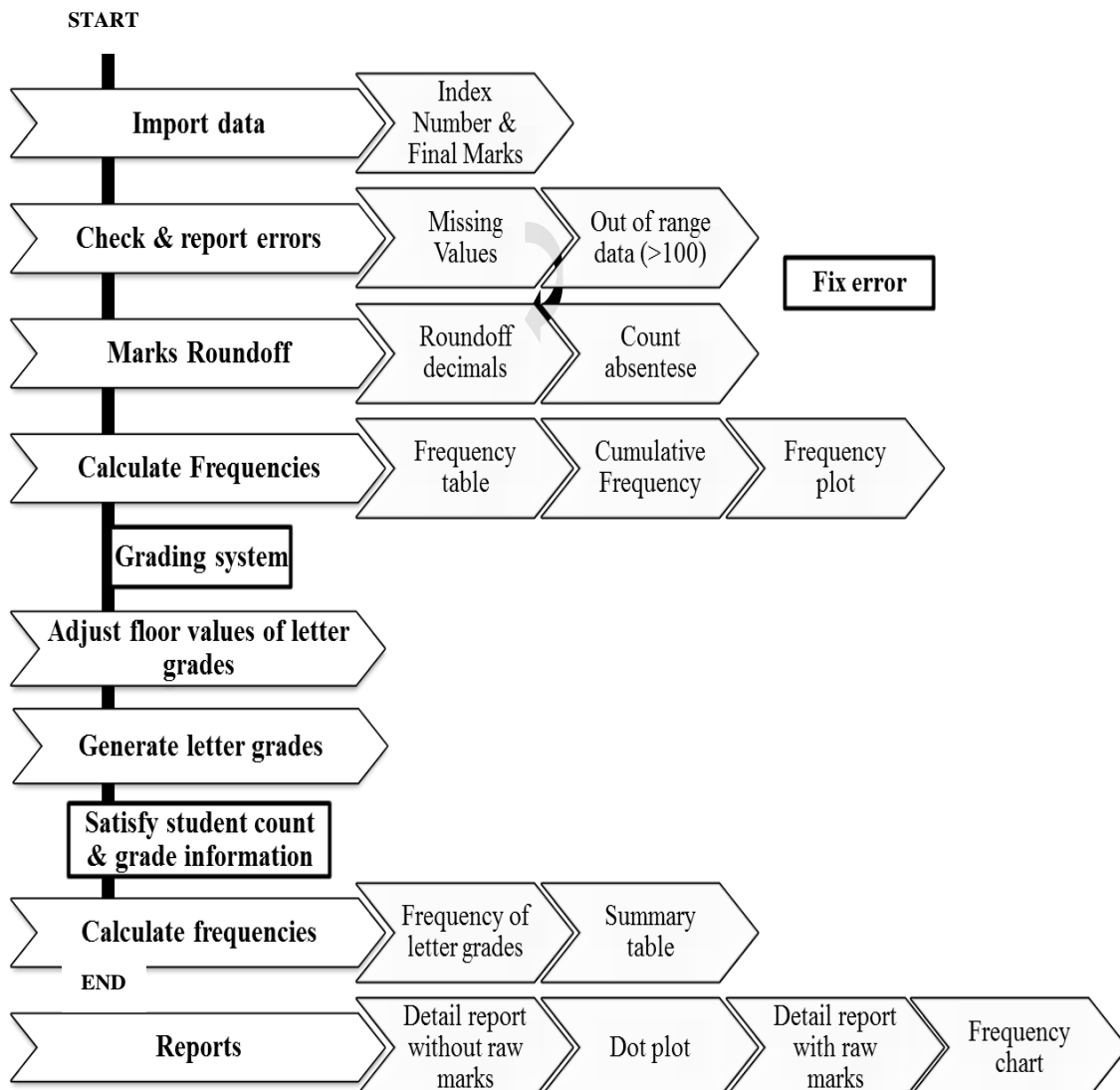**Figure 3: A sample report generated using the software**

Figure 4: Schematic diagram of the program structure

User survey and feedback:

A fully on-line user survey was conducted after refining the program through several trials (the present version is named: Easy Letter Grade Assigner Utility – Ver. 1.5). The users were presented with 9 questions which required them to provide their feedback on a 5 point Likert's scale, and one descriptive type question to receive their comments. The survey was organized on a free web based survey site:www.surveymonkey.com(*http://www.surveymonkey.com/s/T8WHPYF*).

The survey format:

The users were presented with the rating scale as shown below (Figure 5). The other questions which are given subsequently were presented in the same format with individual rating scales.

1. The organization of the program is clear, logical and effective, making it easy for the intended audience to understand.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Your response:	○	○	○	○	○

Figure 5: An example of the Likert's scale used in the online survey

2. The language in the program and in the user guide is clear to the intended audience.
3. The program and instructions are designed so that an individual can operate it independently.
4. The user is provided ample opportunity to control the decision making with regard to grade assignment.
5. Invalid commands and entries are handled in a safe and constructive manner.
6. The program is attractive and interesting. It motivates users to continue using the program.
7. The program achieves its purpose and reliable in normal use (no bugs / ambiguities were encountered).
8. Using the program to assign grades is much easier than doing the statistical analyses by myself.

9. Please provide your sincere comments on the Major strengths, Major weaknesses, and / or any other issue with regard to using the program.

Strengths: _____

Weaknesses: _____

Other comments: _____

Figure 6: The open ended questions to receive comments

Summary responses:

A summary of the responses received at the web site is shown below in Table 1. It is clear that the participants of the survey, all members of the permanent academic staff of the Faculty of Agriculture, with sufficient experience in marking examinations and assigning grades, highly preferred the use of the new software utility.

Table 1: Summery of responses received

Question No:	Percentage Responses (%)		
	Positive	Neutral	Negative
1	100	0	0
2	94	6	0
3	78	17	0
4	94	6	0
5	61	39	0
6	83	11	6
7	78	22	0
8	94	6	0

IV. RESULTS AND DISCUSSION

Internal Consistency of the Likert's scale responses was observed to be very high (Cronbach's Alpha = 0.947). Hence, the responses received by the questionnaire could be considered as highly reliable. As it is apparent from Figure 7 below, the users were very confident (100%) that the developed program provided a clear and easy to use work environment and was capable of making their task of analyzing marks easy and trouble free (94%).
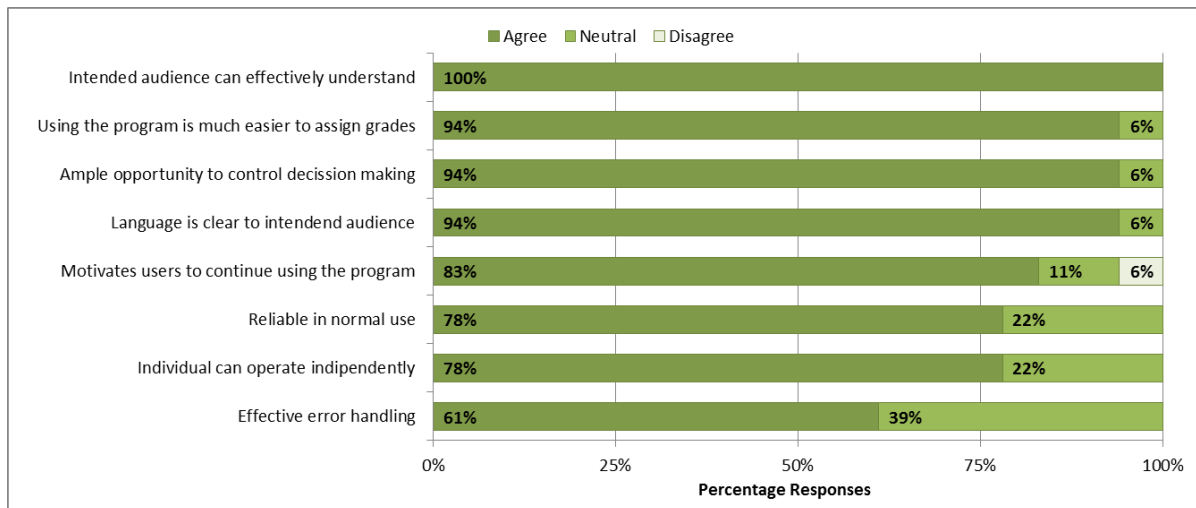

Figure 7: Perception of the academics about the software

Further, the independent work environment and flexibility offered by the program also received high acceptance scores (78%), while the way it provided the opportunity and the freedom for the user to decide on grade assignment was also rated high (94%). The participants rated the motivational aspect and the level of achievement of the main objective very high (83%, 78% respectively), and the convenience of performing the task using the developed program was undoubtedlyhigh (94%).All these responses were significant at 95% confidence interval.

The only negative comment was received for the question 6, which was mainly based on personal assessment of the motivational aspect offered by the program.

This program was used in assigning grades in the examinations held in February 2012 for the undergraduate students of Faculty of Agriculture across 8 academic departments with the direct involvement of a wide majority of the academic staff members. The software was proven successful saving significant amount of time and there were no complaints received by the authors about its consistency. Considering the overall responses, it was clear that the program performed well in offering the users with an efficient, easy to use environment for assigning grades based on the final examination marks. Since the grade assignment mechanism is flexible, this program could be used for distribution based (norm-referenced) grading or fixed scale (criterion-referenced) situations alike.

V. CONCLUSION

The user assisted interactive letter grade assigning software, designed based on MS Excel 2007 environment, could be effectively used to assign letter grades independent from the grading system adopted while saving time and effort significantly. It did not require any additional software installation or enabling macro operations but simply a computer installed with MS Excel 2007 or later version.

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