CALCULATION OF WEIGHED AVERAGE ESTIMATION MARKS BY MEANS OF SPREADSHEET

Dimiter Yordanov Shickalanov

Informatics Department, New Bulgarian University, 21 Montevideo Street, Sofia 1618, Bulgaria,
phone: +028110658, E-mail: dys@nbu.bg

When the weight of each particular component in the formation of the evaluation mark of a subject, expressed as percentage is different, the particular components are more than 10 and several other conditions take a part in the formation of the evaluation mark, it is obvious that the evaluation by formulae can not be done in one's mind, and it is most convenient to use spreadsheets. In order that such requirements be satisfied, it is necessary to work out formulae for calculating the evaluation mark of the subject and to write them in accordance with the syntax of a spreadsheet program. All this is done for the subject ***Graphical Documentation*** *from the bachelor program Computer Media Technologies of New Bulgarian University and several results are given in the table. This technology may by used in similar cases.*

Keywords: education; weighed average evaluation marks; spreadsheet

1. INTRODUCTION

In the most of the universities they have used weighed average evaluation marks for formation of the final mark of the subjects (for example [1], [2]). It is possible such method to be used and in the schools. This work shows practical decision of this problem with several other conditions by spreadsheet program EXEL.

The selection of the evaluation marks system and the rules for the formation of the marks are based on the use of the content of the subject **Graphical Documentation** from the bachelor program Computer Media Technologies of New Bulgarian University. This content is given in its CV and its passport, which are approved for each consequent alumni of students and are published in the corresponding Reference Book and in the university site.

According to the rules, accepted by the New Bulgarian University, the marks may be entered in the examination protocols as a word*: poor, satisfactory, good, very good* and *excellent,* followed either by an integer number 2, 3, 4, 5, 6, or by an integer number with the simple fraction ½ (2½, 3½, 4½, 5½). For this purpose a rule for rounding is accepted, which is applied when calculating the average of two or more marks:

- When the decimal part of the calculated number, initially rounded off within 1/hundredth part of one, is in the interval between 0.01 to 0.24, it is rounded down to the smaller integer number, while in case the decimal part is within the interval between 0.25 to 0.74, then the number is rounded to the smaller integer number plus ½, while in case the decimal part is within the interval between 0.75 to 0.99 then the number is rounded to the greater integer number.

For instance, both numbers 3.01 and 3.24, which are obtained by calculating the average and they are rounded off within 1/hundredth, should be rounded down to 3, while the numbers 3.25 and 3.74 should be rounded off to 3½, and 3.75 and 3.99 should be rounded up to 4.

The results of two test papers, written during the semester, the mark of the individual course project and the semester exam, take part in the formation of the estimation mark.

The weight of each particular component in the formation of the evaluation mark, expressed as percentage, is as follows:

- First test paper 10%;
- Second test paper 10%;
- Course project 30%;
- Semester examination 50%.

Each of the tests and the semester examination include 1 theoretical question, 1 problem for applying the theory and 3 questions related to the work with the software, which is used at the exercise classes. Each of the questions is evaluated by a mark according to the above-mentioned rule of the New Bulgarian University.

The first test includes a question from the first half of the lectures, a problem to draw an outline of the minimum necessary number of orthogonal projections of a given detail, and 3 questions from the synopsis, chosen among the questions which are numbered from 1 to 32. The second test includes a theoretical question from the second part of the lectures, a problem to draw an outline of an assembly drawing of an assembled unit, and 3 questions from the synopsis, chosen among the questions which are numbered from 33 to 64.

The theoretical question is given by the lecturer, the problem for applying the theory is chosen by the student among several ones suggested by the lecturer; furthermore the student chooses 2 numbers, and the lecturer by applying simple arithmetical operations on them, calculates the numbers of three questions, which are uniformly distributed in the corresponding part of the synopsis. At the semester examination the theoretical question may be related to any one of all the lectures, and the three questions about the work with the software are uniformly distributed along the whole synopsis.

If all the marks on the theory – the theoretical questions and the problems for applying theoretical knowledge, give an average with the value of 2 (a poor mark), or if all the marks on the work with the software and the mark on the course project give an average with the value of 2, then the total mark is set to become 2, without applying the average between the marks on the theoretical knowledge and on the practical work, in view of the fact that the student has not learnt one important part of the subject.

2. PROBLEM STATEMENT

In order that this requirement be satisfied, it is necessary to work out formulae for calculating the **T**otal **M**ark on **T**heory (TMT) and the **T**otal **M**ark on **P**ractical **W**ork

(TMPW), which to reflect the percentage weight of the individual marks the student has got.

The designations used in the formulae are as follows:

T1T – the mark on a **T**heoretical question in **T**est **1**;

T1TP – the mark on the **P**roblem for applying the **T**heory in **T**est **1**;

T1S – the average of the marks on the three questions about the **S**oftware in **T**est **1**;

T2T – the mark on a **T**heoretical question in **T**est **2**;

T2TP – the mark on the **P**roblem for applying the **T**heory in **T**est **2**;

T2S – the average of the marks on the three questions about the **S**oftware in **T**est **2**;

CP – the mark on the defense of the **C**ourse **P**roject;

SET – the mark on the **T**heoretical question in the **S**emester **E**xamination;

SETP – the mark on the **P**roblem for applying the **T**heory in the **S**emester **E**xamination, and

SES – average of the marks on the three questions about the **S**oftware in the **S**emester **E**xamination.

After going into examination for the semester, each student gathers totally 16 evaluation marks including the mark from the current control.

The formula for the **T**otal **M**ark on the **T**heoretical aspects (TMT) is:

TMT=(T1T+T1TP)*0.1429/2+(T2T+T2TP)*0.1429/2+(SET+SETP)*0.7142/2

The decimal coefficients are calculated in such a way, that they reflect the percentage ratio for test papers T1 and T2 each with the weight of 10% and for the semester examination SE with the weight of 50%, having in mind that the mark on the defense of the course project with the weight of 30% is excluded, since it does not participate in the formation of TMT.

The formula for the **T**otal **M**ark on the **P**ractical **W**ork (TMPW) is:

TMPW = T1S*0.1 + T2S*0.1 + CP*0.3 + SES*0.5.

According to the rule of the New Bulgarian University, if the student is contented with the total mark from the current control during the semester, the lecturer accepts it as a final evaluation mark and enters it in the examination protocol for the course, and the student is relieved from the semester examination. In this case the weight of the marks on the two test papers T1 and T2 become each with the weight of 35% and the formulae for TMT and TMPW accept the following form:

TMT = (T1T + T1TP + T2T + T2TP)/4 and

TMPW = T1S*0.35 +T2S*0.35 +CP*0.3.

In this case every student has gathered 11 evaluation marks.

After it has been established then none of the two marks TMT and TMPW on the studied course is a poor mark, then the total mark on the course may be calculated by the corresponding formulae. In the case with a **T**otal **M**ark from the **C**urrent **C**ontrol (TMCC) the formula is:

TMCC = (T1T + T1TP + T1S)/3*0.35 + (T2T + T2TP + T2S)/3*0.35+CP*0.3

and for the **T**otal **M**ark with **S**emester **E**xamination (TMSE):

TMSE = (T1T + T1TP + T1S)/3*0.1 + (T2T + T2TP + T2S)/3*0.1 + CP*0.3 + + (SET + SETP + SES)/3*0.5.

When calculating the average, the result numbers of the marks are rounded according to the above-mentioned rule for rounding.

In the cases when a certain student did not go in for test 1, or for test 2, or for both tests, in the last week of the semester the corresponding marks are considered to be poor marks (value 2), in order to ensure the possibility to apply the formulae for calculating the average. Then the rest of the marks can compensate for the poor marks and the result to be a total mark with the value of 3 or more. In case the student sits in for semester examination, the current control affects the total mark, although the percentage is low. If the student refuses the formation of the evaluation mark by the current control, then the total mark is defined only by the results of the semester examination.

It is obvious that the evaluation by the worked out formulae can not be done in one's mind, and it is most convenient to use spreadsheets. The faculty numbers of the students, the three names of the students, the marks from the current control, and eventually from the semester examination, are entered in the table of a spreadsheet, then TMT, TMPW, an intermediate calculated value and the final calculated mark for the semester - consistent with the above described rules and formulae, are calculated by the relevant formulae, which are entered in the corresponding cells of the table. If the faculty numbers of the students are entered in the cells in column A of the table, the three names - in the cells in column B, the marks on the theoretical question in the first test - in column C, the mark on the problem for applying the theory in the first test - in column D, the average of the three questions from the synopsis in the first test - in column E, respectively the marks from the second test paper in columns F, G and H, the mark by which the defense of the course projects are rated - in column I, respectively the marks on the semester examination - in columns J, K and L, then in the cells in column M one can enter the formula for calculating TMT when the student has sit for semester examination, which formula is written in accordance with the syntax of the spreadsheet program EXEL for raw 3 of the table:

=SUM((C3+D3)*0.1429/2+(F3+G3)*0.1429/2+(J3+K3)*0.7142/2),

in column N - the formula for TMPW:

=SUM(E3*0.1+H3*0.1+I3*0.3+L3*0.5),

in column O - the formula for the intermediate calculated value:

=IF(AND(M3>2.49;N3>2.49);SUM((C3+D3+E3)/3*0.1+(F3+G3+H3)/3*0.1+I6*0.3+(J3+K3+L3)/3*0.5);2),

and in column P - the formula for the total mark with semester examination TMSE of the student:

=IF(AND(O3-INT(O3)>0.49;O3-INT(O3)<0.75);INT(O3)+0.5;IF(O3-INT(O3)>0.74;ROUNDUP(O3;0);IF(O3-INT(O3)>0.24;INT(O3)+0.5;ROUNDDOWN(O3;0)))).

When the student agrees to get the estimation mark only from the current control, columns M, N, O and P contain the formulae for calculating TMT, TMPW, the

intermediate mark and the total mark from the results of the current control for raw 6 of the table:

- in column M - TMT:
  =SUM((C6+D6+F6+G6)/4);
- in column N - TMPW:
  =SUM(E6*0.35+H6*0.35+I6*0.3);
- in column O – the intermediate calculated value:
  =IF(AND(M6>2.49;N6>2.49);SUM((C6+D6+E6)/3*0.35+(F6+G6+H6)/3*0.35+I6*0.3);2)
- and in column P – TMCC:
  =IF(AND(O6-INT(O6)>0.49;O6-INT(O6)<0.75);INT(O6)+0.5;IF(O6-INT(O6)>0.74;ROUNDUP(O6;0);IF(O6-INT(O6)>0.24;INT(O6)+0.5;ROUNDDOWN(O6;0)))).

3. RESULTS

The following Table 1 shows the results, calculated by the above-mentioned formulae by the EXEL spreadsheet, for 2 students who have went in the semester examination, and for another two students, who have been currently rated only by current control.

Table 1 Exemplary Exel spreadsheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Faculty No.	Names	1st test paper			2nd test paper			Project	Semester exam			**TMT**	**TMPW**		**Ex.Mark**
2		WITH SEMESTER EXAM														
3	F24322	…	2	2	2	2	2	2	3.5	4.5	2	5	2.89	3.95	3.37	3.5
4	F24165	…	2	2	2	2	2	2	5.5	3	3	3	3.50	3.55	3.55	3.5
5		ONLY WITH CURRENT CONTROL														
6	F24111	…	3	3	2	3	3	2	5				3.00	2.90	3.37	3.5
7	F14200	…	2	3	4	3	3	5	5				2.75	4.65	3.83	4

The Table 1 shows that for the last two students, whose results are calculated by the current control, there exists a difference between the TMCC which are obtained by the formula calculations, and the average of the Total Mark on Theory TMT and the Total Mark on the Practical Work TMPW. This is explained by the fact that when

calculating TMT, it is not necessary to take into account the influence of the mark on the course project (which in these particular cases is higher), and it was not done, while the mentioned mark is present in the formula for calculating TMCC.

After the last week of the semester a spreadsheet with the results of the current control during the semester is published on the university site. As well after the semester examination a spreadsheet with the total marks is published on the university site.

4. CONCLUSIONS

This technology may by used in similar cases from lecturers in universities, in scools and others.

5. References

[1] ПРАВИЛА ЗА ОЦЕНЯВАНЕ НА ЗНАНИЯТА И УМЕНИЯТА НА СТУДЕНТИТЕ В ТУ – ГАБРОВО, http://sqn.tugab.bg/attachments/392/Pravila.doc

[2] ПРОГРАМА НА ЛЕКЦИИТЕ И СЕМИНАРИТЕ ПО ИКОНОМИЧЕСКА СОЦИОЛО ГИЯ - 2006/2007 http://forum.uni-sofia.bg/filo/display.php?page=bak_soc_9

[3] Кирил Гатев, Въведение в статистиката, Издателство ЛИА, София 1995.