The R score : what it is, and what it does

Document approved by the Comité de gestion des bulletins d'études collégiales, November 30, 2000 and updated February 5, 2009

CREPUQ
CONFÉRENCE DES RECTEURS
ET DES PRINCIPAUX
DES UNIVERSITÉS DU QUÉBEC

TABLE OF CONTENTS

INTRODUCTION **4**

1. CLASSIFICATION METHODS **5**

1.1 The average grade 5
1.2 The Z score 5
1.3 The R score 6

2. A SAMPLE DETERMINATION OF THE R SCORE **7**

2.1 The effect of using the Z score 7
2.2 Using the ISG 10

3. THE R SCORE AND THE ADMISSIONS PROCESS **13**

3.1 The importance of the R score in the admissions process 13
3.2 Global average R score 13
3.3 Weight of failures in the calculation of the average R score 13
3.4 Program specific average R score 14
3.5 Adjustments for particular candidates 15

CONCLUSION **16**

APPENDIX A: FORMULA FOR THE R SCORE **17**

APPENDIX B: PROGRAM SPECIFIC AVERAGE R SCORE AND THE ADMISSIONS PROCESS **21**

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 in comparing and classifying 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 purposes of selection by utilizing statistical methods to correct for observed differences in the grading systems used by the colleges, and to adjust the resulting values so as to take into account the relative strength 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 formulation.

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 on the college R score*. These two informational documents, as well as the present document, are available on the web site of the Conference of Rectors and Principals of Québec Universities (CREPUQ) at the following address: www.crepuq.qc.ca in the section "Admission et dossier étudiant".

[1] The R score is now generally accepted in English to mean the *cote de rendement au collégial (CRC)*.

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's student record and dividing the sum by the number of these 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 thus 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 in admitting 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 R SCORE

The R score contains two types of information for each course taken by a student: an indicator of that student's rank in the group based on that individual's grade (the Z score), and an indicator of the relative strength of that group (ISG). Thus, the R score allows for the initial differences between groups in addition to the advantages of the Z score.

This corrective method can be applied to all college courses as it permits an adequate adjustment of each student's situation. Its general utility allows appropriate adjustments to be made to account for each student's particular situation. In other words, should a student attend a different college, or switch to another program or another group, the Z score for each course will be adjusted according to the indicator of the group in which the evaluation takes place.

Thus, in addition to retaining all of the advantage of the Z score, the R score adds a correction that takes into account the initial differences between the groups.

2. A SAMPLE DETERMINATION OF THE R SCORE[2]

The following example shows how the R score is calculated and illustrates how it can influence candidate classification. In the process, its two main components, the Z score and the ISG (Indicator of the relative strength of a group), are described.

2.1 THE EFFECT OF USING THE Z SCORE

As seen in Table 1, grades for the students in class A range from 81 to 89 percent, in class B between 71 and 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.

If the differences in average grades between these three groups of students 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.

TABLE 1
GRADE DISTRIBUTION

Class A		Class B		Class C	
Brigitte	89*	Benoît	79	Annie	91*
Claude	88*	Camille	78	Bastien	87*
Dominique	87*	Denis	77	Catherine	83
Étienne	86*	Élise	76	Émilie	79
Françoise	85	Francis	75	Francine	75
Guillaume	84	Gilles	74	Guy	71
Marie	83	Monique	73	Mathieu	67
Philippe	82	Robert	72	Richard	63
Sophie	81	Suzanne	71	Sarah	59
Sun of the grades	765		675		675
Number of students	9		9		9
AVERAGE GRADE	85		75		75

* The six best scores

[2] This example was drawn from an article by Fernand Boucher, registrar at the Université de Montréal: “La cote de rendement au collégial et l’admission à l’université”, *Guide pratique des études universitaires au Québec, 2001*, Service régional d’admission du Montréal métropolitain (SRAM), 2000.

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 if, 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 is one of the deficiencies in simply posting grades that can be corrected for when using the Z score.

TABLE 2
DEVIATION FROM THE AVERAGE

Class A		Class B		Class C	
Brigitte	4*	Benoît	4 *	Annie	16*
Claude	3	Camille	3	Bastien	12*
Dominique	2	Denis	2	Catherine	8*
Étienne	1	Élise	1	Émilie	4*
Françoise	0	Francis	0	Francine	0
Guillaume	-1	Gilles	-1	Guy	-4
Marie	-2	Monique	-2	Mathieu	-8
Philippe	-3	Robert	-3	Richard	-12
Sophie	-4	Suzanne	-4	Sarah	-16

* The six best scores

But, 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 due to variations in the grading methods are to be made. 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 results from the grades for this class being 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, while penalizing even more the weaker ones 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.

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, Brigitte 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.

TABLE 3
SQUARE OF THE DEVIATION FROM THE AVERAGE

Class A		Class B		Class C	
Brigitte	16	Benoît	16	Annie	256
Claude	9	Camille	9	Bastien	144
Dominique	4	Denis	4	Catherine	64
Étienne	1	Élise	1	Émilie	16
Françoise	0	Francis	0	Francine	0
Guillaume	1	Gilles	1	Guy	16
Marie	4	Monique	4	Mathieu	64
Philippe	9	Robert	9	Richard	144
Sophie	16	Suzanne	16	Sarah	256
Sum of the square 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

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 mean 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	
Brigitte	1.55 *	Benoît	1.55 *	Annie	1.55 *
Claude	1.16 *	Camille	1.16 *	Bastien	1.16 *
Dominique	0.77	Denis	0.77	Catherine	0.77
Étienne	0.39	Élise	0.39	Émilie	0.39
Françoise	0.00	Francis	0.00	Francine	0.00
Guillaume	-0.39	Gilles	-0.39	Guy	-0.39
Marie	-0.77	Monique	-0.77	Mathieu	-0.77
Philippe	-1.16	Robert	-1.16	Richard	-1.16
Sophie	-1.55	Suzanne	-1.55	Sarah	-1.55

* The six best scores

2.2 USING THE ISG

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 comparisons of these grades are invalid since a choice of the six best students would leave out all the students from class B. The Z score, for its part, by permitting the retention of two students per class, 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 the grades and the Z score cannot take into account the specific characteristics of these three groups of students, in order to assure them equitable treatment, it is therefore necessary to examine another element these individuals have in common: the relative strength of the group in which a student is part of for a given course. This group strength is based on the weighted average of the grades obtained in the compulsory courses of Secondary IV and V specific to each pedagogical regime (present and past) and followed in the Youth sector.[3] Various studies have conclusively shown that academic performance in the last two years of secondary study is a fair indicator of subsequent performance in college[4]. On the other hand, it should be kept in mind that the classification a student obtains in a course taken at the CEGEP depends entirely on the grade obtained in that course and not on results at the secondary level. The student's average at the secondary level, like that of the other students in the same course, will only serve to determine the ISG. The direct effect of a student's secondary school average on that individual's classification at college will be very limited: for example, it will count for no more than 3% of the ISG if there are 35 students in the group.

The ISG, the term used to correct the Z score, is obtained from the following expression:

$$\text{ISG} = \frac{\text{average grade of the group at the secondary} - 75}{14}$$

This formula was not simply pulled out of the air. It was developed through simulations using data from a large number of college students studying in various parts of the province.

As an example, consider the students in class B. The average of their individual average grades at secondary school is 85. As shown in Table 5, the correction value to be added to each Z score is 0.71. This value would have been larger for a stronger group, and smaller for a weaker one. To obtain the R score, the negative values of the corrected Z score are eliminated by adding the number 5 to them. Multiplying the resulting sum by 5 distributes the resulting R scores on a new scale extending

[3] For admissions prior to the Fall 2009 semester, all grades obtained in Secondary IV and V serve to the calculation of the ISG.

[4] *See* Terril et Ducharme (1994), *Passage secondaire-collégial : Caractéristiques étudiantes et rendement scolaire, Montréal*, SRAM.

from 0 to 50; the majority of the R scores will be found between 15 and 35. As one can see in Table 5, Camille, for example, obtains an R score of 34.35.

If the strength of group A at the secondary were assumed to be 78 and that of group C to be 82, the formula above would have 0.21 added to the Z score of each student in group A and 0.5 added to each student in group C. The R score can now be calculated for the students of classes A and C using the protocol that was used in Table 5. Table 6 lists the calculated R scores for the three classes A, B, and C. By using the R score as a classification tool, one can see 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 an average or strong group (class B) penalize its better students.

TABLE 5
DETERMINING THE R SCORE

Class B					
Student	**Grade**	**Z score**	**Correction**	**Corrected Z score**	**R score**
Benoît	79	1.55	0.71	2.26	36.30
Camille	78	1.16	0.71	1.87	34.35
Denis	77	0.77	0.71	1.48	32.40
Élise	76	0.39	0.71	1.10	30.50
Francis	75	0.00	0.71	0.71	28.55
Gilles	74	-0.39	0.71	0.32	26.60
Monique	73	-0.77	0.71	-0.06	24.70
Robert	72	-1.16	0.71	-0.45	22.75
Suzanne	71	-1.55	0.71	-0.84	20.80

Average grade: 75
Group average at secondary school: 85
Correction: ((85-75)÷14) = 0.71
Taking Camille as an example:
Corrected Z score : 1.16+0.71 = 1.87
R score = (1.87+5) x 5 = 34.35

TABLE 6
R SCORE

Class A		Class B		Class C	
Brigitte	33.80*	Benoît	36.30*	Annie	35.25*
Claude	31.85	Camille	34.35*	Bastien	33.30*
Dominique	29.90	Denis	32.40*	Catherine	31.35
Étienne	28.80	Élise	30.50	Émilie	29.45
Françoise	26.05	Francis	28.55	Francine	27.50
Guillaume	24.10	Gilles	26.60	Guy	25.55
Marie	22.20	Monique	24.70	Mathieu	23.65
Philippe	20.25	Robert	22.75	Richard	21.70
Sophie	18.30	Suzanne	20.80	Sarah	19.75

* The six best scores

Moreover, it should be kept in mind that the correction made to the Z score depends on the group the student is part of at the time of the evaluation. Indeed, this group could include all the students of a college who took this course in one or another of the many sections it was offered that 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 be of a single group of 120 students. It is from this whole group that the Z score and the ISG will be determined.

3. THE R SCORE AND THE ADMISSIONS PROCESS

3.1 THE IMPORANCE OF THE R SCORE IN THE ADMISSIONS PROCESS

Even if the R score is the instrument of choice in 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 of 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 several limited enrollment programs, other criteria may replace or supplement the R score in the selection of candidates. In certain cases this could mean sitting for a particular exam, taking an entrance test, being interviewed, submitting a portfolio, etc. This kind of information is kept on file by the CREPUQ 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 then well be a criterion in the selection process, though not necessarily the only one, for those college students who hope to go into fields where admission to the study program is highly competitive.

3.2 GLOBAL AVERAGE R SCORE

The global average R score keeps track of all CÉGEP activities of a student. It is the weighted average of that student's valid R scores: only Physical Education taken before Fall 2007 and qualifying courses[5] are excluded. The weighting is a function of the number of units attributed to each course. Thus, the R score obtained in a course to which was attributed 2.66 units is multiplied by this number (2.66), while the R score in a course of 2 units is multiplied by 2.

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

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 of the Comité de gestion des bulletins d'études collégiales (CGBEC) to give less importance to failed courses in the calculation of the average R score. Consequently, beginning with admission for Winter 2005, the weight of failures is considered in the calculation of the R score: for the first term of registration at CEGEP, failed courses only count for one quarter of the units allocated to the course, in other words they have a weighting of 0.25; for subsequent terms, the weighting is 0.50. This method of calculation is applied for all records present in the ministerial system, known as "système de gestion des données d'élèves au collégial" of MELS (Socrate), regardless of the date of first registration at CEGEP.

[5] Qualifying courses (*cours d'appoint*) are secondary-level courses that must either be taken or repeated and passed to satisfy the admission requirements for certain college programs.

3.4 PROGRAM SPECIFIC AVERAGE R SCORE

The CLES approved the recommendation of the CGBEC that, as of admissions to Fall 2009, the MELS includes in its system (Socrate) a mechanism permitting each course to be linked to the study program to which it belongs, thus making possible the calculation of an average R score for each program in which a student has registered in CÉGEP.

For the purpose of selecting candidates, universities therefore use the average R score of the last DEC program in which a candidate has registered, with the condition that at least 16 courses contribute to its calculation. The R scores of the courses that are considered to be relevant prerequisites for admission to certain university programs are integrated into the average R score calculation, when necessary. If the calculation of the average R score of the last registered program is not based on at least 16 courses then the global average R score, that is, the one that takes into account all CÉGEP grades of a student, is used for the analysis of a student record.

Furthermore, when the student has already completed a DEC, the university uses the highest amongst the average R score of the program that has led to the DEC and the average R score of the last registered program (with the condition that at least 16 courses contribute to its calculation). If many DEC sanctions appear in a student record, then a university uses the highest amongst the average R score of the completed DEC programs and the R score of the last registered program (again if the 16 courses 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 the DEC. That R score is thus not influenced upwardly or downwardly by previous academic activities that are not linked to the DEC program aimed at by a candidate. It is important to underline here that all general background courses contribute to each average R score appearing in a student record.

Since university programs do not all require the same prerequisite courses, it is possible that the value of the average R score serving for the analysis of a candidate's record may vary depending on the university program applied to. However, the prerequisites are in most cases already integrated into the CÉGEP program of a student. The addition of the prerequisites to the calculation of the R score is then not required. It is the case, for example, for a CÉGEP graduate of a DEC in Science who wishes to be admitted into a Health Sciences program in university.

[6] In order to facilitate the understanding of these rules, fictitious examples representing a certain number of potential cases are described in appendix B. Note that if the "régime de sanction des études collégiales" is prior to Fall 1999 ("régime 1"), then no program specific average R score can be calculated in the ministerial system. The concerned courses then simply contribute to the calculation of the global average R score.

3.5 ADJUSTMENTS FOR PARTICULAR CANDIDATES

Since the Fall 1999 semester, the vice-rectors for academic affairs of Quebec universities agreed to increase by 0.5 points the average of all students completing an international baccalaureate or the DEC programs in Science, Letters and Arts.

Furthermore, in order to facilitate access to doctoral medicine training by candidates in remote regions, universities increase the average R score of all these candidates when their record is analysed. In place since the Fall 2003 semester, universities increase by 0.5 the average R score of any candidate to a doctorate in medicine program who has completed their Secondary 5 studies in one of the remote regions as designated by the ministère de la Santé et des Services sociaux. The list of these regions is available at www.msss.gouv.qc.ca.

CONCLUSION

For many years, universities have relied on the Z score to compare the grades of college graduates. This statistical tool has made it possible to rank students within their group. It was noticed, however, that students in strongly performing groups had great difficulty in getting a good Z score. The R score was introduced to correct for this undesirable situation. The Z score is adjusted by using a correction indicator which takes into account the strength of the college group, and permitting the placement of a student's results independent of the characteristics of the college attended, the program followed, or the class makeup. It was noted that the impact of a student's secondary school grades on the R score is marginal at best; a student need not fear entering the university hobbled by grades at the secondary level.

By adding an indicator of the strength of the group to the Z score, the R score becomes, definitively, a just and equitable classification instrument. It ensures that the academic record of college graduates making a university admission request is evaluated as equitably as possible, no matter the college of origin. The R score thus provides to the best students in all the colleges equal access to university programs of limited enrollment with the smallest quotas.

APPENDIX A: FORMULA FOR THE R SCORE[1]

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

An assessment of someone's academic record in terms of the R score requires that two constitutive elements be evaluated: the Z score, whose numerical value is used to rank the student in his group, and a factor, the ISG, which measures the strength of that group relative to that of other groups. These two elements must be calculated for each grade in a student's academic record, with the exception of courses in Physical Education taken before Fall 2007 and any qualifying courses[2].

The expression used in evaluating the R score is:

R score = (Z + ISG + C) x D

where Z and ISG are respectively the numerical expressions for the Z score and the indicator of the strength of the group and C and D are constants whose value is 5.

THE CONSTITUTIVE ELEMENTS OF THE R SCORE

1. THE FIRST ELEMENT: THE Z SCORE

Drawn from the field of statistics, the Z score expresses an individual's rank within a distribution of students in terms of two parameters: the average grade for the group and the standard deviation of their grade distribution. The Z score normalizes to a common scale grade distributions that differ in their averages and standard deviations, thereby simplifying the process of grade comparison. 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***

  The Z score appropriate to a given grade is obtained using the following expression:

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

  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 average and the standard deviation of the grades 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 must be used. Grades of less than 50 percent are excluded from the calculation of these two reference quantities, i.e., the average and the standard deviation.

[1] The R score is generally accepted in English to mean *the cote de rendement au collégial (CRC).*

[2] Qualifying courses (*cours d'appoint*) are secondary-level courses that must either be taken or repeated and passed to satisfy the admission requirements for certain college programs.

- ***The arithmetic average***

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

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

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

  The Z score corresponding to a grade X in a distribution can be evaluated 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 units of standard deviation. 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. Comparing results is now possible.

  Transforming 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 the academic records of candidates.

- ***Constraints***

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

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

  All grades below 31 percent are given the Z score of a grade of 30 percent.

By general agreement, a Z score can never exceed +3.0 nor be inferior to -3.0.

If the Z score obtained for a grade of 100 is inferior to 2, a corrected standard deviation is determined using the following expression:

$$\sigma_{corrected} = \frac{100 - \overline{X}}{2}$$

Thus, the corrected standard deviation is always equal to half the difference between a grade of 100 and the arithmetic average of the grades equal to or greater than 50. It is this standard deviation value which is used in evaluating the Z score of each of the students whose grade is between 100 and the arithmetic average grade of the group. Because of this correction, a student with a grade of 100 is assured a Z score of at least +2.

Some courses, such as Physical Education taken before autumn 2007 and qualifying courses, are not subject to analysis in terms of the Z score.

2. THE SECOND ELEMENT: THE INDICATOR OF THE STRENGTH OF THE GROUP (ISG)

In addition to determining the Z score corresponding to each of the grades obtained by the students of a group being evaluated, a correction factor must be found for each of these groups. This correction factor requires the calculation of the weighted average of the final grades to all compulsory Secondary IV and V courses specific to each pedagogical regime (present and past) and followed in the Youth sector, of each student in the group being evaluated[3]. The average of these individual averages is then obtained using the expression:

$$Ms_g = \frac{Ms_{i=1} + Ms_{i=2} + Ms_{i=3} + ... + Ms_{i=n}}{\text{Number of students}}$$

where Ms_g is the average of the weighted average grades from the secondary.

The correction factor to be applied to the Z score obtained by each student in the group being evaluated is:

$$\text{ISG} = \frac{Ms_g - 75}{14}$$

- ***Constraints***

  In order for the weighted average of a student's grades from the secondary (Ms_i) to be included in the average for the group being evaluated (Ms_g), two conditions must be met: the student must have obtained the Diplôme d'Études secondaires, and the student must have scored 50 percent or more in the course being evaluated. In other words, if a grade is not included in the calculation of the arithmetic average and the standard deviation, the secondary school average of that student is also excluded from the determination of the ISG for that course. In addition, when the number of units used for the calculation of the weighted average of the grades obtained in the compulsory Secondary IV and V courses is inferior to 36, that average is excluded from the determination of the ISG.

[3] For admissions prior to the Fall 2009 semester, all grades obtained in Secondary IV and V are included in calculation of the ISG.

No correction is made to the Z score of students in a group being evaluated if fewer than six weighted average grades from the secondary (Ms_i) are available, or if all members of the group being evaluated have the same weighted average at the secondary (sigma = 0), the ISG becomes zero, and no correction can be made to their Z scores.

3. THIRD ELEMENT: THE CONSTANTS C AND D

Adding the constant C (C = 5) eliminates negative values in the sum of Z and ISG. If the sum of these three terms is further multiplied by D (D = 5), the product becomes a quantity between 0 and 50. Most R scores will fall between 15 and 35.

4. CONSTRAINTS DURING THE CONVERSION OF GRADES TO R SCORES

No R score is calculated for Physical Education taken before Fall 2007 and for qualifying courses.

No R score will be attributed to a course which cannot be treated by the Z score calculation.

If, for a grade of 100, the R score determined using the first formula in this appendix does not yield a value equal to or greater than 35, a corrected standard deviation is determined using the following expression:

$$\sigma_{corrected} = \frac{100 - \overline{X}}{2 - \mathrm{ISG}}$$

The corrected standard deviation is then always equal to half the difference between a grade of 100 and the arithmetic average of the grades of 50 or more. In fact, it is this standard deviation which is used to determine the Z score as well as the R score of each student whose grade lies between 100 and the arithmetic mean of the grade distribution. This correction ensures that a student with a grade of 100 will obtain an R score of at least 35.

In addition, + 0.5 is added to the R score of students having completed either an International Baccalaureate or a Diploma of Collegial Studies (DCS) in the Sciences, or in Arts and Letters.

Finally, it is the weighted average of the R scores which serves as the basis of evaluation of a candidate's academic record. This value is obtained by weighting the R score for each course according to the units attributed to that course, summing up these weighted values, and dividing the result by the total number of units attributed to the college academic record of a candidate. It should be noted, however, that the weight of failures is considered in the calculation of the R score: for the first term of registration at CEGEP, failed courses only count for one quarter of the units allocated to a course, in other words, they have a weighting of 0.25; for subsequent terms, the weighting is 0.50. This method of calculation is applied to all records present in the ministerial system, regardless of the date of first registration at CEGEP.

APPENDIX B: PROGRAM SPECIFIC AVERAGE R SCORE AND THE ADMISSIONS PROCESS

This appendix provides fictitious examples to facilitate comprehension of the set of rules regarding the use of the program specific average R score for university admissions purposes stated in section 3.4. For illustrative purposes, it is assumed 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 minimal average R score thresholds presented in these examples are for illustrative purposes only. Candidates will find all relevant information relative to admission thresholds and prerequisites on each university's website.

1. When a candidate has not previously completed a DEC program prior to changing programs in CÉGEP.

Example 1

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

Program	Last registration	Average R score	Number of contributory courses	DEC
Social sciences	Fall 2008	28.53	28	No
Science	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 has registered (Social Sciences) is used to analyse the record of the candidate. He is admitted, since it is above 28 (28.53).

Example 2

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

Program	Last registration	Average R score	Number of contributory courses	DEC
Science	Fall 2008	30.40	25	No
Social sciences	Winter 2005	31.78	26	No
Overall record	s.o.	31.10	n/a	n/a
University prerequisites	s.o.	29.15	10	n/a

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

Example 3

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

Program	Last registration	Average R score	Number of contributory courses	DEC
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 to which is added the university prerequisites R scores, is used to analyse the record of the candidate. 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 entering the average R score calculation is presumed to have the same amount of units. However, the general principle consists in weighting the R score of each course by the number of units 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 DEC program prior to returning to CÉGEP in a different program.

Example 4

Candidate 4 applies to Physiotherapy, for which the minimal average R score to be admitted is 30. Furthermore, he has completed a DEC in Social Sciences before returning to CÉGEP in Science.

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 the analysis of the record is the score which is highest amongst the average R score of the program that has led to the DEC (Social Sciences) and the average R score of the last academic program in which the student was registered (Science), to which is added, if necessary, the relevant University prerequisites R scores. In this example, Science prerequisite R scores is added to the average R score of the Social Sciences program:

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

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