The R Score: What It Is and What It Does

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INTRODUCTION

In the context of the admissions process, the general policy of universities is to accept all applicants to a program who meet its general and specific admission requirements. However, when a selection must be made from among those who qualify, most often because of program enrollment limits, each university must decide if and to what extent a student's academic record should be used in the selection process. For example, in some programs, admission could be based solely on college grades whereas, in others, college grades are merely one of a number of criteria in the selection process. In all cases, universities are well aware that the methods used to compare and classify candidates must be as objective and fair as possible.

The use of academic records for purposes of classification and selection assumes that there is a common basis for evaluation, or, alternatively, that the groups of students, their learning experiences, and the grading methods are inherently the same. The college education regulations are clear on the autonomy enjoyed by each institution in the evaluation of learning. Consequently, universities have devised a way of classifying students for selection purposes by utilizing statistical methods to correct for observed differences in college grading systems and to adjust the resulting values so as to take into account the relative strength and dispersion of each group of students. This method, called the R score[1], was adopted by Québec universities in 1995.

This document aims to explain the role and scope of the R score in the university admissions process. After reviewing the elements which may be used in the classification process, a simple example will be used to demonstrate the effect of the R score on student selection. Appendix A describes its mathematical formula.

An abridged version of the present document, stripped of its mathematical content, is available; it is entitled *The R Score: a Survey of Its Purpose and Use*. Complementary information on the R score is also available in *Questions and Answers about the College R Score*. These two information documents, as well as this document, are available on the Bureau de coopération interuniversitaire (BCI) Web site at the following address: http://www.bci-qc.ca/en/students/r-score/.

[1] The R score is now generally accepted in English to mean the *cote de rendement au collégial (CRC).*
When adopted in 1995, the adjustment only considered the group's relative strength.

1. Classification Methods

Various methods can be used to establish ranking: the student's average grade, the Z score, and the R score.

1.1 The average grade

The average grade is obtained by adding all the grades on an individual student's record and dividing the sum by the number of grades. With this method, however, differences in grading procedures among the colleges could result in the average grades of students from some institutions being systematically higher than those of students having attended other colleges, falsely suggesting that members of the first group are stronger students than those of the second group.

In fact, it is not uncommon to find some classes where no one receives less than 75 percent while in other classes the highest grade is 80 percent. In each of these classes, the student with the highest grade ranks first. Measuring academic achievement based on relative rank in a class cannot therefore distinguish between two students who are first in their groups.

1.2 The Z score

The Z score is a statistical unit of measure which expresses a student's position within a distribution of grades in terms of two fundamental elements of this distribution, i.e., the average grade and the standard deviation, or grade spread.

By taking into account the average of the grades and their degree of spread for a class of students, the Z score normalizes the grades of different classes or groups to a common scale, allowing comparisons to be made between them. With this concept, students can then be ranked according to academic achievement.

There are two fundamental advantages to the Z score: first, it maintains the student ranking obtained in conformity with the grading guidelines prescribed by each college and, second, it allows for a direct comparison of grades between student groups that are both different yet equivalent.

While using the Z score presents certain advantages in the classification and selection processes, it does not resolve all of the difficulties encountered in evaluating students for admission to university. Indeed, when student groups present different characteristics, the comparisons made using the Z score become less valid and less equal. The selection process used by the colleges to admit students to their different programs; the various ways of organizing students into groups (homogeneous and heterogeneous); the types of programs offered, e.g., Diploma of Collegial Studies (DCS) in the Sciences and in Arts and Letters, Enriched DCS, International Baccalaureate, etc., are just some of the factors that can influence the classification of students from different colleges and possibly affect the chances for admission of some of them.

1.3 THE COLLEGE R SCORE

The college R score is based on three types of information for each course taken by a student: an indicator of the student's rank in the group based on that individual's grade (the Z score), an indicator of the relative strength of the group (ISG) and an indicator of the dispersion of the group (IDG). Thus, in addition to the advantages of the Z score, the college R score uses two correction factors to account for initial differences between groups. These two indicators are also measured for the Z score.

This very useful correction method can be applied to all college courses as it permits appropriate adjustments to be made to account for each student's situation. In other words, should a student attend a different college, or switch to another program or group, the college Z score for each course will be adjusted according to the two indicators for the group in which the evaluation takes place.

2. EXAMPLE OF R SCORE CALCULATION

The following fictitious example shows how the R score is calculated and illustrates how it can influence candidate classification. The example includes descriptions of the three main components of the R score: the college Z score, the group strength indicator, and the group dispersion indicator.

2.1 EFFECT OF USING THE COLLEGE Z SCORE

As seen in Table 1, grades for the students in class A range from 81 to 89 percent, in class B from 71 to 79 percent, while for class C grades are as low as 59 and as high as 91 percent. In this example all the students want to be admitted to the same university program, but only six can be accepted. Who amongst them will be chosen? Based solely on the grades shown in Table 1, the first four in class A and the first two in class C would be selected; none would be selected from class B.

TABLE 1
GRADE DISTRIBUTION

Class A		Class B		Class C	
Florence	89*	William	79	Annie	91*
Olivier	88*	Camille	78	Alexis	87*
Jade	87*	Vincent	77	Catherine	83
Étienne	86*	Olivia	76	Émilie	79
Gabrielle	85	Francis	75	Rosalie	75
Guillaume	84	Antoine	74	Xavier	71
Marie	83	Emma	73	Jacob	67
Samuel	82	Nathan	72	Félix	63
Chloé	81	Audrey	71	Sarah	59
Sum of the grades	765		675		675
Number of students	9		9		9
AVERAGE GRADE	85		75		75

* The six best scores

Since the differences in average grades between these three groups of students may depend solely on the degree of severity with which their respective teachers evaluated their work, it is easy to see that some students are favoured by this while others are severely penalized. This is one of the situations that can be rectified by using the Z score. Instead of ranking the students according to their grades, the position of each student must be found relative to the average grade in the class. In other words, the students must be ranked according to the difference between their grade and the average grade for their class.

To obtain this type of ranking, the average grade for each class must be determined. For example, an average grade of 85 is obtained for class A by dividing the sum of these grades (765) by the number of students (9). Next, the difference between each student's grade and the average grade for that class is found. Table 2 lists these results, expressed as the deviation from the average. An examination of the figures shows that the results for the students in classes A and B are now identical even though, as shown in Table 1, the lowest grade in class A was superior to the highest grade in class B. Thus, the deviation from the average helps eliminate artificial differences. This illustrates one of the deficiencies that can be corrected by using the Z score.

TABLE 2
DEVIATION FROM THE AVERAGE

Class A		Class B		Class C	
Florence	4 *	William	4 *	Annie	16*
Olivier	3	Camille	3	Alexis	12*
Jade	2	Vincent	2	Catherine	8*
Étienne	1	Olivia	1	Émilie	4*
Gabrielle	0	Francis	0	Rosalie	0
Guillaume	-1	Antoine	-1	Xavier	-4
Marie	-2	Emma	-2	Jacob	-8
Samuel	-3	Nathan	-3	Félix	-12
Chloé	-4	Audrey	-4	Sarah	-16

* The six best scores

However, in addition to taking into account the deviation from the average, it is also necessary to consider the amount of spread, or dispersion, in the grades if corrections are to be made for variations in grading methods. Indeed, if the choice of the six best students were to be based on the deviation from the average, the students in class C would evidently be favoured. This is because the grades for this class are spread out more than those of the other classes. A grading approach by the professor resulting in a wider dispersion in grades unduly favours the top-graded students by giving them a large positive deviation from the average, while penalizing the weaker ones even more by giving them an equally large negative deviation.

In order to take into account the amount of spread in the grades, the standard deviation, another statistical quantity, must be calculated. The procedure to follow is to square the deviations from the average, add up the resulting quantities, and then divide this sum by the number of grades; the square root of the quotient is the standard deviation. The resulting values of the standard deviations for each of the classes A, B, and C are shown in the last line of Table 3.

TABLE 3
SQUARE OF THE DEVIATION FROM THE AVERAGE

Class A		Class B		Class C	
Florence	16	William	16	Annie	256
Olivier	9	Camille	9	Alexis	144
Jade	4	Vincent	4	Catherine	64
Étienne	1	Olivia	1	Émilie	16
Gabrielle	0	Francis	0	Rosalie	0
Guillaume	1	Antoine	1	Xavier	16
Marie	4	Emma	4	Jacob	64
Samuel	9	Nathan	9	Félix	144
Chloé	16	Audrey	16	Sarah	256
Sum of the squares of the deviations	60		60		960
Number of grades	9		9		9
AVERAGE	6.67		6.67		106.67
STANDARD DEVIATION	2.58		2.58		10.33

The Z score for each student can now be determined from these data. The first step is to calculate the difference between the student's grade and the class average: what is known as the standard deviation from the average. To account for the spread in grades for the class, this deviation from the average is divided by the standard deviation of the class grades. For example, Florence in class A has a grade of 89; her deviation from the class average is 4 points (89-85); dividing this value of 4 by the standard deviation of the class (2.58) gives her a Z score of 1.55 for that subject. Numerical values for the Z score determined in this way for all the students in the three classes are shown in Table 4.

Using the Z score to rank the students in the example, the six best candidates are the two with the highest grades in each of the three classes. Thus, by taking into account the deviation from the average and the amount of spread in the grades, it is possible to neutralize any bias in the grading method used by the professor while strictly respecting the original class rankings. Consequently, no matter how severe or generous a professor might be in grading, the results in the three classes can be compared once the grades are converted to Z scores. In other words, the Z score ensures fairness for all the students.

TABLE 4
Z SCORE

Class A		Class B		Class C	
Florence	1.55 *	William	1.55 *	Annie	1.55 *
Olivier	1.16 *	Camille	1.16 *	Alexis	1.16 *
Jade	0.77	Vincent	0.77	Catherine	0.77
Étienne	0.39	Olivia	0.39	Émilie	0.39
Gabrielle	0.00	Francis	0.00	Rosalie	0.00
Guillaume	-0.39	Antoine	-0.39	Xavier	-0.39
Marie	-0.77	Emma	-0.77	Jacob	-0.77
Samuel	-1.16	Nathan	-1.16	Félix	-1.16
Chloé	-1.55	Audrey	-1.55	Sarah	-1.55

* The six best scores

2.2 IMPACT OF USING TWO INDICATORS: STRENGTH OF THE GROUP AND DISPERSION OF THE GROUP

Classification by Z score is fair for all students if and only if the classes being compared are equivalent, i.e., if they are of the same calibre. It often happens that some groups are not directly comparable. Consider the hypothetical situation where, given the same discipline, class A is made up of only weak students, class B has only strong students, and class C is a mixture of strong, average, and weak students. The data in Table 1 readily show that conclusions drawn from comparison of these grades are invalid since selecting the six best students would leave out all the students in class B. By permitting the retention of two students per class, the Z score appears to reintroduce a certain equity. Realistically, however, the class limited to strong students (class B) is severely penalized by this method of analysis and by its makeup.

Because grades and the Z score do not reflect the specific characteristics of these three groups of students, in order for them to be treated fairly, it is necessary to consider two other statistics common to all students: the group strength and relative dispersion of the group of students in a given course. To determine the group's strength and dispersion, the MEES uniform examination subjects in the Secondary 4 and 5 Youth sector, taken by all students that belong to a given college group[2], are used. Various studies have shown that grades obtained in these ministerial examination subjects at the end of secondary school are very good performance indicators for later college performance[3] and constitute a sound common basis for assessing the strength and dispersion of a college group. However, keep in mind that if a student obtains a good or poor grade in a CEGEP course, that will be the grade obtained for that course, with no relation to the secondary school grades. Secondary school grades, like those of all other students that take the course with the student, are only used to calculate the indicator of the strength of the group (ISGZ) and the indicator of the dispersion of the group (IDGZ). The direct impact of the individual student's secondary school grades on his or her college ranking will be very limited because they will count for only about 3% of the ISGZ and IDGZ if, for example, there are 35 students in the group.

To find the correction factor to apply to the college Z score (Zcol), use the following formula:

$$\text{Corrected Zcol} = (\text{Zcol} \times \text{IDGZ}) + \text{IFGZ}$$

where

Zcol = college Z score

2 For admissions prior to the Fall 2009 semester, all final grades obtained in Secondary 4 and 5 were used to calculate the group strength. From Fall 2009 to Summer 2016, the Secondary 4 and 5 ministerial examination subjects were used for this purpose.

3 See Terril and Ducharme, *Passage secondaire-collégial : Caractéristiques étudiantes et rendement scolaire*, Montréal, SRAM, 1994.

IDGZ = indicator of the dispersion of the group based on the standard deviation of the secondary school Z scores of the students in the college group

ISGZ = indicator of the strength of the group based on the average secondary school Z scores of the students in the college group

This correction formula is based on research by the Comité de gestion des bulletins d'études collégial. Their analyses—theoretical, experimental and empirical—show that an R score based on correction of the college Z score with indicators of group strength and group dispersion applied to the Z scores for Secondary 4 and 5 MEES uniform examination subjects is more equitable for all students, regardless of the characteristics of the group to which they belong[4].

As an illustration, consider the students in class B. Assuming that the IDGZ is 0.60 and the ISGZ is 1.12, applying the formula in Table 5 produces the corrected college Z score. To take the groups' homogeneity into account, the college Z score is weighted with the standard deviation for the secondary school Z scores (IDGZ), then the indicator of group strength is added, based on the average secondary Z scores (ISGZ). To obtain the college R score, first the negative values are eliminated by adding the constant 5 to the corrected college Z score. This figure is then multiplied by 5 to situate the results on a new scale with a fixed amplitude between 0 and 50. Most of the R scores are between 15 and 35. As shown in Table 5, Camille, for example, has a college R score of 34.08.

Considering the hypothesis that for group A, the IDGZ is 0.80 and the ISGZ is 0.55 and for group C, the IDGZ is 1.00 and the ISGZ is 0.72 and applying the same calculations as in Table 5, we obtain the college R scores for each student in the three groups shown in Table 6. Using the R score as a classification tool, it is obvious that the six best students are the following: the first in class A, the first three in class B, and the first two in class C. Clearly, there is no advantage to being in a class of weaker students (class A), nor does being part of a more homogenous or stronger group (class B) penalize the better students.

4 For more information about this topic, see the report on the college R score submitted by the Comité de gestion des bulletins d'études collégiales (CGBEC) to the members of the Comité de liaison de l'enseignement supérieur (CLES) on September 3, 2014.

TABLE 5
DETERMINING THE R SCORE

Class B						
Student	**Grade**	**Z score**	**Correction with IDGZ**	**Correction with IFGZ**	**Corrected Z score**	**R score**
William	79	1.55	0.60	1.12	2.05	35.25
Camille	78	1.16	0.60	1.12	1.82	34.08
Vincent	77	0.77	0.60	1.12	1.58	32.91
Olivia	76	0.39	0.60	1.12	1.35	31.77
Francis	75	0.00	0.60	1.12	1.12	30.60
Antoine	74	-0.39	0.60	1.12	0.89	29.43
Emma	73	-0.77	0.60	1.12	0.66	28.29
Nathan	72	-1.16	0.60	1.12	0.42	27.12
Audrey	71	-1.55	0.60	1.12	0.19	25.95

R score = ((Zcol x IDGZ) + ISGZ +5) x 5

Example of Camille:

Corrected college Z score: (1.16 x 0.60) + 1.12 = 1.82

College R score: (1.82 + 5) x 5 = 34.08

TABLE 6
R SCORES

Class A		Class B		Class C	
Florence	33.95*	William	35.25*	Annie	36.35*
Olivier	32.39	Camille	34.08*	Alexis	34.40*
Jade	30.83	Vincent	32.91*	Catherine	32.45
Étienne	29.31	Olivia	31.77	Émilie	30.55
Gabrielle	27.75	Francis	30.60	Rosalie	28.60
Guillaume	26.19	Antoine	29.43	Xavier	26.65
Marie	24.67	Emma	28.29	Jacob	24.75
Samuel	23.11	Nathan	27.12	Félix	22.80
Chloé	21.55	Audrey	25.95	Sarah	20.85

* The six best scores

Moreover, it should be kept in mind that the correction made to the college Z score depends on the group to which the student belongs at the time of the evaluation. Indeed, this group may not be limited to one class, but could include all the students at a college who took the same course in the same year, in the same semester, and who were graded in the same manner. This is called the “group at evaluation.” For example, if during the Winter term a professor teaches the same course to three groups of 40 students each, and if the same grading method is used, the evaluation should focus on a single group of 120 students. It is for this entire group that the college Z score and the two correction factors (group strength and dispersion) will be calculated.

3. THE R SCORE AND THE ADMISSIONS PROCESS

3.1 IMPORTANCE OF THE R SCORE IN THE ADMISSIONS PROCESS

Even though the R score is the instrument of choice for evaluating an application for admission to a university program, in the final analysis it is used mainly in the selection process for admission to programs with limited enrollment. A student planning to apply for admission to such a program should be aware of the important role that grades play in the selection process.

It should be pointed out that, in a number of limited enrollment programs, other criteria may replace or supplement the R score for the selection of candidates. In some cases this could mean sitting for a particular exam, taking an entrance test, being interviewed, submitting a portfolio, etc. This kind of information is compiled by the BCI and is available in the "Tableau comparatif des critères de sélection des candidatures évaluées sur la base du DEC aux programmes contingentés de baccalauréat". The R score may well be a criterion in the selection process, but is not necessarily the only one, for college students who hope to go into fields where admission to the study program is highly competitive.

3.2 OVERALL AVERAGE R SCORE

The overall average R score encompasses all the courses a student has taken. It is the weighted average of that student's valid R scores: only Physical Education taken before Fall 2007 and remedial courses are excluded. The weighting is a function of the number of credits attributed to each course. Thus, the R score obtained in a 2.66-credit course is multiplied by this number (2.66), while the R score for a 2-credit course is multiplied by 2.

For admissions to semesters prior to Fall 2009, an academic record was evaluated, compared, and classified in terms of its overall weighted average R score.

3.3 WEIGHT OF FAILURES IN THE CALCULATION OF THE AVERAGE R SCORE

The Comité de liaison de l'Enseignement supérieur (CLES) approved the recommendation by the Comité de gestion des bulletins d'études collégiales (CGBEC) to give less importance to failed courses for calculation of the average R score. Consequently, beginning with admissions for Winter 2005, the weight of failures in the calculation of the R score changed: for the first term of CEGEP registration, failed courses only count for one quarter of the credits allocated to the course, in other words they have a weighting of 0.25; for subsequent terms, the weighting is 0.50. This calculation method applies to all records in the MEES system, known as "système de gestion des données d'élèves au collégial" (Socrate), regardless of the date of first registration at CEGEP.

3.4 PROGRAM AVERAGE R SCORE[5]

The CLES approved the CGBEC recommendation that, as of admissions in Fall 2009, the MEES would include in its system (Socrate) a mechanism whereby each course would be linked to the study program to which it belonged, thus making it possible to calculate an average R score for each DCS program in which a student registered.

For the purpose of selecting candidates, universities use the average R score for the last DCS program in which a candidate was registered, on the condition that at least 16 courses contribute to the calculation. The R scores of courses that are considered to be relevant prerequisites for admission to certain university programs are incorporated into the average R score calculation, when necessary. If the average R score calculation for the last registered program is not based on at least 16 courses, then the overall average R score, the one that takes into account all of a student's CEGEP grades, is used to evaluate the student's record.

Furthermore, when the student's record includes a completed DCS, the university uses the higher of the average R score for that DCS program and the average R score for the last registered program (still with the condition that at least 16 courses contributed to the calculation). If a student's record shows MEES certification for several DCS programs, then the university will use the highest average R score of the completed DCS programs and the last registered program (again if the 16-course condition is satisfied). Relevant prerequisites are added, when necessary, to the average R score used for admissions purposes[6].

The 16 courses criterion ensures that, in the great majority of cases, the last registered program is the one which will lead to *obtaining* the DCS. That R score is thus not influenced positively or negatively by the candidate's previous academic activities that are unrelated to the DCS program. It is important to emphasize here that all general education courses always contribute to every average R score in a student's record.

Since university programs do not all require the same prerequisite courses, the value of the average R score used for analysis of a candidate's record may vary depending on the intended university program. However, in most cases, the prerequisites are already included in the student's CEGEP program. The prerequisites then do not need to be added to the calculation of the R score. Such is the case, for example, for a CEGEP graduate with a DCS in Science who wishes to be admitted into a university Health Sciences program.

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5 To manage most admissions to their study programs, McGill University does not use the program R score but rather the overall R score, which includes all of the college-level grades obtained by a candidate. If the candidate is enrolled in more than one college program and would like to know which R score will be used for evaluation of his file, he must contact the Admissions Office at McGill University.

6 To facilitate understanding of these rules, some fictitious examples of potential cases are described in Appendix B. Note that if the MEES certification of college studies was issued prior to Fall 1999, then no program average R score can be calculated by the MEES system. The courses concerned will only contribute to the calculation of the overall average R score.

3.5 ADJUSTMENTS FOR CERTAIN CANDIDATES

For admissions to the Fall 2009 and subsequent terms, the academic affairs vice rectors of Québec universities agreed to increase the average Z score for each student graduating from an International Baccalaureate program or a Diploma of College Studies (DCS) program in Science, Letters and Arts (SLA) by 0.5 point. However, the introduction of the modified Z score no longer justifies such an increase. As mentioned in section 3.6 below, the modified formula is being used by colleges as of the Fall 2017 term and applied retroactively to all courses taken from the Fall 2014 to Summer 2017 semesters (nine semesters). Consequently, students who registered at college after the Fall 2014 term in the IB or DCS (SLA) programs will no longer have the 0.5 point added to their average R score.

Furthermore, in order to facilitate access to doctor of medicine programs for candidates in remote regions, universities increase these candidates' average R score when their record is analysed. Since the Fall 2003 semester, universities have added 0.5 to the average R score of any doctor of medicine program candidate who completed their Secondary 5 education in one of the remote regions designated by the Ministère de la Santé et des Services sociaux. The list of these regions is available at www.msss.gouv.qc.ca.

3.6 PROCEDURE FOR INTRODUCING THE MODIFIED R SCORE

Initially, the R score calculation was based on a college Z score corrected by only one indicator, the ISG[7]. This calculation was in effect until the end of the Summer 2017 semester. Beginning in Fall 2017, the R score will be calculated with the college Z score corrected by the two indicators described in section 2.2 of this document, the ISGZ and the IDGZ. To smooth the transition between the two calculation methods, the following procedure has been agreed upon:

- The modified R score will be used in colleges as of the Fall 2017 term (benchmarks to be calculated in January 2018) and will apply retroactively to all courses taken between the Fall 2014 and the Summer 2017 terms (nine semesters).
- Retroactive use of the calculation will not reduce any course R score already obtained before the modified R score was introduced.

To illustrate this procedure, here is an example for a student who started college in Fall 2016. For both the Fall 2016 and the Summer 2017 semesters, the revised formula will be applied retroactively. However, the student's course R scores, based on the initial calculation, will not change if they are higher than the scores obtained with the modified formula. As of the Fall 2017 term, and for all subsequent semesters, the student's course R scores will be calculated exclusively with the revised formula.

With this method, the first students whose R scores are calculated with the modified formula will enter university in Fall 2018. Also, with the revised formula, it is possible that some R score thresholds, i.e., the last candidate admitted to a given university program, may rise.

7 For more information about this topic, see: *The R Score: What It Is and What It Does*, CREPUQ, March 4, 2013.

CONCLUSION

For many years, universities have relied on the college Z score to compare the grades of college graduates. This statistical tool made it possible to rank students within their group. It was noticed, however, that students in high-performing groups had serious difficulty obtaining a good college Z score. The R score was introduced to correct for this undesirable situation. The college Z score is adjusted by using two indicators that take the college group's strength and dispersion into account; a student's results can thus be ranked independently of the characteristics of the college attended, the program, or the class composition. It was further noted that the impact of a student's secondary school grades on calculation of the R score is marginal at best; a student need not fear being hobbled by secondary school grades when entering university.

By incorporating an indicator of group strength and an indicator of group dispersion into the college Z score, the college R score becomes a definitively fair classification instrument. It ensures that the academic records of college graduates applying for university admission are evaluated as equitably as possible, no matter the college of origin. The R score thus gives the best students from all colleges equal access to university programs with the lowest enrollment quotas.

APPENDIX A: R SCORE FORMULA

The following is a detailed mathematical description of the concepts that make up the R score.

An assessment of a person's academic record in terms of the R score requires, for each course, the calculation of a college Z score, a numerical value that ranks the student within his group, and two correction factors reflecting the strength and dispersion of that group relative to other groups. These calculations are made for each grade in a student's academic record, except for Physical Education courses taken before Fall 2007 and any remedial courses.

The formula used to evaluate the R score is:

R score = ((Zcol x IDGZ) + ISGZ+ C) x D

In which Zcol is the college Z score; ISGZ is the indicator of the strength of the group; IDGZ is the indicator of the dispersion of the group; C and D are constants with a value of 5.

CONSTITUTIVE ELEMENTS OF THE R SCORE

1. THE FIRST ELEMENT: THE COLLEGE Z SCORE

Drawn from the field of statistics, the Z score represents one individual's position within a distribution of students in terms of two parameters: the average grade for the group and the standard deviation of the grade distribution. The Z score normalizes to a common scale grade distributions that differ in their averages and standard deviations, which simplifies the grade comparison process. Therein lies its utility. Grades obtained in different courses can, in principle, be compared when each is expressed as a Z score.

- ***Calculating the Z score***

$$\text{Z score} = \frac{X - \overline{X}}{\sigma}$$

where X is the student's grade;

$\overline{X}$ is the average grade for the group

σ is the standard deviation (a measure of the grade spread)

The value of the Z score is determined by two basic parameters of the grade distribution: its arithmetic average, and its standard deviation.

To evaluate the grade average and standard deviation for a course, the grades of all the students at a college who took that course during the same semester of the same year in the same group are used. Grades of less than 50 percent are excluded from the calculation of the two reference quantities, i.e., the average and the standard deviation.

- ***The arithmetic mean***

The arithmetic mean $(\overline{X})$ (or average) of a grade distribution is its center of gravity: all the grades are distributed in a balanced fashion on either side of it. It is obtained by dividing the sum of all the grades in the distribution by the number of the grades:

$$\overline{X} = \frac{\sum X_i}{N}$$

where $\sum X_i$ is the sum of the grades, and

N is the number of grades.

- ***The standard deviation***

The standard deviation (σ) of a grade distribution measures the spread of the grades about the arithmetic mean. A large value for the standard deviation indicates that the group's grades extend quite far from the mean, whereas a small standard deviation value is a sign that the grades are more bunched up. In mathematical terms, the standard deviation is the square root of the average squared deviation:

$$\sigma = \sqrt{\frac{\sum (X_i - \overline{X})^2}{N}}$$

where $(X_i - \overline{X})$ is the deviation of grade X_i from the grade average.

The Z score corresponding to a grade X in a distribution can be calculated once the average and standard deviation for that distribution have been determined.

The Z score expresses the difference between the corresponding grade and the distribution average in standard deviation units. Thus, Z = 0 means that the grade is equal to the average, while Z = +1 indicates that the grade is one standard deviation above the average, etc.

The Z scores of a group always have the same average (0.0) and the same standard deviation (1.0), retaining their significance regardless of the numerical values of the averages and standard deviations of their source distributions. Consequently, grades from different distributions transformed into Z scores are simply normalized to a common scale whose average value is 0 and whose standard deviation is 1. Comparison of results is now possible.

Converting grades to Z scores so that they can be compared from one course to another and from one college to another rests on the principle that all grade distributions are identical. While this postulate is impossible to verify, it must be accepted if there is to be a relatively objective basis for comparing candidates' academic records.

2. Second and third elements: indicator of the strength of the group (ISGZ) and indicator of the dispersion of the group (IDGZ)

In addition to calculating the college Z score for every grade obtained by the students in a given group, two correction factors, ISGZ and IDGZ, need to be calculated for each group. These two factors are obtained from the secondary Z score for MEES uniform examination subjects[8] taken by each student in the college group. The calculation is based on the final grades for Secondary 4 and 5 subjects for which uniform examinations are imposed by the MEES. The indicator of the strength of the group is based on the average of the secondary Z scores and calculated with the formula below:

$$ISGZ = \frac{Z\sec_{i=1} + Z\sec_{i=2} + Z\sec_{i=3} + \ldots + Z\sec_{i=n}}{\text{Number of students}}$$

The indicator of the dispersion of the group, based on the standard deviation of the secondary Z scores, is calculated with the following formula:

$$IDGZ = \sqrt{\frac{(Z\sec_{i=1} - ISGZ)^2 + (Z\sec_{i=2} - ISGZ)^2 + (Z\sec_{i=3} - ISGZ)^2 + \ldots + (Z\sec_{i=n} - ISGZ)^2}{\text{Number of students}}}$$

3. Fourth element: the constants C and D

Adding the constant C (C = 5) eliminates negative values. When the sum of the three values is multiplied by D (D = 5), the product becomes a quantity between 0 and 50 that can be situated on a scale with a fixed amplitude. Most R scores fall between 15 and 35.

4. Course R score weighting

This is the average R score weighted by the number of credits for each course used to evaluate candidates. This value is calculating by adding the weighted college R scores for the courses (weighted by the number of credits for each course) and dividing by the total number of credits in the candidate's college record. Note that weightings of failed courses are included in the R score calculation: for the first semester of CEGEP registration, failed courses count for one quarter of the credits allocated to the course, for a weighting of 0.25; for subsequent semesters, the weighting is 0.50.

5. Calculation conventions

No R score is calculated for Physical Education taken before Fall 2007 or for remedial courses.

No R score will be attributed to a course that cannot be processed with the Z score calculation.

Grades below 50 are not considered when calculating the average and standard deviation of a grade distribution.

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[8] Grades for each course are weighted by the number of credits for the course.

A college Z score will not be calculated when there are fewer than six grades in a group or when all of the students in the group have received the same grade.

In order for a student's secondary grades to be included in calculation of the ISGZ and IDGZ, two conditions must be met: the student must have obtained a Diploma of College Studies (DCS), and as noted above, the student must have scored at least 50 percent in the college course concerned.

If there are fewer than six secondary Z scores in a group, the ISGZ will have a value of 0, the IDGZ will have a value of 1 and no correction will be made to the college Z score for these students.

By general agreement:

- a college Z score with IDGZ weighting can never be greater than +3.0 nor less than -3.0
- an indicator of the strength of a group can never be greater than +2.0 nor less than -2.0
- an indicator of the dispersion of a group can never be greater than +1.5 nor less than 0.5

If, for a grade of 100, the formula does not produce a minimum college Z score, weighted by the IDGZ, of 2 and a minimum R score of 35, the formula used to calculate the Z score for students whose grades are higher than the group average is as follows:

- when the ISGZ is greater than or equal to 0:

$$Z\ score = \frac{\left(X - \overline{X}\right)}{\left(\frac{\left(100 - \overline{X}\right)}{2}\right)}$$

- when the ISGZ is less than 0:

$$Z\ score = \frac{\left(X - \overline{X}\right)}{\left(\frac{\left(100 - \overline{X}\right)}{(2 - IFGZ) \div IDGZ}\right)}$$

APPENDIX B: PROGRAM AVERAGE R SCORE AND THE ADMISSIONS PROCESS

This appendix provides fictitious examples to facilitate comprehension of the set of rules provided in section 3.4 for use of the program average R score for university admissions purposes. The illustration assumes that 10 college courses (all of them from the Science program) are required for admission to Physiotherapy, while none are required for admission to Law

The minimum average R score thresholds in these examples are for illustrative purposes only. Candidates will find all the relevant information regarding admission thresholds and prerequisites on each university's website.

1. WHEN A CANDIDATE HAS NOT PREVIOUSLY COMPLETED A DCS PROGRAM PRIOR TO CHANGING PROGRAMS AT CEGEP

Example 1

Candidate 1 applies to Law, for which the minimum average R score to be admitted is 28.

Program	Last registration	Average R score	Number of contributory courses	DCS
Social sciences	Fall 2008	28.53	28	No
Sciences	Fall 2006	26.15	18	No
Overall record	n/a	27.60	n/a	n/a

In this example, the average R score of the last academic program in which the student was registered (Social Sciences) is used to analyse the candidate's record. He is admitted, since it is above 28 (28.53).

Example 2

Candidate 2 applies to Physiotherapy, for which the minimum average R score to be admitted is 30.

Program	Last registration	Average R score	Number of contributory courses	DCS
Science	Fall 2008	30.40	25	No
Social sciences	Winter 2005	31.78	26	No
Overall record	n/a	31.10	n/a	n/a

University prerequisites	n/a	29.15	10	n/a

The last academic program in which the candidate was registered is Science. Given that the R scores of the relevant prerequisites are already included in the program average R score for Science, it is not necessary to include them. The candidate is admitted since the average R score used to analyse the candidate's record is above 30 (30.40).

Example 3

Candidate 3 applies to Physiotherapy, for which the minimum average R score to be admitted is 30.

Program	Last registration	Average R score	Number of contributory courses	DCS
Social sciences	Fall 2008	32.15	26	No
Science	Fall 2006	26.75	22	No
Overall record	n/a	29.68	n/a	n/a

University prerequisites	n/a	27.50	10	n/a

The Social Sciences (last registered academic program) average R score, with the addition of the R scores for the university prerequisites, is used to analyse the candidate's record. A new weighted average (supposing that the prerequisites have the same weight as the other contributory courses in the average R score calculation) is calculated. In this example, each course used in the average R score calculation is presumed to have the same number of credits. However, the general principle consists in weighting the R score for each course by the number of credits that are attached to it:

R score = (32.15 X 26 + 27.50 X 10) / (26 + 10) = **30.86**

The candidate is admitted since his average R score used for admissions purposes is above 30 (30.86).

2. WHEN A CANDIDATE HAS PREVIOUSLY COMPLETED A DCS PROGRAM PRIOR TO RETURNING TO CEGEP IN A DIFFERENT PROGRAM

Example 4

Candidate 4 applies to Physiotherapy, for which the minimal average R score to be admitted is 30. He completed a DCS in Social Sciences before returning to CEGEP in a Science program.

Program	Last registration	Average R score	Number of contributory courses	DEC
Science	Fall 2008	28.25	20	No
Social sciences	Fall 2006	31.10	26	Yes
Overall record	n/a	29.86	n/a	n/a

University prerequisites	n/a	28.12	10	n/a

The average R score used for record analysis is the higher of the program R score that led to the DCS (Social Sciences) and the average R score of the last academic program in which the student was registered (Science), with the addition, if necessary, of the R scores for the relevant university prerequisites. In this example, the Science prerequisite R score is added to the average R score for the Social Sciences program:

R score = (31.10 X 26 + 28.12 X 10) / (26 + 10) = **30.27**

The candidate is admitted since the average R score used to analyse the candidate’s record is above 30 (30.27).

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