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A Spreadsheet Template for Forced Grading System

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Abstract: ***Forced Grading Systems are popular and accepted for evaluating students, particularly in business schools. Under such systems students' numerical test scores are converted to letter grades (A, B, etc.) and awarded in mandated percentages. In common practice, schools mandate that 10% to 15% of students in a class receive As, 25% to 35% Bs, and 40% to 50% Cs. However, instructors must identify what numerical cutoffs satisfy mandated grade distributions, and that tedious effort might entail several solutions. This study introduces an Excel-based template with which instructors can establish numerical cutoffs that distribute students' grades in accord with mandated standards. Results indicate that the spreadsheet template is an efficient tool to evaluate students following the Forced Grading System***

Keywords : Evaluation, Forced Grading, Distribution, Grading, Spreadsheet, Template

I. INTRODUCTION

Forced Grading Systems (FGS) are a popular and accepted method for evaluating students relative to their peers. Under this system, students' numerical test scores are converted to letter grades (A, B, etc.) and awarded in mandated percentages. In common practice, institutions mandate that top 10%–15% of students in a class receive As, 25%–35% Bs, and 40%–50% Cs and the remaining students (<10%) D and E grades. The institution or the instructor might establish the percentages, but instructors must determine what numerical cutoffs satisfy the required grade distribution. However, the exact percentage of students being assigned different grades may vary across institutes around the world. The subject of student evaluation or performance appraisal using forced grading has been controversial. Burke [2] stated that "*If you've spent considerable resources trying to hire the best employees or admit the best students, forcing some of them to fail simply because you believe in a "normal distribution" there should be failures is a confession that all your efforts at prior selectivity are a waste of time.*" The proponents of Forced Grading System argue that it is effective for multi-section courses when more than one instructor is teaching the same subject across multiple sections to ensure distribution of grades [8]. The purpose of this paper is not to argue in favor of FGS, neither point its drawbacks. The paper highlights the effort undertaken by the instructors to implement Forced Grading System and propose a simple Excel-based template to complete this tedious process quickly and reliably.

The study proceeds as follows. First it describes FGS and previous research. Then we describe the problem and reveal step-by-step solutions produced by the Excel-based template.

II. LITERATURE REVIEW

FGS are used widely to appraise the performance of employees and students. Also called a forced distribution, forced ranking system, or "grading on a curve," FGS entails categorizing subjects into performance "buckets" using a pre-defined distribution curve from best to worst [6]. The practice is controversial. Some corporate professionals extol it as an efficient and pragmatic means of rewarding "doers" and "muscle-building" organizations [1],[13],[14] Others call it dysfunctional and hazardous to organizational health and culture [5][9][10][11].

As applied to evaluating students, FGS require instructors to convert numerical performance (e.g., test scores) into letter grades and distribute them in pre-specified percentages such as a normal distribution [8]. Instructors who favor forced grading argue it ensures fairness of evaluation if several instructors teach multiple sections of the same course. Critics say its merits apply only to classes exceeding 30 students and it easily awards students lower grades than they deserve [7]. Dubey and Geanakoplos [4] conclude that grading on a curve is a disincentive to study and that absolute grading is better. Chattopadhayay and Ghosh [12] in their paper pointed out the problems of Forced Grading System for the purpose of appraisal and proposed a modified version using a simple measure of rank correlation.

Few practitioners or researchers have developed easy-to-use software or Excel-based spreadsheets that assist instructors with implementing forced grading. Champion [3] developed a spreadsheet that curves students' scores after instructors set a variable defining the curve, but it does not address the core problem.

III. THE PROBLEM

A typical Excel spreadsheet (Figure 1) illustrates a situation wherein 71 students took a 30-minute test containing 20 multiple choice questions (maximum score = 20). The spreadsheet features three columns: (1) Name, (2) Seat Number, (3) Points Scored. The institution mandates that all test scores be converted to grades that satisfy stipulated distributions (Tables 1.1 and 1.2).

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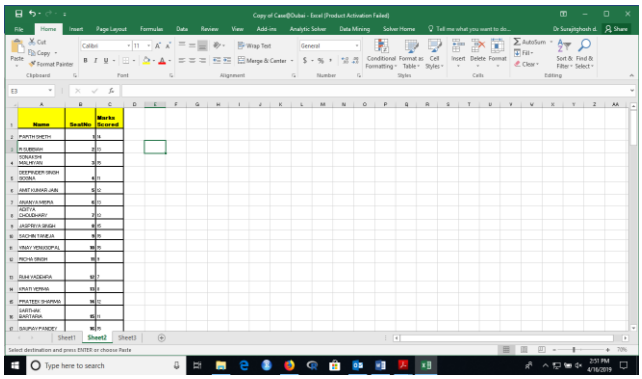
Table 1.1

			GRADE	COMMENTS
A	10%–15%		A	Excellent
B	25%–35%		B	Good
C	40%–50%		C	Satisfactory
D+E	<10%		D	Average
			E	Poor

Table 1.2

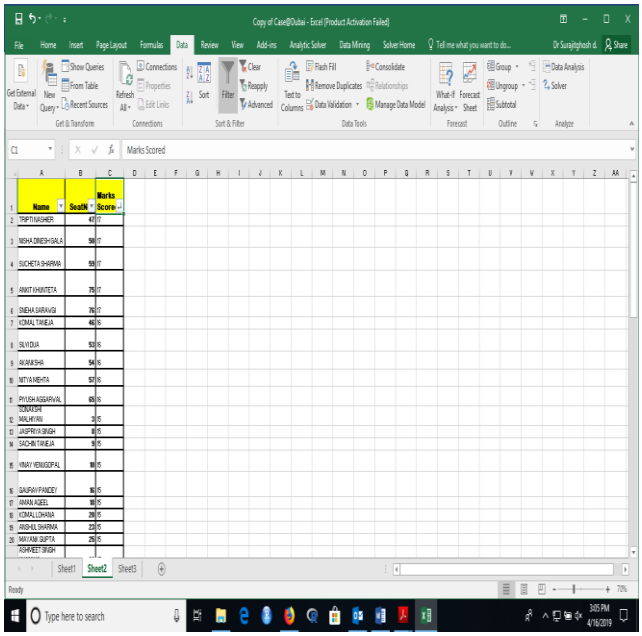


Most instructors would execute the following steps to enforce a grade distribution.

Step 1:

Turn on the Filter icon in Excel and arrange test scores in descending order (Table 2)

Table 2

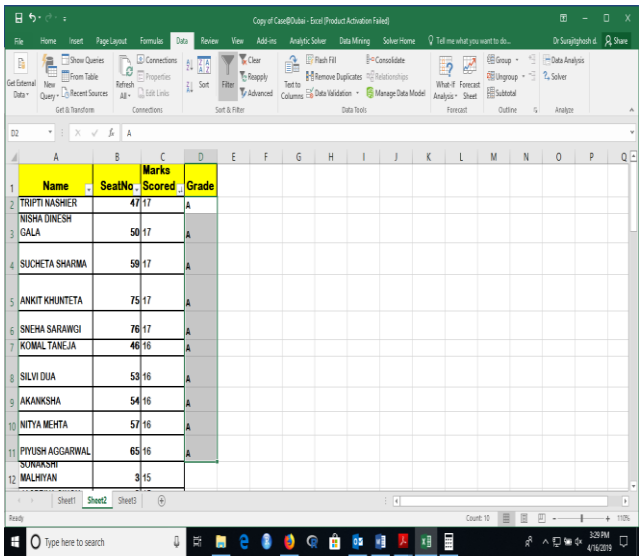


Step 2:

Policy mandates that 10%–15% of students receive a grade of A. Lenient instructors might wish to assign As to 15%—i.e., to 11 student. However, problems arise if several students have the same score. In this instance, the 11th student (Seat 3) cannot receive an A because 17 others earned scores that merit an A (15 points), and awarding As to 28 of 71 students (39.4%) violates the mandated distribution. The instructor must award an A to 10 students only—i.e., to those who scored at least 16 points on the test.

The instructor creates a separate column titled **Grade.** The top 10 students receive an A (Table 3).

Table 3



Name	SeatNo	Marks Scored	Grade
TRIPTI NASHIER	47	17	A
NISHA DINESH GALA	50	17	A
SUCHETA SHARMA	59	17	A
ANKIT KHUNTETA	75	17	A
SNEHA SARAWGI	76	17	A
KOMAL TANEJA	46	16	A
SILVI DUA	53	16	A
AKANKSHA	54	16	A
NITYA MEHTA	57	16	A
PIYUSH AGGARWAL	65	16	A
SONAKSHI MALHIYAN	3	15	

Step 3:

Again, policy mandates that 25%–35% of students receive a grade of B. Our lenient instructor prefers 35%, making 25 students eligible (.35 x 71 = 24.85). As above, however, 31 students (43.66%) deserve a B on the basis of their test scores. Forced to observe the mandated percentage, the instructor assigns Bs to only 18 students.

Step 4:

The plurality of students (40%–50%) can receive a grade of C. The instructor may wish to minimize that number to 40% of the class. For reasons illustrated above, 28 students could receive a C (.40 x 71 = 28.4), but 32 (45%) did so because nine students earned identical points on the test. Note that 45% satisfies the range for C grades.

Step 5:

The 11 remaining students can be awarded grades of D or lower. However, that percentage (11/71 = 15.49%) exceeds the mandated maximum of 10%.

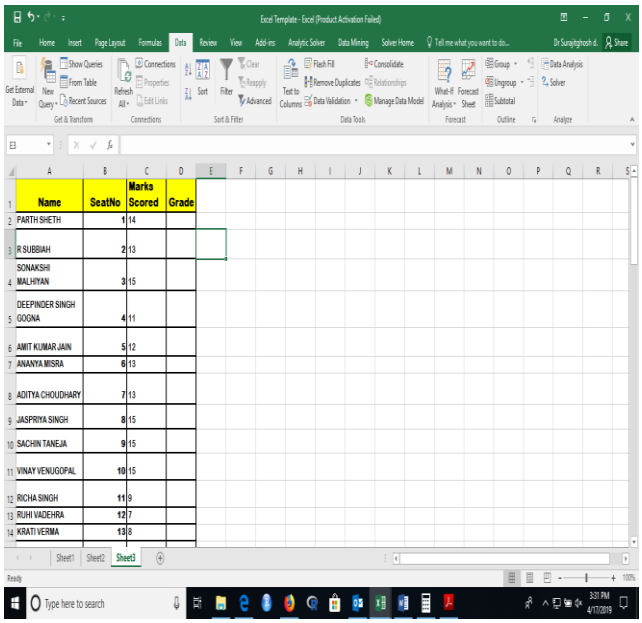
To satisfy mandated grade distributions the instructor must redo Steps 1 through 5 by altering percentages—for example, assigning an A to 10% of students instead of 15%—and then fitting numbers to the mandated percentages for grades B, C, etc. This undertaking is tedious and frustrating.

IV. THE SOLUTION

Following is a step-by-step by illustration of an Excel template that might serve such a scenario.

Step 1: An additional column is created and titled "**Grade**" as shown in Table 4.

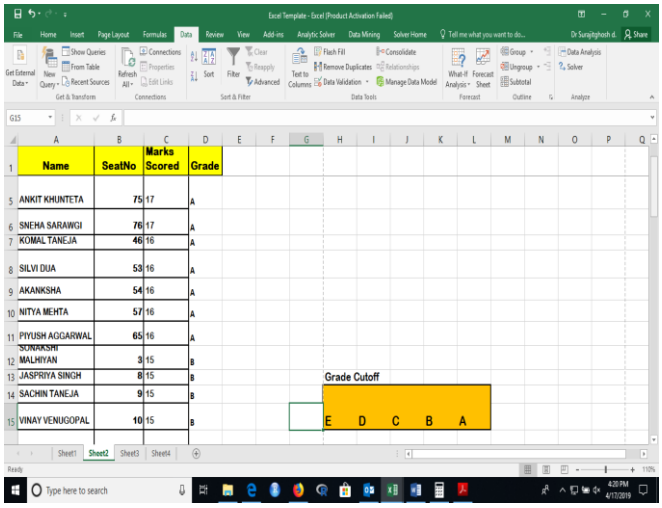
Table 4



Name	SeatNo	Marks Scored	Grade
PARTH SHETH	1	14	
R SUBBIAH	2	13	
SONAKSHI MALHIYAN	3	15	
DEEPINDER SINGH GOGNA	4	11	
AMIT KUMAR JAIN	5	12	
ANANYA MISRA	6	13	
ADITYA CHOUDHARY	7	13	
JASPRIYA SINGH	8	15	
SACHIN TANEJA	9	15	
VINAY VENUGOPAL	10	15	
RICHA SINGH	11	9	
RUHI VADEHRA	12	7	
KRATI VERMA	13	8	

Step 2: The cell range H14:L15 is highlighted in yellow. The cell range is chosen arbitrarily. In-cell H13 we write Grade Cutoff. Then we write Grades A, B, C, D, and E in cells L14, K14, J14, I14, and H14, respectively, as shown in Table 5.

Table 5



Name	SeatNo	Marks Scored	Grade
ANKIT KHUNTETA	75	17	A
SNEHA SARAWGI	76	17	A
KOMAL TANEJA	46	16	A
SILVI DUA	53	16	A
AKANKSHA	54	16	A
NITYA MEHTA	57	16	A
PIYUSH AGGARWAL	65	16	A
SONAKSHI MALHIYAN	3	15	B
JASPRIYA SINGH	8	15	B
SACHIN TANEJA	9	15	B
VINAY VENUGOPAL	10	15	B

Grade Cutoff

E	D	C	B	A

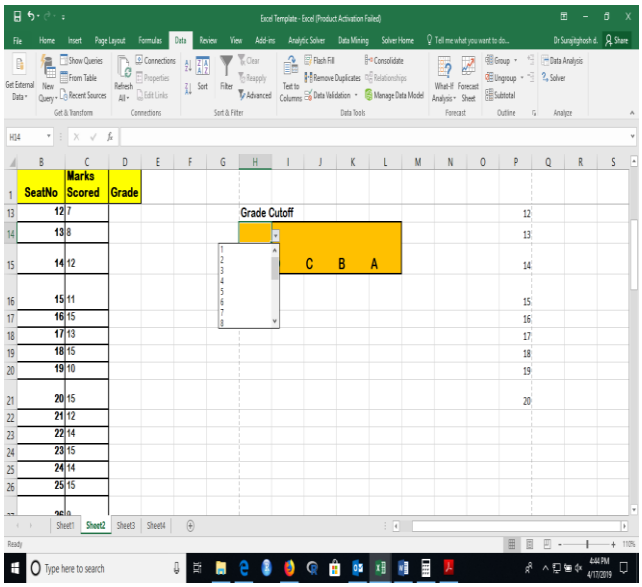
Step 3: In cells H14 to L14 we create a dropdown list for test scores from 0 to 20 (the maximum).

We add this dropdown list to the sheet by following these steps:

1. Create the list in cells P2:P22.
2. Select cell H14:L14.
3. Choose Data Validation from the Data menu.
4. Choose List from the dropdown list under the Allow option.
5. Click the Source control and drag to highlight cells P2:P22. Alternately, enter the reference (=$P$2:$P$22).
6. Make sure the In-Cell Dropdown option is checked. If unchecked, Excel still forces users to enter only list values (P2:P22), but it will not present a dropdown list.
7. Click OK.

The dropdown list is created as shown in Table 6. Similar dropdown lists will be created for each letter grade in cells I14, J14, K14, and L14. We must select any number from 0 to 20 to establish numerical cutoffs for each letter grade. We randomly chose cutoff points shown in Table 7.

Table 6

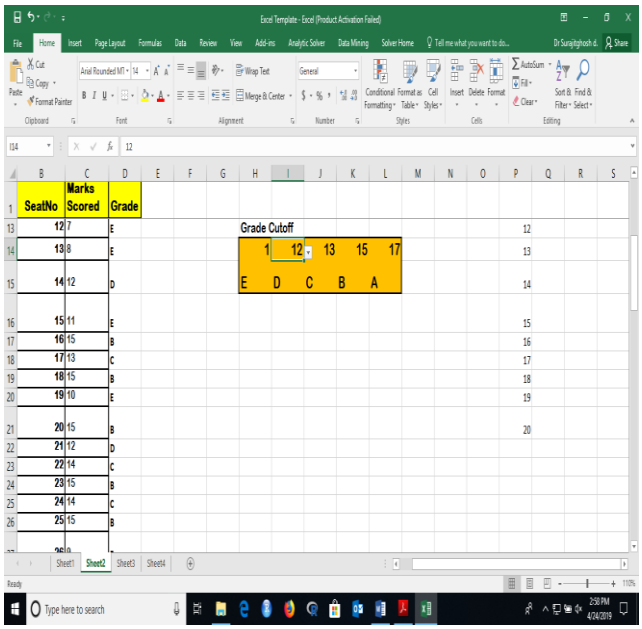


SeatNo	Marks Scored	Grade
12	7	
13	8	
14	12	
15	11	
16	15	
17	13	
18	15	
19	10	
20	15	
21	12	
22	14	
23	15	
24	14	
25	15	

Grade Cutoff

C	B	A

Table 7



SeatNo	Marks Scored	Grade
12	7	E
13	8	E
14	12	D
15	11	E
16	15	B
17	13	C
18	15	B
19	10	E
20	15	B
21	12	D
22	14	C
23	15	B
24	14	C
25	15	B

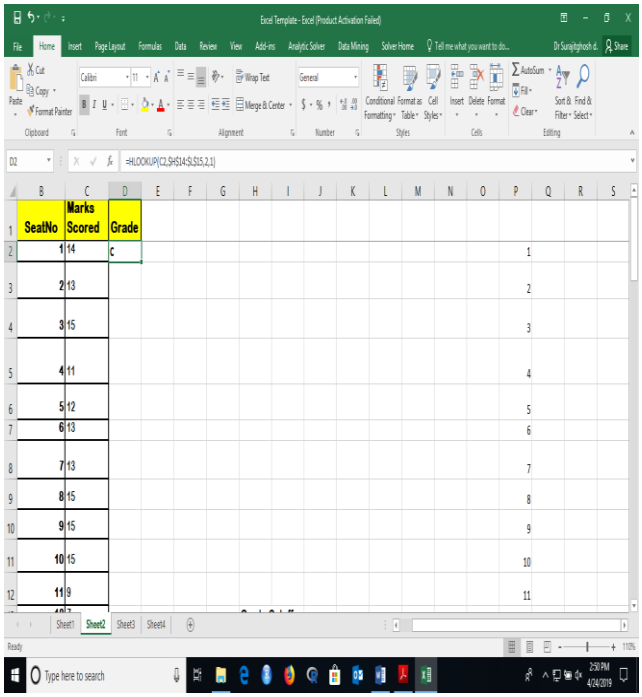
Grade Cutoff

1	12	13	15	17
E	D	C	B	A

Step 4:
Select cell D2 and type the formula =HLOOKUP(C2,$H$14:$L$15,2,1).

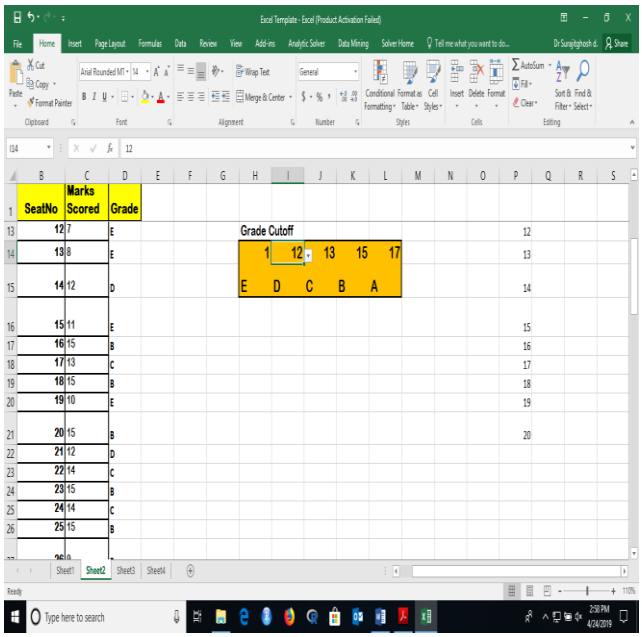
Step 5:
Place the cursor at the lower right corner of cell D2. It will change to a + sign, shown in Table 8.

Table 8



Holding the cursor, drag and select the entire cell range from D2:D72 as shown in Table 9.

Table 9



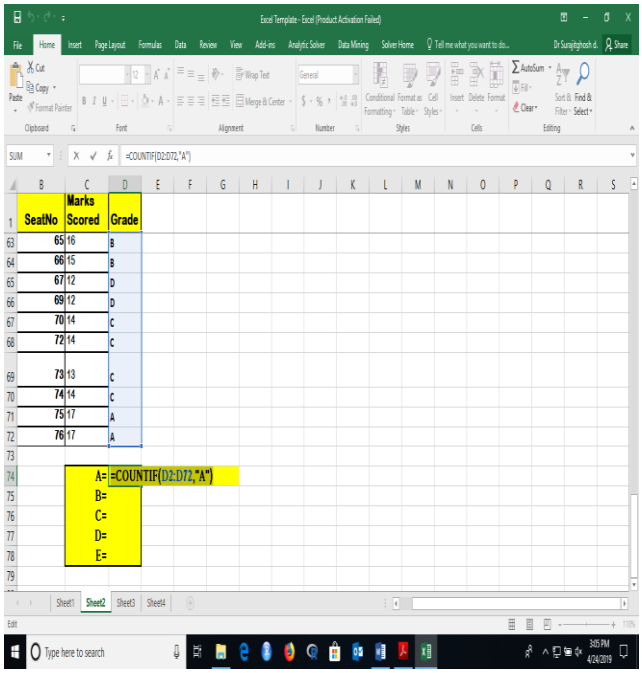
Note that grades appear automatically under the Grade column next to each student's score as determined by the cutoff point assigned in the box titled Grade Cutoff. For example, students with 17 or more points receive an A. The range of grades is as follows:

Points ≥ 17 [Grade A]
Points ≥15 and <17 [Grade B]
Points ≥13 and <15 [Grade C]
Points ≥12 and <13 [Grade D]
Points ≥1 and <12 [Grade E]

If the instructor alters the cutoff, grades change for each student.

Step 6:
The next step is to count the A, B, C, D, and E grades and plot them on a pie chart. Accordingly, we write A=, B=, C=, D=, and E= in cells C74, C75, C76, C77, and C78 respectively. Then we select cell D74 and write the formula =COUNTIF(D2:D72,"A") as shown in Table 10. Similarly, we write =COUNTIF(D2:D72,"B") in D75 to count the number of B grades and so on.

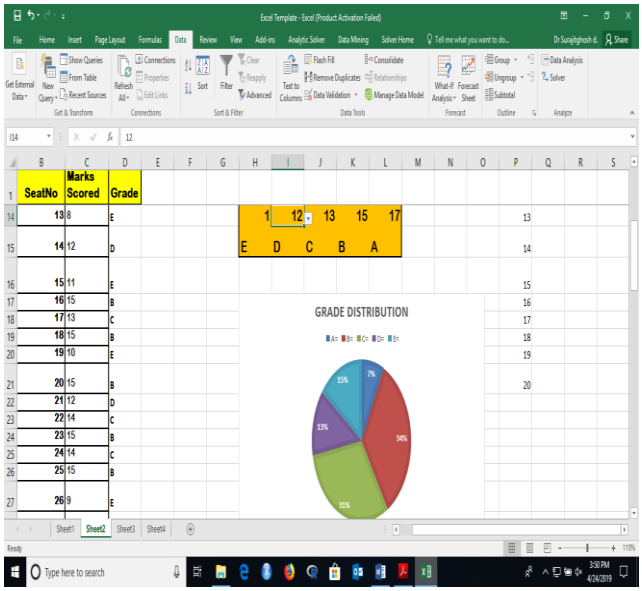
Table 10



This procedure produces total for individual grades.

Step 7:
We insert a pie chart by selecting cell range C74:D78 as shown in Table 11.

Table 11



The chart has been Titled Grade Distribution. However, note that the distribution of grades in the pie chart does not satisfy mandated policy. For example, fewer than 7% of students receive an A even though the mandated minimum is 10%. That also is the case for C grades. To produce results that satisfy mandates instructors adjust the cutoff points. That is, they select different cutoffs for each grade. Let us take the following cutoff points

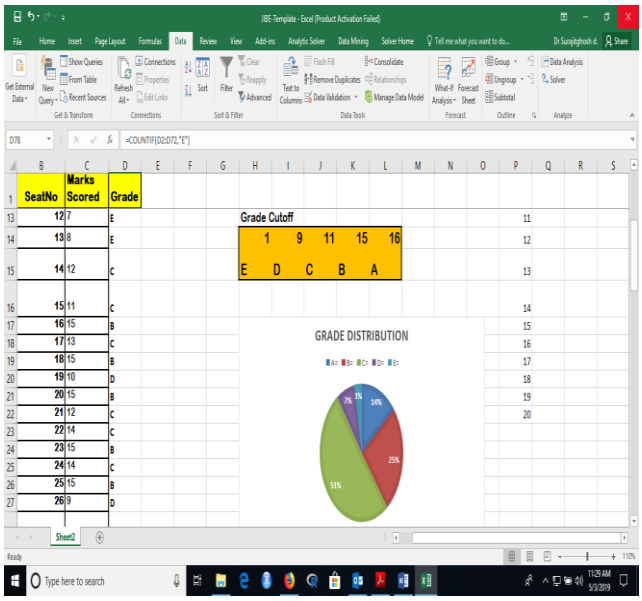
Points ≥ 16 [Grade A]
Points ≥15 and <16 [Grade B]
Points ≥11 and <15 [Grade C]
Points ≥9 and <11 [Grade D]
Points ≥1 and <9 [Grade E]

The pie chart in Table 12 indicates that mandated grade distributions are satisfied, although the 51% of students receiving a C exceed limits by 1%. Following is a suggested step-by-step approach for determining cutoff points:

(a) Determine what cutoff initially satisfies the percentage of A students (e.g., 16 points).
(b) Determine what cutoff initially satisfies the percentage of B students without changing the cutoff for A.
(c) Determine what cutoff initially satisfies the percentage of C students without changing cutoffs for A and B.
(d) Determine what cutoff initially satisfies the percentage of D students without changing cutoffs for A, B, and C.

If satisfied with the outcomes, exit the program. Otherwise redo steps (a) and (b).

Table 12



V. RESULTS

Table 13

	RANGE OF TEST SCORES		
Class Size	**0-20**	**0-50**	**0-100**
Small Class (30)	**17.23%**	**12.76%**	**11.23%**
Medium Class (50)	**16.45%**	**11.33%**	**8.21%**
Large Class(75)	**15.21%**	**9.32%**	**7.34%**

The template was tested with class size of three types namely small, medium and large having class sizes of 30, 50 and 75 respectively as depicted in Table 13. The range of test marks were also considered of three types (1) 0 to 20 (2) 0 to 50 (3) 0 to 100 marks. The table above, shows the results of the test that was performed for each of the 9 cases. 100 simulations were performed for each of the 9 cases. The results shows the percentage deviation from the actual cases. It was observed that the heuristic was able to solve most of the cases when the class size is large and the range of marks is between 0 to 100.

VI. CONCLUSION

This study has introduced and discussed an Excel-based template for implementing enforced grade distributions. The HLOOKUP() function in Excel is used to assign grades per cutoff points determined by the instructor. Teachers can adjust cutoff points to arrive at a distribution of grades that satisfies institutional policy. The Excel template assists instructors by displaying the distribution visually as a pie chart. Multiple cutoffs for different grades can satisfy institutional policies, but the template does not guarantee an optimum solution for all possible scenarios. The Excel template can be extended to any number of students and is not limited to classes of a particular size. It also can be extended to any number of grades.

VII. FUTURE SCOPE

The template can be designed to provide optimal mandated grade distributions. It can formulate any range of exam scores and mandated distributions as an optimization problem and find a solution—sometimes an optimal solution—using Excel Solver.

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